



**Adoption and Use of Emerging Technologies by Learners in Higher Education
Institutions: The Case of Open Education Resource Currency at Africa University
in Zimbabwe**

By

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Dedication

This research is dedicated to my late father Laissone Nasho Candieiro, my wife Hlupekire, my mother, my two daughters Cleopatra (Kudzai) and Octavia (Kudzo), and my son Agrippah Jr. They are my source of motivation and inspiration, jointly and severally.

Candidate's Declaration

I, Agripah Kandiero, hereby declare that the work contained in this dissertation is my own work, and that it has not been submitted for any degree or examination at any other university.

Signed:

A handwritten signature in black ink, appearing to read 'Agripah Kandiero', with a stylized, cursive script.

Date: 15 March 2019

Acknowledgements

My acknowledgements go to my supervisor Dr Ephraim Mhlanga, co-supervisor Dr Reuben Dlamini, Econet Wireless Zimbabwe, and my colleague Sabelo Chinzwina. Without their dedication and support, it would have been impossible to complete this research successfully.

Abstract

The overarching goal of this study was to investigate and understand the determining variables affecting adoption and use of Open Education Resources (OER) among Africa University students. The theoretical framework used was the second generation Unified Theory for Acceptance and Use of Technology (UTAUT2). The study adopted a critical realist perspective, using the mixed methods approach. Stratified probability sampling and purposive convenience sampling were used to select a sample size of 375 participants from the population consisting of learners, at Africa University. An adapted UTAUT2 psychometric questionnaire was used to collect quantitative data for the main research component, while document analysis (archival records) and interviews were used to collect data for the complementary qualitative component of the research. Confirmatory factor analysis, theoretical propositions and examining plausible rival explanations were used as strategies to analyse and interpret data. Analysis techniques included pattern matching, logic and explanation building. The major findings from the research were: (1) There is no significant adoption and use of EcoSchool OER resources among Africa University students and (2) There is significant adoption and use of other forms of OER among Africa University students. The contribution this study makes is the modification of UTAUT2 by adding Utility Value to the original UTAUT2 research model. Ultimately, a new research model referred to in this thesis as the Modified UTAUT2 model was presented. In essence, the recommended modification of the UTAUT2 could have a significant impact on explaining acceptance and use of emerging technologies in higher education contexts and could be applicable to acceptance and use of emerging technologies universally. In terms of future research, it is recommended that another post-implementation research using the Modified UTAUT2 research model and the recommended research instruments be undertaken.

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List of Abbreviations

BI	Behavioural Intention
CoP	Community of Practice
CWL	Common Wealth Learning
EE	Effort Expectancy
FC	Facilitating Conditions
HM	Hedonic Motivation
HT	Habit
ICT	Information Communication Technologies
IPR	Intellectual Property Rights
OER	Open Educational Resources
PC	Personal Computer
PE	Performance Expectancy
PV	Price Value
SI	Social Influence
TAM	Technology Acceptance Model
UNAM	National Autonomous University of Mexico
USD	United States Dollar
UTAUT	Unified Theory for Acceptance and Use of Technology
UTAUT2	2 nd Generation Unified Theory for Acceptance and Use of Technology
U	Use

Chapter 1: Introduction to the Study

1.1 Introduction

The purpose of this chapter is to clearly state the focus of the research. The chapter begins by motivating the research and proceeds with the presentation of the problem statement, research aim and research model. Research questions and hypotheses are presented, and their relationship with the research model is articulated and demonstrated. The chapter culminates with the elaboration of the significance of study and the limitations of the study.

1.2 Background and context

Emerging technologies are defined by Valetsianos (2010) as follows:

... tools, concepts, innovations, and advancements utilised in diverse educational contexts to serve varied education-related purposes ... emerging technologies are evolving organisms that experience hype cycles, while at the same time being potentially disruptive, not yet fully understood, and not yet fully researched (pp. 3–4)

Several research studies (Association for Learning Technology, 2010; Contact North, 2013; Sharples, Adams, Ferguson, Mark, McAndrew, Rienties, ... & Whitelock (2014); Siemens & Tittenberger, 2009) have been dedicated to 21st century educational challenges and pedagogical transformation. Recently, most researchers consistently presented compelling field-traceable proof that emerging technologies are a promising solution to addressing education costs, equity, quality and transformation in the 21st century and beyond. However, it is currently not clear how emerging technologies can be effectively integrated into education systems across the globe. Nevertheless, the application of emerging technologies is not yet common in the education domain and, therefore, is subject to increasing research enquiry. “There is a growing trend in English-speaking education (UK and USA) systems to assume a technology rich environment for learning, and to investigate the impact of particular pedagogical approaches or learning strategies within that context” (Association for Learning Technology, 2010, p. 5). Despite this emerging trend of increasing adoption, it is not yet clear “what works and in what context(s), to what extent — if there is evidence — why and/or how?” (Association for Learning Technology, 2010, p. 6). As a result, this research is partly motivated by some of

these unanswered questions about the adoption and efficacy of Open Educational Resources (OER).

OER are generally used for teaching, learning and research and are stored in the public domain with creative commons and licence permission to retain, reuse, remix, redistribute and repurpose. OER include: complete course curricula, textbooks, videos, course content, modules, evaluations, software platforms, tools, materials, and techniques used to support teaching and learning (Ally & Samaka, 2013; Hewlett Foundation, June 2013; Hewlett Foundation, October 2013; Hewlett Foundation, November 2013; UNESCO, 2016a; UNESCO, 2016b; Wiley, 2017a).

In Zimbabwe, particularly at Africa University (the research case study institution), implementing OER was a typical case of emerging technologies because it exhibits the key features identified by Valetsianos (2010). From Valetsianos's (2010) definition, OER fit into the category of emerging technologies because they: (1) Will evolve through hype cycles within the Zimbabwean and Africa University context; (2) are not yet fully understood at Africa University and nationally; (3) have not been exhaustively researched at institutional and national levels; (4) have the potential to create a new teaching and learning order (potentially disruptive) at Africa University and in Zimbabwe; and (5) have mostly unfulfilled potential and are already available technologies that are evolving. Moreover, like any other technological innovation, their acceptance and use may be better understood and explained using technology acceptance theories and models (Kripanont, 2007).

Similar OER technologies or solutions include podcasts, Facebook and blogs. Mugwanya, Marsden, Ng'ambi and Traxler (2012) define a podcast as "a form of mobile learning in which audio/video content is authored and made available on the internet, using some server or shared storage space for downloading onto a computer and/or transferring to mobile devices (possibly via data cables)." From this definition, the elements of a podcast can be seen as audio/video files, playable through mobile devices or a computer, and downloadable from the internet, a server or storage space. This definition is appropriate since it considers the local environment. Most definitions of podcasts are based on the premise that learners have reliable internet access, high-end mobile devices such as iPads or the latest smartphones (Mugwanya et al., 2012, p. 67); unfortunately, these premises are incorrect in the local environment. The reality is that internet access is a challenge to most students at Africa University. Most students use the internet on

campus with their own or the institution's computers. Besides, the cost of mobile devices and smartphones is too high for most students. Podcasts can be used in higher education in four ways namely: as traditional lectures delivered in a classroom, as additional course material, as supplemental course material, and as "podcasts containing content from students for the lecturer or other students" (Ng'ambi & Lombe, 2012, p. 182).

Facebook is another emerging technology that has applications in teaching and learning that were considered in this research. Facebook was created in 2004 at Harvard University and was developed for Harvard and Ivy League students in the USA (Mugwanya et al., 2012). Since 2006 it has been made available to the whole world. Essentially, Facebook has been used by many for formal learning, with instructors setting up open, private or secret groups for students (Minocha, 2009 as cited by Ivana & Gachago, 2012:154). Informally, Facebook has been used to keep in touch with friends, search for old friends, reconnect with old friends, and keep abreast of friends' lives. Facebook also has tools that can meet the media, temporal navigation and access-control requirements of the task under study. A blog is similar to an online journal rendered as a website and allows continuous addition of content (Hill, 2006). In fact, the term blog is short for weblogs, which started as personal online publications of individuals' lives. Blogs are initiated by a Community of Practice (CoP), a small group or an individual, to initiate a conversation or discussion around a common topic or phenomena; hence, they are informal and conversational in nature. A blog also allows for a frequent exchange of ideas and information in the chronology of a discussion. These emerging technologies have found increasing application in teaching and learning, thus, warranting their inclusion in this study. As detailed later in the literature review, OER, Facebook, blogs and podcasts are among the emerging technologies that have been used to address specific teaching and learning challenges with positive outcomes.

The benefits of OER are consistently echoed by several OER researchers and conferences (Ally & Samaka, 2013; CWL, 2011, CWL 2015; Downes, 2007; UNESCO, 2012a; 2012b; 2015a; 2015b; 2016a; 2016b). Wiley (2010) points out that education cannot happen without the sharing of resources. Research evidence from the global North revealed that OER have moved from awareness to adoption, use and mainstream adoption. However, this is yet to happen in sub-Saharan Africa. Arising from the above, OER mainstream adoption is for students "to become integrated into the education mainstream, delivering access to knowledge and

improved teaching and learning and supported by a robust market” (Ally & Samaka, 2013, p. 12). In other words, OER mainstreaming entails the involvement of all stakeholders that take part in the education system and processes, including the infrastructure, policy and incentives. The reality, though, is that mainstream adoption has not been reported anywhere in sub-Saharan Africa. However, significant inroads have been made by projects like OER Africa¹, TESSA and Siyavula in some countries, notably South Africa and Kenya. As a result, OER attracted attention from both researchers and education practitioners, although it still has not been significantly implemented. MIT OCW statistics showed that only 2% of MIT OCW traffic since 2004 has come from users in sub-Saharan Africa (MIT, 2014). Moreover, the extent to which OER have been adopted in the global South does not show whether their use is having an impact on the quality of teaching and learning, educator practices and student outcomes, and its impact is only partially understood (Pawlowski & Bick, 2012). More importantly, mainstream adoption is in the mission and vision of several OER movements and advocacy groups, and their efforts are motivating research that can inform current and future OER interventions. However, despite the benefits cited in the literature, there is no widespread uptake of these free educational materials and methods, particularly in Africa. In Tanzania, the Open University of Tanzania took the initiative to adapt and use MIT OCW; however, only 21.8% of 150 respondents indicated awareness of its existence (Mtebe & Raisamo, 2014). It seems the outcomes of most OER interventions on the continent have been reported to yield suboptimal results. The concern of this study is to explore why this is so by asking:

- What is missing in the OER interventions?
- What is the best OER intervention framework?

(Paradis, 2014; Hodgkinson-Williams, Paskevicius, Cox, Shaikh, Czerniewicz, & Lee-Pan, 2013).

Limited empirical research has been undertaken to understand OER implementation in Africa, and in Zimbabwe in particular, in a way that reveals the outcomes, impact and challenges. Unfortunately, at a time when the impact of OER interventions was expected to have been felt in the access, equity and cost of education, a dilemma has been revealed by the recent student protests in both the global North and South. Hodgkinson-Williams et al., (2013) describe the situation as follows:

¹ www.oerafrica.org

Discontent about the lack of affordable access to relevant higher education is evident around issues such as the imposition of tuition fees (for example, Germany), and high tuition fees (for example, South Africa). In addition, there is discontent arising from issues including cuts to education spending (for example, Spain), the imposition of tax on tuition fees (for example, Bangladesh), the discontinuation of scholarships (for example, India), transformation or ‘decolonisation’ of universities (for example, South Africa) and full education reform (for example, Chile) (p. 5).

From the examples of countries listed above, it seems student-related protests are a result of increasing political and humanitarian pressure to provide free quality education for all by subsidising tuition and reducing the cost of learning materials. It is, however, important to note that OER has the potential to reduce the cost of higher education and make it more affordable to the lower income earners (Ally & Samaka, 2013; UNESCO, 2015a; 2015b; 2016a; 2016b). In Zimbabwe there is shortage of educational resources to the extent that it may potentially affect cost, equity and quality of teaching and learning processes. The Africa University bookshop is inadequately stocked and hardly has any official curriculum textbooks. Africa University lacks capital to adequately stock the bookshop, and the students can also not afford to order traditional textbooks online or from alternative bookstores. The unavailability and unaffordability of traditional textbooks to Africa University students are the key factors that warranted this research enquiry for alternative solutions. This shortage of educational resources was noticed by other stakeholders, notably Econet Wireless Zimbabwe, who approached Africa University with a proposition for OER adoption in February 2014.

It is evident from the preceding discussion, that there is a problem in the education sector at global, regional and national levels that can be potentially alleviated by using OER. It is, however, not possible to efficiently achieve the outcomes of OER interventions in the absence of specific research-based evidence to guide learners, educators, institutions and policymakers, hence, the motivation of this research.

1.3 Zimbabwe’s educational resources status

The motivating factor for this research was the unavailability of university curriculum textbooks because of high costs in Zimbabwe (Shizha & Kariwo, 2011; UNESCO-UIS, 2016). At the point of starting this research, there was not a single official curriculum textbook in the Africa University bookshop. A visit to the main bookshops outside campus in the city of

Mutare confirmed the critical shortage of university textbooks, as only primary and secondary school textbooks were available. This situation has been caused by Zimbabwe's economic recession between 2000 and 2009. The recession saw Zimbabwe breaking the world inflation record by reaching a new record rate of 79,600,000,000% (seventy-nine billion six hundred million) per month (Shizha & Kariwo, 2011). At some point during the recession, schools stopped lessons and bookshops closed down. After 2009, the government of Zimbabwe introduced the United States Dollar (USD) as its primary currency, bringing about some recovery in the economy. The national stock of imported textbooks was used up during the economic downturn, since all imports had to be approved by the Central Bank. Moreover, the Central Bank had to give priority to essentials like fuel, food and medication. Since then, the education sector has not fully recapitalised (Shizha & Kariwo, 2011). This deficit has also been increasing with the emergence of new private and state universities. All universities in Zimbabwe increased their intake by introducing block release programmes, evening and weekend classes. The practice is commonly referred to as 'parallel programmes'. Many universities in Africa are also introducing weekend and evening classes. This is driven by the need to generate additional income in the wake of declining public subsidies to universities, which has placed a strain on the limited university resources, including reading materials. There are quality concerns that arise from this mass increase in service offerings using the same pool of resources. A study conducted by Nyanga, Mpala and Chifamba (2012) confirmed there was widespread brain drain due to the exodus of highly skilled workers from Zimbabwe, which constituted an average of 14% of the total labour force migration. This has affected the supply of human resource skills in specialised areas of the economy, but it is not the main reason for the increased demand for higher education. According to Shizha and Kariwo (2011), the Zimbabwe education evaluation report pointed to a general increase in the demand for tertiary education. Consequently, the increased demand against the high cost of university education is costing the Zimbabwean government 300% of the Gross National Product per capita to finance university education, compared to only 19% of the Gross National Product per capita required for primary and secondary education (UNESCO-UIS, 2016). Therefore, there is a need for initiatives like OER projects to reduce the cost of university education. Related statistics by the UNESCO Institute of Statistics revealed that in 2014, government expenditure on tertiary education in Zimbabwe was 59% of the total education budget, compared to the combined total of 22% for primary and secondary education, with the balance going to the informal education sector (UNESCO-UIS, 2016). This is proof of the very high cost of higher education in Zimbabwe.

In Zimbabwe, tertiary education enrolment rates are determined by cost and income structures. Therefore, less than 1% of the most deprived 20% aspiring university candidates are able to enrol in tertiary education. When compared with the privileged class, it is noted that 10% of the top 20% income earners in Zimbabwe manage to enrol their children in universities. This reveals an alarming inequity in the access to education in Zimbabwe (UNESCO-UIS, 2016). In fact, the figures above are low, compared to 19% tertiary education enrolment rate of neighbouring South Africa (UNESCO-UIS, 2016). Notwithstanding the differences among countries, participation rates in higher education are low in the region, ranging between 6% and 20% for the 18–25-year age group. The average tertiary gross enrolment rate for sub-Saharan Africa was 8.23% by 2014, compared to an average of 28.56% for developing countries and 22.75% for South and West Asia. The figures show that sub-Saharan Africa has by far the lowest gross enrolment rate at tertiary level in the world (UNESCO-UIS, 2016). This is despite the fact that it is the region that has the biggest need for human resource skills to support economic and social development. Zimbabwe's economic collapse resulted in a temporary paralysis and collapse of the education system. As a result, several development agencies came to the rescue of the nation's education system. However, the interventions were mainly in primary and secondary schools. Notably, the Education Transition Fund, a USD 50 million multi-national aid fund, came to the rescue by providing textbooks, related materials and technical support to improve the quality of primary and secondary school education in Zimbabwe. According to the Education Transition Fund report of 2012, by the end of 2011, at least 13 252 000 books had been dispatched to all provinces (5 667 primary schools in the country). However, the same support was not extended to higher and tertiary education, and the crisis of educational resources remains a significant challenge in higher education and tertiary institutions.

1.4 Responsive OER initiatives in Zimbabwe

In response to the textbooks shortages highlighted above, some initiatives were rolled out in Zimbabwe. Such initiatives include: the EcoSchool² project (funded and hosted by Econet

²<https://www.ecoschool.co.zw/oer/>

Zimbabwe³ as a social responsibility programme), ALISON free online courses⁴, Zimbabwe Education Portal⁵, and Teach for Zimbabwe⁶. Econet Wireless Zimbabwe officially launched its nationwide EcoSchool OER project at Africa University on the 28th of February, 2014. I was motivated to conduct this exploratory research to understand the adoption of OER by students at Africa University as a result of this initiative. This is a post-implementation study aimed at providing insights on the factors that determined both ‘how’ and ‘why’ OER adoption occurred among Africa University students.

The 28th of February, 2014, marked the release of Econet’s university learning platform for the registered university students in Zimbabwe. The platform would enable both learners and educators to access local and global learning material. The EcoSchool platform, which had been pilot tested at the University of Zimbabwe’s Faculty of Science, was finally rolled out to students in all universities in Zimbabwe after six months of testing. The EcoSchool platform was meant to alleviate the problem of acute shortages of textbooks and course material in higher education institutions in Zimbabwe. In addition, the EcoSchool product enables university students and lecturers to access over 50 educational websites for free. The main shortcoming of this initiative is that the platform is only for registered Econet mobile line users and those registered on the EcoSchool platform. Thus, one does not have to pay to access these websites on their computer, smartphone or tablet.

EcoSchool also introduced 90% textbook titles or equivalents via the e-library platform, where users can access softcopy textbooks on their smartphones, tablets, laptops and computers. It does not only offer reading and studying, but also introduced a CHAT platform where educators and learners can chat about their findings in their studies. Furthermore, students can access modules from other universities in the country or anywhere in the world free of charge for a whole year. Moreover, the issue of devices was also addressed by introducing an EcoSchool tablet equipped with the EcoSchool resources. However, the EcoSchool platform is not completely free. The charges are USD 2 per month for personal smartphones, tablets and laptops, and the EcoSchool tablet costs USD 6 per month for 24 months. Every university

³<https://www.econet.co.zw/>

⁴<https://alison.com/free-online-courses/zimbabwe>

⁵<https://sites.google.com/site/zimbabweeducation/>

⁶<https://sites.google.com/site/teachforzimbabwe/>

student who registers with EcoSchool will have access to this learning platform. Registration processes and procedures were put in place at every university in Zimbabwe. The EcoSchool OER project is a commendable effort from Econet Wireless Zimbabwe and marks the formal OER implementation at Africa University and all universities in the country.

1.5 Statement of the problem

In response to the textbook shortages highlighted earlier in Section 1.3, Econet Wireless Zimbabwe officially launched its nationwide EcoSchool OER project at Africa University on the 28th of February, 2014. Mainstream adoption and use of EcoSchool OER resources by Africa University students was widely expected by all stakeholders. The extent and pattern of OER adoption and use at Africa University is not yet well understood, and yet it has the potential to address challenges of cost, access, equity and quality of educational resources. It seems like the outcomes of OER interventions have been reported to be below their maximum potential (Hodgkinson-Williams et al., 2013).

Despite several research reviews, it remained unclear how and why the EcoSchool OER intervention influenced adoption and use of OER among students at Africa University. An OER implementation study would be able to identify reasons, barriers and facilitators that influence how learners at Africa University use OER. It is also unclear from existing research how OER and Africa University conditions and practices can be improved to increase the probability of effectively conducting OER interventions. Furthermore, an OER implementation research would help address concerns about the best approach to originate, build, implement and ameliorate OER. The overarching research question in this study was: ‘How and why did OER adoption and use occur the way it did among students at Africa University?’

1.6 Research aim

The aim of this study was to identify variables that influence the adoption and use of OER by Africa University students, with a view to making recommendations for improvement.

1.7 Research model

The theoretical perspective used in this research is the second generation Unified Theory for Acceptance and Use of Technology (UTAUT2), developed by Venkatesh, Thong and Xu (2012). It has been used in OER adoption research in sub-Saharan Africa in recent years (Mtebe & Raisamo, 2015). The theory contends that Performance Expectancy (PE), Effort Expectancy

(EE), Social Influence (SI), Facilitating Conditions (FC), Hedonic Motivation (HM), Price Value (PV) and Habit (HT) influence the Behavioural Intention (BI) and actual Use behaviour (U) of a set of emerging technologies or innovations, and that the influence of these seven constructs is moderated by age, gender and experience, as depicted in Figure 1.1. As applied to this study, UTAUT2 held the expectation that the seven constructs Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Price Value and Habit are the independent variables that could influence the two dependent variables, Behavioural Intention and actual Use behaviour of OER among students at Africa University. Age, gender and experience are the moderating or intervening variables in this adoption process. The presence of intervening variables in this context means that students of different ages, genders, and experience are expected to make different OER adoption decisions and may have different OER usage characteristics.

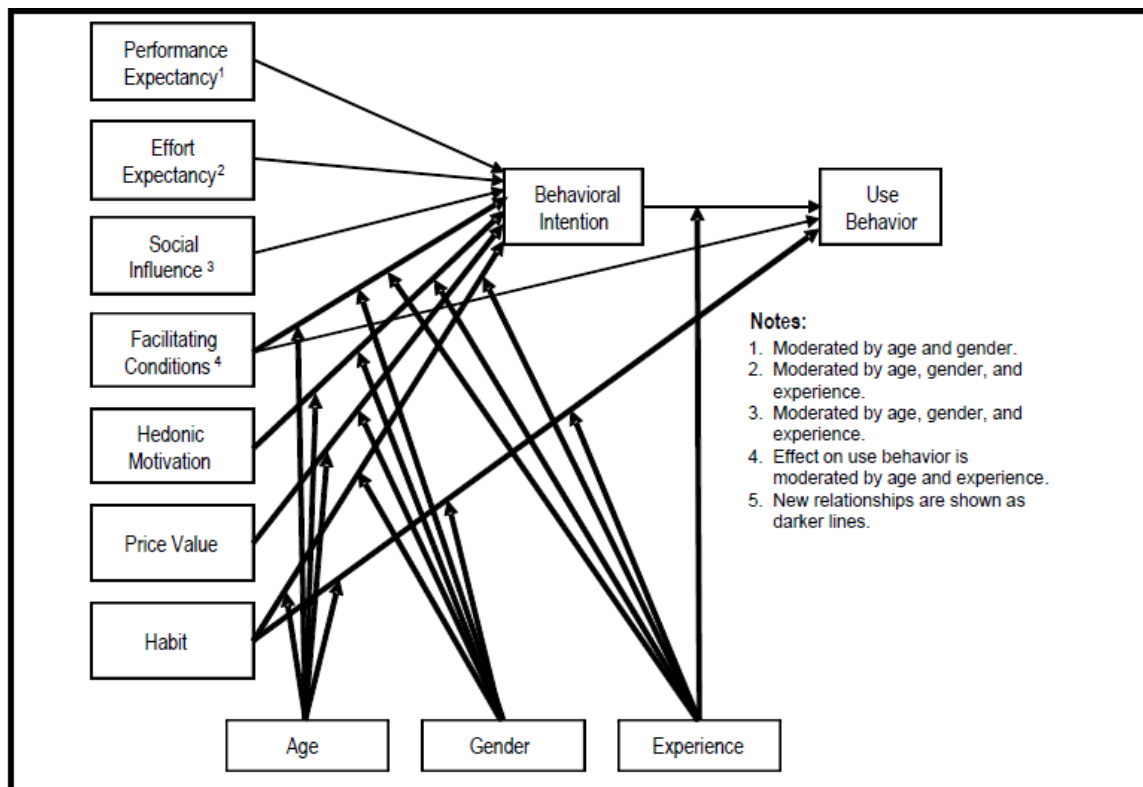


Figure 1.1: UTAUT2 model

Source: Venkatesh et al., 2012, p. 160

1.8 Research questions and hypotheses

The research questions were constructed based on the statement of the problem. The literature review, logical propositions and analogy confirmed the UTAUT2 variables were a close match

to the desired measures required to address the research problem. The primary research question was: How and why did OER adoption and use occur the way they did among students at Africa University? (RQ0). This primary research question was complemented by the following sub-research questions:

- 1) How do the UTAUT2 variables significantly influence Africa University students' mainstream adoption of OER in their learning process? (RQ1)
- 2) How do the UTAUT2 variables significantly influence actual OER use behaviour among Africa University students? (RQ2)
- 3) What is the prevalent OER usage pattern among Africa University students? (RQ3)

Ultimately, 12 hypotheses were formulated to derive test statistics and significant qualitative statements from the outcomes of each hypothesis test, and these were used to answer the research questions. Table 1.1 depicts a mapping of the research questions and the hypotheses that characterised this research.

Table 1.1: Research questions and hypothesis

Research Question	Hypothesis
RQ1: How do the UTAUT2 variables significantly influence Africa University students' mainstream adoption of OER in their learning process?	H1: PE→BI Performance Expectancy significantly influences Behavioural Intention. H2: EE→BI Effort Expectancy significantly influences Behavioural Intention. H3: SI→BI Social Influence significantly influences Behavioural Intention. H4: FC→BI Facilitating Conditions significantly influence Behavioural Intention. H5: HM→BI Hedonic Motivation significantly influences Behavioural Intention. H6: HT→BI Habit significantly influences Behavioural Intention. H7: PV→BI Price Value significantly influences Behavioural Intention.
RQ2: How do the UTAUT2 variables significantly influence actual OER use behaviour among Africa University students?	H8: FC→U Facilitating Conditions significantly influence actual Use. H9: HM→U Hedonic Motivation significantly influences actual Use. H10: BI→U Behavioural Intention significantly influences actual Use.
RQ3: What is the prevailing OER usage pattern among Africa University students?	H11: There is no significant use of EcoSchool OER resources among Africa University students. H12: There is significant use of other forms of OER among Africa University students.

1.9 The research argument

The thesis argued and illustrated that localisation and bottom-up approaches are important to achieve the anticipated levels of OER adoption and use by students. Most OER interventions in Zimbabwe so far have used a top-down approach model, thus, coming across as a philanthropic funded initiative, as is the case of the EcoSchool OER initiative funded by Econet Wireless Zimbabwe. Such interventions are not yielding the anticipated adoption and use by learners and educators. Besides, the search, evaluation, adoption and use of online educational resources are now universal activities for a typical 21st century student. Preliminary enquiries at Africa University revealed that every student uses internet searches to complement their learning materials. It is irrelevant to students whether these learning resources yielded by internet searches are OER, as long as they are free and of acceptable quality. It became apparent that OER searches, evaluation, adoption and use happened naturally without formal OER training and policy among Africa University students faced with the challenges of cost and access to educational resources. Therefore, the thesis argued and illustrated that it is not publicity that determines OER adoption and use among students in institutions of higher learning. Rather, it is evident that Zimbabwe's EcoSchool OER initiative has not yielded the desired levels of adoption and use among Africa University students because of the top-down intervention model used. Top-down intervention models continue to characterise OER interventions in Zimbabwe, the region and globally. Furthermore, the adoption and use of OER is not fixed or static but shifts from one form to another and the benefits redistribute and rearrange themselves from one context to another. Essentially, the thesis postulated that an effective model of OER adoption and use for Africa University ought to start from the bottom, that is, from a needs analysis of students, and then evolve to appropriate technical, content, staffing and funding models. More importantly, when an OER intervention is anticipated to be the ideal teaching and learning solution, a research enquiry must be conducted to pre-determine the appropriate OER institutional model and strategy. Lastly, an appropriate OER intervention model that will maximise the acceptance and use of OER among Africa University students should be identified.

1.10 Significance of research

The research made an interesting contribution to Africa University by making recommendations on how to address the current challenges standing in the way of optimal adoption and use of OER among Africa University students. In addition, important

recommendations on how the EcoSchool OER project could improve university OER models to increase the use of OER were also derived from this research. Also arising from this research were general recommendations and guidelines on how emerging technologies can be used in general to address teaching and learning challenges in higher education contexts. Recommendations for the improvement of some models identified in the literature review were proposed and justified on the basis of the findings from this research. In general, the conclusions and recommendations arising from this research could in many ways, directly and indirectly, contribute to addressing capacity, cost, equity, quality and access to educational resources at Africa University. The research design may allow transferability of the OER research findings to other higher education institutions in Zimbabwe. It is important to note that teaching and learning could be a perennial challenge to learning institutions, policy makers and development agencies both in the developing and developed countries. Specifically, the research provided case specific, useful insights on what motivates Africa University students to adopt and use OER, and the current usage trend. Lastly, these findings may be used to leverage OER to address the challenge of education resources at Africa University more efficiently and effectively.

1.11 Limitations of the study

Due to financial and time constraints, this research was limited to Africa University. To allow for increased validity and transferability of the research findings, it would have been ideal to increase the mix of educational, institutional and geographical coverage to adequately cover higher education institutions in Zimbabwe. However, to mitigate this limitation, probability sampling and a fairly large sample size of 375 participants (370 quantitative + 5 qualitative) against the acceptable minimum sample size of 51 participants (Onwuegbuzie, Jiao & Bostick, 2014; Tashakkori & Teddlie, 2015). These measures, according to Creswell (2009), helped to increase the validity and transferability of the research findings. Apart from the above, there were also inherent limitations in time, scope of objectives, and number of words. Lastly, detailed analysis, as opposed to broad general analysis of what should be achieved, was also a prevalent limitation.

1.12 Organisation of the thesis

Chapter 2 covers relevant literature on OER. The case studies presented in the literature review complement the theoretical framework to aid understanding and interpretation of the research outcomes and conclusions, where they differ, and why.

Chapter 3 outlines and describes the theoretical framework adopted in this research. A series of candidate theoretical frameworks are presented with the evaluation and selection criteria to justify how the selection decision was made.

Chapter 4 is a narrative of the research methodology and methods applied in this study. It includes the philosophical underpinnings, research design, research instruments, ethical considerations, population used, and sampling procedures. The goal of the chapter is to enable independent validation and execution of the research processes.

Chapter 5 is a presentation of collected research data, mainly in the form of frequency tables, descriptive statistics, and their interpretations. The chapter is divided into sections based on the research questions. It is confined to the outline and description of research data.

Chapter 6 uses statistical methods to analyse and discuss the data presented in Chapter 5. All the hypotheses are tested and then rejected or accepted on the basis of test statistics. The research questions are also systematically answered using the hypothesis test outcomes.

Chapter 7 outlines the conclusions from the research and gives recommendations on the basis of the research questions and hypotheses. Practical recommendations are also given in this chapter.

Chapter 2: Literature Review

2.1 Introduction

The literature review in this study was conducted to achieve the following three objectives:

- 1) To summarise the existing body of knowledge on the research problem and constructs closely related to it;
- 2) To solidify the research problem by revealing the knowledge gaps and conflicting/ambiguous facts from different schools of thought; and
- 3) To help understand and interpret research outcomes and conclusions where they differ.

The process of reviewing the literature happened concurrently with the designing and positioning of the problem and the motivation for the study (Creswell, 2009; 2012). The motivation for the study entailed relating the problem statement to the existing body of research and literature. The literature review process also served the purpose of evaluating the importance of the research area and whether it were possible and worth researching or not (justification of research gap).

This study sought to identify and explain factors that influence the adoption of OER by students at Africa University as a result of the introduction of the EcoSchool OER project. The following six themes of literature helped me to gain a firm understanding of the fundamental tenets of OER interventions and adoption:

- 1) OER research gap
- 2) Variables that influence adoption of OER
- 3) Variables that influence actual use of OER
- 4) Determinants of actual OER use pattern
- 5) Emerging technologies and learning challenges
- 6) OER emerging technologies adoption and use success factors

2.2 OER research and literature gaps

This section summarises the existing body of knowledge on the research problem and the constructs that are closely related to it. The section is an analytic review of OER research gaps identified in the reviewed literature. Smith (2013) explores nine areas of OER research, ranging from design to implementation (Table 2.1). Despite the significance of existing OER research,

a lot of areas remain unresearched, particularly in the context of Zimbabwe and Africa University hence; the need for this research.

Table 2.1: OER research buckets

Research area	Description
Policy Research	studies of how and why OER might be better embedded in local, state and national policy and practice
Access and Use	studies of how OER add value by increasing access and use, including going to scale
Effectiveness	studies of how OER improve outputs and outcomes (learning, efficiency
Innovation	investigations into new ideas and possible creative disruption arising from the use of OER
Beyond Formal Education	research on the use of OER in other sectors, including public health and agriculture
Sustainability	research on the viability of OER products over the long term;
Development and Improvement	studies to understand and improve the processes of creating, altering and using OER
Implementation	studies of the processes of introducing and using OER around the world in classrooms, schools, districts, states, and countries;
Infrastructure	research on the underlying framework and health of OER and the institutional ICT infrastructure

Source: Smith, 2013, p. 4–5

The research buckets presented in Table 2.1 do not have a strict ranking or order. Smith (2013) recommends that researchers should start by reviewing access and use. This recommendation is logical because access and use have to occur first.

My earlier OER research at Africa University (Kandiero, 2015) was on OER access and use by educators at Africa University. The aim of the study was to elicit, measure and evaluate challenges and Behavioural Intention of educators in using OER. One of the key findings was that while intention to use OER was high among educators, actual use was very low. This finding could not be explained sufficiently by the research findings. After reviewing literature

on OER research gaps by Smith (2013), the idea of an OER post-implementation study appeared to be the next logical step to take in finding the answer to the high intention and low effective use of OER. Therefore, in this study I use a post-implementation study of the EcoSchool OER project to investigate this particular OER implementation strategy using the bottom-up approach, as corroborated by other OER researchers (Friesen, 2009a; 2009b; Sapire, Reed & Welch, 2012; Wiley, Bliss & McEwen, 2014). A research on OER implementation could help address grey areas on how to “design, develop, implement and improve OER” (Smith, 2013, p. 1).

Across the globe, there are several studies on OER and its application in the classroom that can help to close the gap between adoption, use, implementation and efficacy (Smith, 2013). This research could enhance the outcome of OER intervention and help to address the impending challenges of educational resource access, cost, and quality that have been confirmed by several research studies (Hysten, 2006; Friesen, 2009a; 2009b; Sapire et al., 2012; Wiley et al., 2014). However, using research findings from other contexts cannot establish with certainty why Africa University students adopt and use OER. The logical possibilities could include awareness and acceptance of emerging global open culture, a prevailing institutional environment that promotes the adoption and use of OER, or individual decisions. Similarly, if individuals, institutions or both do not subscribe to the culture of openness, it is a barrier to the adoption and use of OER (Hodgkinson-Williams, 2010). It is equally essential to ascertain what makes OER implementation successful. Therefore, OER design, funding, staffing, and technical and content models are possible lines of enquiry. This new direction of investigation could help to unpack OER interventions to yield useful insights and recommendations that can help to enhance OER adoption and use among Africa University students.

Table 2.2: UTAUT2 applications in adoption research in 2018 & 2019

No.	Research Title	Reference
1	The battle of brain vs. heart: A literature review and meta-analysis of ‘Hedonic Motivation’ use in UTAUT2	Tamilmani, Rana, Prakasam, & Dwivedi (2019)
2	Factors influencing the adoption of mobile commerce applications in Cameroon	Verkijika (2018)
3	Exploring the role of ‘Price Value’ for understanding consumer adoption of technology: A review and meta-analysis of UTAUT2 based empirical studies	Tamilmani, Rana, Dwivedi, Sahu, & Roderick (2018a)
4	Use of ‘Habit’ is not a habit in understanding individual technology adoption: A review of UTAUT2 based empirical studies	Tamilmani, Rana, & Dwivedi (June, 2018b)
5	What determines tourist adoption of smartphone apps? An analysis based on the UTAUT-2 framework	Gupta, Dogra, & George (2018)
6	Examining factors influencing Jordanian customers’ intentions and adoption of internet banking: Extending UTAUT2 with risk	Alalwan, Dwivedi, Rana, & Algharabat (2018)
7	How long tail and trust affect online shopping behaviour: An extension to UTAUT2 framework	Singh & Matsui (2018)

My search on google scholar for scholarly articles on the application of UTAUT2 on OER adoption research yielded only seven matches, as presented in Table 2.2. The research titles confirm that in 2018 and 2019 there was no research on the application of UTAUT2 in the adoption and use of OER. Only one 2018 research on the application of UTAUT in the adoption and use of OER by educators was found. This research, which was done by Padhi (2018), is titled “Acceptance and Usability of OER in Indian Higher Education: An Investigation Using the UTAUT Model”. Therefore, there is lack of literature on the application of UTAUT on the adoption and use of OER by learners in higher education contexts. None of the UTAUT2 research applications involved the adoption and use of OER by learners. In Chapter 6, only UTAUT applications to OER adoption by educators are available for comparison with the results from this study. The literature gap is glaring.

2.3 Research questions and literature review

The relationship between the research questions and the literature review is depicted in Table 2.3. The reviewed literature falls into three categories. The first category seeks to identify the variables that influence adoption of OER, while the second category looks at variables that influence actual use of OER, and the third category considers the possible determinants of actual OER use pattern.

Table 2.3: Research questions and literature review

Research question	Related literature
RQ1: Variables that influence adoption of OER	2.4.1 Affordances of OER 2.4.2 OER awareness 2.4.3 OER support and training 2.4.4 OER stakeholders 2.4.5 OER barriers
RQ2: Variables that influence actual use of OER	2.5.1 OER funding models 2.5.2 OER technical models
RQ3: Variables that influence the pattern of OER usage	2.6.1 OER content models 2.6.2 OER staffing models 2.6.3 Online learning theories and models

2.4 Variables that influence OER adoption

This category of the literature review focuses on the affordances of OER, OER awareness, OER support and training, OER stakeholders, and OER adoption barriers.

2.4.1 Affordances of OER emerging technologies

Significant cost savings, educational efficacy, learning outcomes and innovative pedagogy are the OER affordances discussed in this section. The term affordance was first used by the psychologist Gibson in 1966 (Gibson, 1979). An affordance is defined as a tool or environment that is provided to the beneficiary. The definition includes both positive and negative outcomes that arise from the use of the tool or the environment. The concept of affordances includes the complementarity of the beneficiary and the tool or environment (Gibson, 1979). In this study, affordances of OER refer to all that OER can do to improve the teaching and learning environment, including all possible transactions (positive and negative) between OER and the teaching and learning environment.

As costs of post-secondary education continue to rise, the idea of sharing educational resources is promising. Unaffordability of educational resources creates barriers to higher education for many learners from low income backgrounds. Adopting open textbooks and other OER could reduce some of these costs. As noted in Chapter 1, the cost of teaching and learning materials is soaring to unaffordable levels for learners, educators and institutions. Between 2004 and 2014, textbook prices in the USA rose by an average of 6% per annum (Mitchell, 2014). Donaldson, Nelson and Thomas (2012) reveal that 65% of Florida's post-secondary students reported that they had foregone buying a textbook for a course because of the cost. According to Wiley, Bliss, and McEwen (2014), in June 2013 the USA Government Accountability Office

released the findings of a 12 year longitudinal study, and the figures confirmed that while the price of consumer goods had increased by 28%, the price of textbooks had escalated by 82% and tuition fees by an alarming 89%.

The above findings are corroborated by a related research that was concluded in January 2014 by the USA Student PIRGS (Wiley, 2017a), which confirmed that 65% of students could not afford textbooks and chose not to buy them; 94% admitted that their grades had been affected by the decision not to purchase textbooks; and 48% had opted to enrol for different or fewer courses than they would have wanted because of textbook cost considerations. Consequently, the adoption and integration of open textbooks, OER and open journals could save students and institutions money. This shift may also help to change the way educators teach and learners learn.

Moreover, academic journal subscriptions can cost individual institutions millions of dollars per year, while the primary publishers of these journals reap massive profits (Larivière, Haustein & Monegeon, 2015). For example, in 2012–2013, profit for Reed-Elsevier⁷ was more than USD 2 billion (Larivière et al., 2015). In practice, only an elite minority of publishers control a significant number of these journals; approximately 50% of elite journals in the social, natural and medical sciences are controlled by a small group of publishers (Larivière et al., 2015). The above discussion reveals that cost is an important consideration for learners before they choose to adopt an educational resource. OER offer a significant cost advantage.

Research-based evidence on significant cost savings accruing from OER adoption and use are continuously being reported. In fact, there are cost savings that accrue when academic resources are quickly translated, reused and remixed, thus allowing knowledge to be built on a common foundation. As already highlighted, these economic attributes of OER have persisted in showing savings as the world grapples with an increasing demand for tertiary education, resulting from the rising cost of textbooks. This demand cuts across primary and secondary school sectors in many countries. Wiley (2017b) reveal that, on average, it costs a student USD 90.61 to complete a course using traditional printed material, compared to USD 5 for the same course using OER. The main point made in the discussed literature is that the use of OER is more cost-effective than traditional printed material.

⁷ <https://en.wikipedia.org/wiki/RELXGroup>

It is worthwhile to note at this point that cost saving translates into greater educational efficiencies and effectiveness. Therefore, increasing OER contribution will lead to educational efficacy (Wiley, 2017a; 2017b). As a result, faculty and students are empowered to take full advantage of the flexibility of being able to adapt OER to local contexts and learning goals (Wiley, 2017a). It is believed that OER could form a critical building block underpinning the solutions required to provide equitable and sustainable education. Recent research (Wiley et al., 2014) reveals that OER adoption helps to improve ‘education efficiency ratios’. These studies define efficiency ratio as a comparison of some metric and the resources that it takes to achieve that metric. Important metrics in education management are engagement, final grade, withdrawal rate, completion rate, enrolment intensity, persistence, and time to graduate. These ratios are affected by costs, and the higher the costs, the more unfavourable the ratios become. Consequently, OER achieve better efficiency ratios by keeping costs at minimum levels. In this context, cost refers to the monetary value attributed to tuition, textbooks, students’ time, teachers’ time and instruction payment.

Fischer, Hilton, Robinson and Wiley (2015) conducted research to investigate how the adoption of open textbooks impacted on the learning outcomes of post-secondary school students across multiple institutions. The study involved 16 000 students across 10 colleges in the USA, taking 50 out of the 130 different courses on offer. The study looked at the degree to which the use of OER was associated with the rate at which students completed the courses and earned satisfactory grades (C or better) and at the number of students enrolled that term and the following one. Their key findings were that students using OER took more credits than those using traditional printed materials; OER students saved more money; and there was no significant variation in the count of students who obtained a grade of C or higher. The study showed evidence that OER have higher efficiency and effectiveness compared to traditional printed material. Wiley & Hilton (2018) researched how course throughput rates could be improved and the OER mainstreaming outcomes from a ‘Z-Degree’ pioneer programme rolled out at Tidewater Community College. A Z-Degree is a zero-textbook-cost degree. This means that a student can earn an A.A. without buying a textbook. Any CLC student can take Z-Degree classes, and students may take as many Z-Degree classes as desired or available. The study revealed a higher dropout rate in students using traditional printed material than those using OER. Moreover, the completion rate for OER students was 66% compared to 60% for students using traditional printed material. The study revealed that students who use OER had a higher

completion rate compared to students who used traditional textbooks, and this is what makes OER relevant to this study.

Another study (Wiley & Hilton, 2018) looked at the tuition revenue retained (not refunded) due to decreased dropout rates. The analysis was done at Tidewater Community College in Virginia to see the impact of continued adoption of OER. The study revealed that for the business administration courses, the effective course dropout was reduced by USD 101 042 annually. The dropout rate for students using traditional printed material was 60% compared to 54% for those using OER. Therefore, the figures reveal the potential of OER to reduce dropout rates and cut revenue losses. Dropout rates are a concern at Africa University for both postgraduate and undergraduate programmes.

A related research that used a framework for evaluating the relative return of investment on traditional printed material textbooks revealed that OER recorded 25% savings compared to traditional printed material (Wiley & Hilton, 2018). This study was done at Tidewater Water Community College where one ordinary degree had been transformed into a Z-Degree, after the introduction of OER in its mainstream teaching and learning process. The statistics show that OER have some benefits over traditional printed material. The potential of OER to address educational challenges is vast and as yet unexplored, particularly in developing contexts where the need appears to be increasing daily. Therefore, at Africa University there is an opportunity for OER applications, like the 'Z-Degree' pioneer programme that was rolled out at Tidewater Community College. According to Wiley & Hilton (2018), in the USA there is an increasing trend to adopt OER in higher education institutions, particularly in low income community colleges. Recent evidence from the USA includes: 25 Virginia community colleges were funded by the Hewlett Foundation to launch at least one OER degree; Tidewater Community College, funded by NOVA, has been introducing OER degrees in phases since 2016; Achieving the Dream has been funding 38 colleges to use OER to address teaching and learning gaps since 2016; and the State of California has been funding OER initiatives in 25 colleges since 2016.

It can be argued that traditional printed material benefits institutions through revenue from book sales and financial support from textbook sellers. The prevailing business practice is that publishers only pay small amounts of money to learning institutions. When considering the running costs and dropout rates, compared to downloaded print-on-demand OER copies that can sell from USD 5 to USD 20, it is clear that there are more benefits in migrating to OER. Therefore, offering print-on-demand OER copies would have a positive impact on both the

institution and the students. According to Lalonde (2015), in February 2015 students in British Columbia reported savings estimated at USD 470, 000 – 760, 000 as a result of OER adoption. The financial savings that come with the adoption of open textbooks are significant, given the negative impact of rising textbook costs on students. There is reported evidence that “greater flexibility and instructor satisfaction” are attributed to OER adoption because learners and educators are not constrained on how to adapt and use OER (Masterman, Wild, White & Manton, 2011). The use of OER frees users from concerns about copyright. However, the use of some creative commons licences may limit the ability to receive monetary gains from open resources. On the other hand, there are never restrictions on the ability to share freely with others. There is also research-based evidence to support greater instructor collaboration when OER are used (Petrides, Jimes, Middleton-Detzner, Wallin & Shenandoah, 2011; Wiley & Green, 2012). Ehlers (2011) suggests that because of the ability to share and adapt materials, the creation and use of open materials allows for greater collaboration between instructors and colleagues, as well as between instructors and learners, and learners and learners. Apart from the above, OER have been reported to offer “diversity and infusion of local content” because the creative commons licence allows or permits open resources to be customised to suit local contexts and the integration of existing content (Petrides, Jimes, Middleton-Detzner, Wallin & Shenandoah, 2011; Wiley & Green, 2012). As open licences allow others to build on the original material, each adaptation may build on the original and subsequent iterations, which could result in improving the quality of the resource at each iteration. In brief, the nature of OER use and adaptation facilitates diversity of content and continuous infusion of new ideas.

There are increasing claims that OER provide opportunities for using innovative pedagogy (UNESCO, 2016a; 2016b; Wiley, 2017a; 2017b). The main argument put forward is that access to an extensive pool of resources that can be customised and redistributed promotes increased collaboration and participation and spurs innovative pedagogy. The reality, though, is that people learn when they do things, and copyright restricts what people are allowed to do with the teaching and learning resources; OER permit users to do new things and learn more deeply, more quickly and in broader contexts (Wiley, 2017a). However, there is still much research required to justify these claims of OER efficacy in different contexts.

Lastly, the central socio-economic values of OER include cost reduction and the potential to expose learners and educators to more and varied content not found in traditional books. The nature of OER lifecycle also promotes enhanced corroboration that can improve the quality of the resources. Overall openness is an essential ingredient to active learning (UNESCO, 2016a;

2016b; Wiley, 2014a; 2014b). Therefore, given the current state of educational resources in Zimbabwe, where the government and textbook retailers are not able to finance minimum stock levels, higher education institutions are not able to stock campus bookshops with the minimum stocks required, and most students are not able to afford commercial textbooks, it appears that OER are an excellent alternatives for all higher education institutions in Zimbabwe.

2.4.2 OER awareness

Awareness is the starting point in the process of OER adoption and use. Consequently, many studies have been conducted to explore OER awareness. A summary of OER awareness research recently conducted in the USA by Allen and Seaman (2017) reveals that most university professors in the USA are unaware of OER but are willing to try to use them in their mainstream teaching. The effort to find and evaluate OER is the most significant barrier to OER adoption and use. This would not be the case if there were universal use of OER, but universal awareness needs to come first. In the USA, awareness of OER is generally low, but it tends to increase with the size of classes, suggesting the cumulative impact of awareness with the increasing number of students. However, in a 2016 survey conducted in the USA, only 6.6% of professors were completely aware of OER, and a modest 19% were moderately aware of OER; only 34% of faculty were aware of open textbooks (Allen & Seaman, 2017). Although the surveys involved mostly faculty, their level of awareness gives some insight into the level of awareness among students in the same environment.

In Zimbabwe, Econet Wireless Zimbabwe conducted a comprehensive OER awareness campaign using television, print media, mobile text messages, road shows and promotions. Currently, the EcoSchool OER project is still promoted through various forms of publicity, advertising and campaigns throughout the year. However, the exact level of awareness achieved among Africa University students cannot be quantified with certainty at this stage. A question to establish awareness of the EcoSchool OER project was included in this study and will be discussed in Chapter 4.

2.4.3 OER support and training

Knowing how to search, select and use OER is proving to be the most significant barrier to OER adoption and use. Therefore, training and technical support need to be addressed efficiently (Armellini & Nie, 2013; Harley, 2008; Lynch & Rathert, 2015; Rolfe, 2012; Lane & McAndrew, 2010). Africa University students have not received any form of OER training

and there are no formal OER support structures. This presents a gap at Africa University that requires attention. Corroborating the importance of training and support structures, Armellini and Nie (2013) reiterated that during the OER implementation cycle there is a need for well coordinated training and support for educators and learners that focuses on what outcomes can be accrued from OER adoption and how to achieve them. They listed five areas of support that are directly related to OER training namely: locating and selecting, conducting research on OER usage, using emerging technologies to find and customise OER, OER licensing options and tools, and creating and licensing OER. These five training areas speak to the need of OER training at Africa University that have not been adopted in any form so far. It is clear that Africa University must work towards including these forms of support. The exact level of support provided at Africa University for each of these five pillars is an imperative influencing variable in the level of adoption and use of OER among Africa University students. Therefore, documentation on training and capacity building workshops for students and academic staff is recommended for review during data collection, so as to give an informed position on this crucial dimension of institutional support for OER and training.

A research by Chae and Jenkins (2015) confirms that students and instructors expected support in the form of an OER support unit, an OER CoP and instructional designers. In the case of Africa University, having a dedicated team that is only paid for OER adoption and use may not be feasible because of the small size of the institution. However, it is necessary to have a team with allocated responsibilities to drive the project. The team should be composed of selected OER champions among the students, academic and administrative staff. The administrative staff could be picked from the Information Communication Technologies (ICT) support team and library staff. It is important to nominate senior management as project gatekeepers and sponsors. In addition to OER, the team could engage in other activities like innovative pedagogy and recognition and rewards to promote the use of emerging technologies to address teaching and learning challenges.

In their studies on OER support, Harley (2008), Lynch and Rathert (2015) and Rolfe (2012) found that lack of support in terms of training in how to find and use OER is a barrier to the integration of open education materials. Lane and McAndrew (2010) note that the absence of support to encourage innovative teaching and learning practices negatively influences OER adoption. Using the comparison approach, these findings could be useful in interpreting the research findings at Africa University. Besides, the nature of the support and training provided

to students in their OER adoption and use journey has a bearing on the success of the process. On this note, the question that must be asked is: ‘Is the lack of training for students in using OER a factor at Africa University?’ The question cannot be answered without a field research. Therefore, this study also assessed the level and type of support provided to students and its related influence on OER adoption and use.

2.4.4 OER stakeholders

Some essential stakeholders, such as course developers, bookstores, administrators and librarians, can significantly benefit from playing roles in assisting in the successful integration of open educational practices (Butcher, 2015). According to Butcher (2015), librarians play a pivotal role in the process of adopting and incorporating OER. Essentially, librarians can enhance adoption by collaborating with academic staff in creating and promoting open digital resources. They are more informed on copyrights and licensing issues than academic staff (Jensen & West, 2015). On the other hand, educators need capacity building to search, select, create, adapt, improve, use and share OER. Furthermore, instructors need a readily available knowledgeable person whom they can rely on for assistance. Top management, including deans, may play a role in supporting the adoption of OER by addressing some of the barriers mentioned above. Administrators can assist by providing financial and other resources to units such as libraries and teaching and learning centres. The support of administrators can also take the form of policy, incentives and training (Chae & Jenkins, 2015). Regarding the role of campus bookstores, Lalonde (2013) contends that campus bookshops can sell printed copies of OER or offer print-on-demand services. One good example is Simon Fraser University in British Columbia that offers OER print-on-demand services at a fraction of the total cost of commercial textbooks. From the preceding discussion, it is evident that various stakeholders have essential roles to play in the adoption and use of OER in a university. Understanding the nature of Africa University’s stakeholders in the adoption and use of OER by students was an essential entity of this study.

2.4.5 OER adoption barriers

Understanding the barriers that prevent students and lecturers from adopting OER will help to inform future OER interventions. Just like traditional printed material, the quality of OER may in some cases be inconsistent, depending on the source, and therefore, some OER have been regarded as poor teaching and learning materials. Although not universally applicable, some

OER collections have a feedback mechanism that allows the users to evaluate and share their performance. Many OER are not regularly updated, depending on the staffing, content, technical and funding models, and the nature of the OER. Therefore, the absence of regular updates may render an OER less relevant. In some cases, it is necessary for OER to be modified to meet the particular course and institutional contexts. However, regular sharing and editing may raise quality and intellectual property concerns. One of the benefits of OER is that they adequately address intellectual property issues through the open licence framework.

In most cases, OER do not cater for people with disabilities (UNESCO, 2016a; 2016b; Wiley, 2010; 2017a). Despite the definite benefits of adopting OER, the intricacies of localising the resources are not easy (Perryman, Hemmings-Buckler, & Seal, 2014). In addition, it is difficult to adopt a new resource, technology or learning practice without the necessary skills. In a research done by Harley (2008), the respondents indicated that the difficulties in finding quality OER, adapt, and then integrate them into the instructor's existing practices were barriers to their intentions to adopt and use OER. Even when adoption occurred, lack of skills to customise has been reported as a barrier to actual OER use behaviour. The participants in that same study (Harley, 2008) also noted that it was difficult to find relevant resources because they lacked sufficient skills to search and find relevant OER. Sometimes neither learners nor educators have the background knowledge and accompanying confidence in using emerging technologies to perform the required customisations on OER. From the facts and findings presented above, it is clear that users require relevant skills and competencies to edit, adapt and transform the OER (Armellini & Nie, 2013). These skills and competencies are equally applicable to Africa University.

When a new textbook is adopted for a course, commercial publishers send textbook representatives to institutions to promote it; this addresses the challenges of training users to use conventional commercial textbooks. This is the advantage that instructors get from using commercial publishers, although it comes with additional costs. In the case of OER, instructors often need to seek out OER materials. Finding or creating the necessary ancillary resources takes time and may prove to be an adoption barrier to some instructors (Armellini & Nie, 2013; Petrides et al., 2011). In a research by Chae and Jenkins (2015, p. 22), the participants showed that "lack of time to find and modify materials" is one of the top barriers to integrating OER. This finding is confirmed by Armellini and Nie (2013), who noted that it takes a great deal of time for academics to find and adapt resources across multiple repositories. While the reviewed literature highlighted some barriers to the adoption of OER for students and instructors, I do

not think the barriers are insurmountable. Therefore, further research needs to be done to better understand how to remove some of these barriers and increase the prevalence of OER adoption in particular contexts. This study, therefore, also assessed barriers to OER adoption at Africa University among students and used the findings to make recommendations to mitigate them.

2.5 Variables that influence actual use of OER

OER funding and technical models are discussed as some of the variables that influence the actual use of OER. These factors are also determinants of the sustainability of OER. Sustainability means to maintain something at a certain desired rate or level. OER sustainability means meeting the present OER requirements and demand and guaranteeing the same for future generations. In other words, OER sustainability refers to the process of maintaining and avoiding the depletion of OER in the foreseeable future (Downes, 2007). Generally, sustainability is only associated with the financial resources required. However, there is need to look at the bigger picture because financial resources for OER are only a part of a broader dynamic picture that includes “what they are, who creates them, how we pay for them, how we distribute them and how we work with them” (Downes, 2007, p. 1). As a result, having information with regards to: what OER are, their creators, the creation process, the financial model that supports them, how they are distributed, and how we work with them, will help to solve the dilemma of OER sustainability. Guaranteeing the sustainability of OER is relevant and imperative to university learners, educators and administrators, education policy makers, and government agencies responsible for the stewardship of teaching and learning.

A clear understanding of the concept of a model is important in this research. The following quotation clarifies this concept:

Models, like myths and metaphors, help us to make sense of our world. Whether derived from whim or from serious research, a model offers its user a means of comprehending an otherwise incomprehensible problem. An instructional design model gives structure and meaning to an I.D. problem, enabling the would-be designer to negotiate her design task with a semblance of conscious understanding. Models help us to visualize the problem, to break it down into discrete, manageable units. The value of a specific model is determined within the context of use. Like any other instrument, a model assumes a specific intention of its user. A model should be judged by how it mediates the designer’s intention, how well it can share a work load, and how effectively it shifts

focus away from itself toward the object of the design activity (Clinton, Hakanson & Tracey, 2015, p. 234).

2.5.1 OER funding models

Presently, the most prevalent OER funding models are those that have been rolled out by multi-national development agencies working jointly with governments, in-country stakeholders, private organisations and philanthropists. Not all the funding models are obligatory and some may be discontinued at any point, depending on the development agency, availability of private capital and focus of philanthropists. Consequently, the continued availability of the OER funding models mentioned above cannot be guaranteed, as none of them has a constitutional right arising from an act of law. Therefore, it is necessary to move towards a market driven model. This will only be possible with increased OER adoption and government involvement in promoting open policies and publicly funding OER licences and platforms (Hewlett Foundation, November 2013, p. 15). In countries like Zimbabwe, funding by non-governmental organisations is limited as government policy restricts the activities of these organisations. A self-funding model is only possible when a government reaches the stage of self-sustainability and is able to fund its own policy initiatives.

An internet search of OER resources revealed a long list of OER providers, such as MERLOT, OER Africa, Siyavula, and EcoSchool OER. According to Downes (2007, p. 34), “these have originated from governments, from foundations and organizations, and from groups and individuals.” It is apparent that governments cannot achieve the goal of mainstreaming OER on their own. It is not, however, evident at the moment which model is the most promising. Even when a promising model is identified, literature on credibility contends that the validity, confirmability and transferability of the findings from one context to another are not automatic (Creswell & Clark, 2007). A promising funding model in the USA and South Africa, for example, may not be equally promising in the context of Zimbabwe. It is, therefore, necessary for a research enquiry to determine the ideal OER funding model for Africa University. Downes (2007) outlines and describes the following eight OER funding models:

a) Endowment model

A capital based injection, generally known as an ‘endowment fund’, is injected into the project, and the project will be self-sustaining on the basis of interest generated from the endowment

fund. The Stanford Encyclopaedia of Philosophy raised an endowment of USD 3 – 4 million to raise the required budget of USD 190 000. Scholarships often use the concept of endowment funding, and this has worked very well to perpetuate the funds (Downes, 2007).

b) Membership model

A group of organisations with a common interest is put together and they contribute a predetermined sum of money as seed capital or annual contributions to run the project. The Sabai Educational Program is one such example. On the other hand, the membership model can potentially “replace user-pay models of textbook distribution” (Downes, 2007, p. 34).

c) Donation model

The donation model begins by identifying a project of significant community value that is popularly supported by the community and stakeholders. A request for donations is sent out, and a non-profit foundation is used to manage the funds. Ideally, the funds that are used to finance operating costs and reserves may be used to create an endowment fund. Wikipedia, Apache Foundation, and Mozilla Foundation used this model (Downes, 2007).

d) Conversion model

This model is premised on the reality and realisation that there is a limit to donor funding; therefore, any project can be used to raise both value and continuity. The model works by giving out some free access to prospecting consumers before converting them into paying customers as they progressively increase their range and use of the resources. Examples of relevant open sources are; SuSe, RedHat and Ubuntu, and in the Education sector the prominent ones are Eigg and LAMS (Downes, 2007).

e) Contributor-pay model

In this model there is an interested contributor that is usually committed to funding the publication of certain resources and an OER service provider that receives the funding and makes the resources available for free. This model has been used by foundations that identified publishers that are funded to make resources freely available to the public. This model has been adopted by the USA Public Library of Science and the Wellcome Trust Foundation (Downes, 2007).

f) Sponsorship model

This is a very common model and its examples include free community radio and television stations. The model has been extended to online educational initiatives like the MIT iCampus Outreach Initiative that is sponsored by Microsoft, and the iTunes project that is sponsored by Apple. However, sponsors derive value by channelling their marketing and publicity strategies through these platforms as they guarantee them a large audience and diverse outreach. The EcoSchool OER project embodies every aspect of the sponsorship model. It is an initiative sponsored by Econet Wireless Zimbabwe as a social responsibility project with a complementary agenda of gaining both publicity and market share. This is the nature of all social responsibility initiatives and, ultimately, this compromises the core goals of the project. Hence, in this research recommendations for other OER sustainability models for Zimbabwe were explored (Downes, 2007).

g) Institutional model

This model can be viewed as an alternative version of the sponsorship model, but in this instance the institution creates its own funding and makes the OER freely available to the public. A good example of an institutional model is MIT's Open Courseware project. Therefore, universities could dedicate a budget for the creation and free publication of OER in support of the institutional vision and mission. Considering the success of MIT's Open Courseware project, it will be for the greater good of the OER movement if more institutions of higher education, like Africa University, could successfully implement additional OER institutional models. This will result in more OER repositories, probably with more localisation of content. (Downes, 2007).

h) Government model

This model compares well to the institution model, and the only difference is that the institution takes an agency role for the government and other agencies that work directly with the government, like the UN. One good example of a government-funded model is Canada's SchoolNet project. There are several projects that fall under this category in both the global North and South (Downes, 2007). In the face of donor fatigue in Zimbabwe and the current emphasis on the localisation of the education curriculum, it is logical for the Zimbabwean government to move towards some form of OER government model. Such models have been successfully implemented in developing countries like India and Vietnam. Brazil is another

good example, where all government-funded teaching and learning materials are released as OER. Recently, the South African government adopted a similar policy (Downes, 2007).

i) Partnerships and exchanges

This is not strictly considered a funding model as no direct exchange of funding is involved. It is based on the exchange of resources, with OER being the final outcome. It is a very useful model in the development and expansion of OER networks. The exchange takes the form of technical, functional and administrative resources required for the creation and development of high quality OER. At the UNESCO Open Source Congress in 2006, experts pledged their technical and physical workforce (functional) support for the design, development and implementation of OER. The concept has been successfully implemented by international fellowships in collaboration with the Open University (Downes, 2007).

Resumed, the preceding funding models have found different individual or merged applications in OER projects in different contexts across the globe. However, the degree of effectiveness of OER projects in Zimbabwe cannot be adequately ascertained without a context specific research. Adopted versions of individual funding models may also be found and may probably be referred to as emerging funding models or other funding models (Downes, 2007). These models could individually or jointly provide a starting point for the conception of an ideal OER funding model that might be able to support the demands and requirements of Africa University students. Based on the above discussion, the risk of OER unsustainability in Zimbabwe looms high, given the current predominant funding model (private funding). Therefore, there is need and hope to move towards government and public funding models to guarantee OER sustainability. Currently, the Zimbabwean government faces a severe shortage of resources as it is operating on a huge budget deficit. It would be too optimistic to expect the government to immediately have capacity to channel funds towards a self-sustainable OER model.

2.5.2 OER technical models

According to Downes (2007) and Wolfenden (2008), technical models for sustainable OER projects must address the distribution process of OER. The way OER are rendered to the public (access) and the ultimate affordances they deliver (usability) are imperative technical model specifications. Over the course of the evolution of OER, two distinct technical models can be singled out. The first model offers free access from a local repository and the resources are used verbatim without customisation features. This generally takes the form of an OER

repository. Secondly, downloadable OER resources that can be repurposed and uploaded back into the public domain to continue the sharing cycle, use and repurposing by other users. The ability and facility to repurpose software are the major distinctions between ‘free’ and ‘open source’. There are OER without a derivative licence that people are still free to use and repurpose. This amounts to a breach of Open Licensing agreements. It is important to note that free use of educational resources that are not part of any OER cycle may not necessarily be OER. OER must be reused, redistributed, remixed, repurposed and retained, as provided by their creative commons licences (Wiley, 2010). Whether these processes apply to a specific OER or not depends on the licence. A technical model is said to be effective when it addresses accessibility and usability issues, and “such considerations also comprise mechanisms to assist dissemination, adoption, evaluation and use of open courseware materials” (Downes, 2007, p. 39). It is against this background that several UNESCO OER discussions have suggested a Global Index System to facilitate universal, quick, easy and systematic access of OER (Downes, 2007; Wolfenden, 2008). Moreover, the Global Index System’s recommendations are meant to address or mitigate challenges associated with OER quality. The expectation is that the Global Index System can serve as an OER evaluation and auditing platform.

OER is mainly provided through centralised system repositories with features to track, manage and control versions. Downes (2007) uses the term ‘Specialized Version Control Systems’, for example, CVS or Subversion. However, different offerings or configurations are available from different providers. The following typical configurations are recommended:

- a) Distributed databases must be used to provision the OER.
- b) Downloading and customisation features must be available. Most modern OER are designed to be downloaded and used on multiple devices, including mobile devices. A good example is the new download feature on African Storybook resources⁸.
- c) At least one database index key must be provided for quick searching of the resources.
- d) The index must be regularly updatable with capabilities to provide a snap shot.
- e) Functionalities to rate, provide feedback, and usage audit trails must be an integrated in the index.

⁸ www.africanstorybook.org

Notable examples of OER repository projects are MERLOT, NSDL, CAREO, OER Africa, African Storybook, as well as the digital access-control management system, as implemented in the CORDA project (Downes, 2007). The exact nature of the OER technical model adopted by the EcoSchool certainly influences the adoption rate and usage pattern of OER among Africa University students. Therefore, appropriate OER technical models are included and assessed in this study.

2.6 Variables that influence OER usage pattern

The three categories of variables that influence the effective OER usage pattern namely: OER content models, OER staffing models, and online learning theories and models are discussed in this section.

2.6.1 OER content models

OER content models refer to how OER content is developed, that is, workflow models of creating OER. According to Downes (2007), the discussion or definition of OER content models should take into consideration the nature of the content. The timeline of the content should also be addressed, because textbooks may last years or may need revised editions, while course material does not last more than eight years. The flexibility of the content is another concern; for example, if images are available only inside the textbook, it may be difficult to extract and reuse them unless the textbook is formatted to allow it. Content models also address how the content is developed and look at workflow models of creating the content. The workflow models have to be explicit to make sure that the processes are clear. The reusability of the content is also an important quality incorporated into content models, and significant research has been done to ensuring reusability of OER content. Mason (1994) contends that “the accusation of cultural imperialism has long been levelled against attempts to export courses outside national boundaries, particularly as most of the examples involved Western institutions providing courses for Third World countries” (p. 38). This assertion calls for a federated approach to the development of OER content.

The concept and spirit of co-development of OER content has been corroborated by other researchers (Diakité, 2002). If OER content is to be effective and increasingly accepted, some degree of content co-development, in the form of local case studies and examples, at the very minimum, must be evident. Stephenson (2005) creatively says this using the equation “Open

Content + Community = Open Course”, meaning that the target community must be part of the OER content development process, model, equation, system or lifecycle, as variously defined.

This section looks specifically at the OER content models effectively in use. This will provide a basis of comparison with what literature and research say about how best to design online learning resources. It is important to identify the gap(s) between theory and practice and use existing literature to identify and recommend the most promising model. The content models discussed in this section include early OER workflow models, the MIT OER workflow model, and the CORRE/OTTER model. It is therefore imperative to look at a brief history of OER workflow models. The progression from one model to another has normally been motivated by the need to improve the existing model(s) to close the identified gap(s).

a) MIT OER workflow model

The MIT Open Courseware OER project (Figure 2.1) is based on the institution’s mission and vision to share knowledge. It is a classic OER institutional funding model, which supports its ideal to promote education globally by openly sharing ideas and knowledge in the form of OER. Basically, the OER comes in different forms, including audio, video, complete texts, simulations and animations. Users participating in the MIT OER cycle are obligated to: not use the material for financial gain or on a commercial scale; acknowledge MIT, the originating author(s), and contributing author(s) when repurposing materials; and ensure that redistribution of the original content is always free under the original terms and conditions (P. Parker, 2012).

As depicted in Figure 2.1, the MIT OER workflow model consists of recruiting faculty and courses, planning, building, publishing and supporting. The processes are continuous and iterative, and continuous funding is required to ensure sustainability (Weeramuni, 2019). Ideally, Africa University can start its own OER project similar to this MIT OER model. Africa University is owned by the General Board of Higher Education Ministries of the United Methodist Church. It is registered in the USA and has fund raising structures in the USA. The General Board of Higher Education Ministries has been raising funds for several Africa University projects, and funds can also be raised for an OER project. It is also practically possible for the General Board of Higher Education Ministries to secure partnerships to assist with human resources. The use of emerging technologies is implicitly and explicitly enshrined in Africa University’s mission, vision and strategic plan. It is practically possible for Africa University to successfully rollout an OER project along the lines of MIT OER, and it is only a matter of priority and executive sponsorship for an OER project to be established.

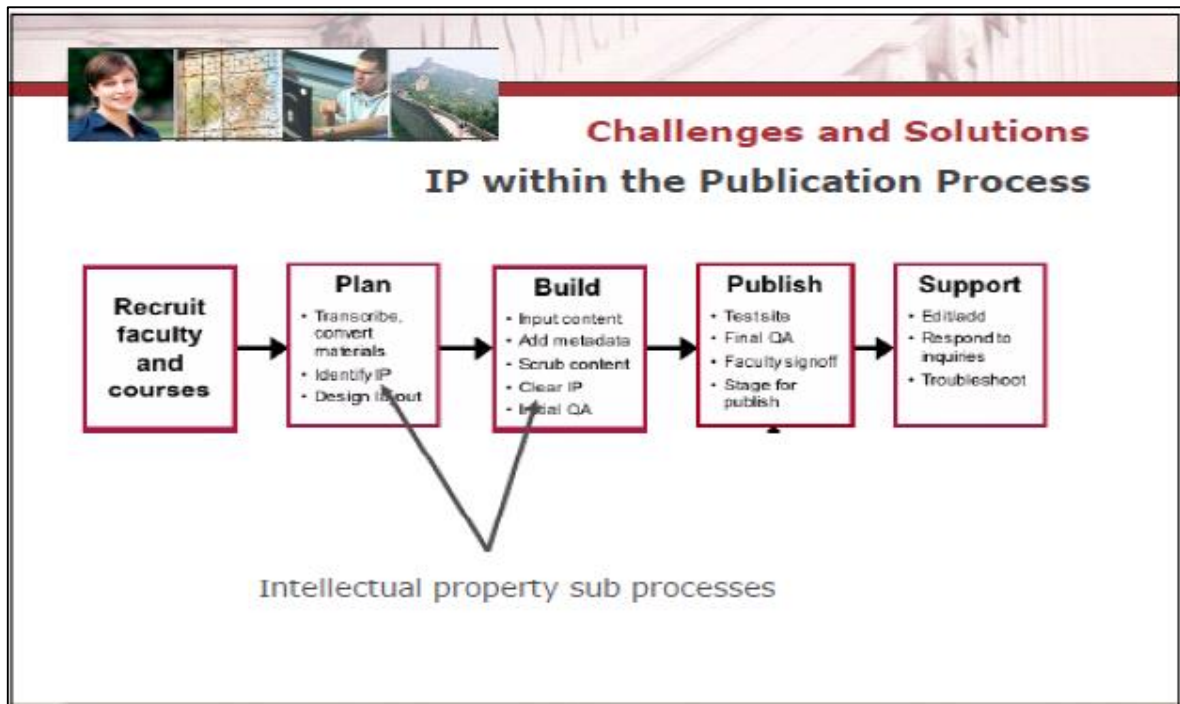


Figure 2.1: The MIT Open Courseware OER project

Source: P. Parker, 2012, p. 238

The workflow model is a five-stage linear process. The first stage is identifying faculty members with courses that can be shared as OER. At this stage, the staff members or required courses are respectively recruited and identified to be part of the OER lifecycle. Then follows the planning stage, and the key activities at this point are: transcription and conversion of course material, designing the layout out of the course and identifying intellectual property. Stage 3 is the actual OER building phase, and its key activities are: input of OER content, adding metadata to facilitate searching of OER using search engines, scrubbing of the OER content, clearing intellectual property issues, and initial quality assurance activities. The fourth stage is the OER publishing phase, and its key activities are: providing a test platform, final quality assurance activities, securing faculty sign off, and providing the live staging platform. The fifth stage is support activities, and it has the following key activities: editorial services of existing OER, adding new materials, responding to inquiries, and troubleshooting (Weeramuni, 2019).

The MIT OCW staffing model consists mainly of paid staff. It is a fairly small team consisting of three publication managers, seven department liaisons, who work with the faculty to identify sources of all third party content, and two intellectual property team members, whose role is to seek permission for all objects assigned to this process, identify untapped resources of open

content, and perform biannual course audits to ensure compliance with standards and copyright law (P. Parker, 2012).

b) Open University OER transformation models

According to Lane and McAndrew (2010), the Open University has three workflow models for OER development and deployment:

- i. Integrity model: The resources are kept in their original mode as far as possible to protect identity
- ii. Essence model: The resources are trimmed down to retain essential content and features required by the target users and some features to enhance navigation and interactivity may be added
- iii. Remix model: The contributed content is used as a baseline for developing ideal online OER using emerging technologies

This model provides an opportunity to provide essential content with added functionality, as opposed to the redistribution of OER that students may find unattractive. When applied in the right context, it can increase adoption.

c) CORRE/OTTER model

The OTTER (Open, Transferable and Technology-Enabled Educational Resources) project is a large scale longitudinal experimental project that started in May 2009, funded jointly by JISC and the HE Academy in the USA. The project afforded Leicester University a unique opportunity to stage a large scale high quality institutional OER repository with a robust evaluation and support framework. OER content catering for an excess of 360 credit hours was made available.

Moreover, significant data on attitudes towards OER and satisfaction levels have been derived from this project. It is important to note that all data pointed to the fact that OER are a promising solution to access, quality and equity of educational resources. Guidelines to commission (put-up) and decommission (take-down) OER were developed. The put-up and take-down guidelines are an essential software project management requirement that ensures ethical compliance. A set of guidelines or a model to convert common teaching content into OER named CORRE was also created (Figure 2.2). CORRE stands for Content, Openness, Reuse & Repurpose, and Evidence. These can be viewed as different progressive stages of a framework

for transforming teaching materials into OER. At the Content stage, the key activities are OER contribution, gathering and screening. The Openness stage addresses intellectual property issues, clearing of rights, transformation of content for usability, creation of multiple formats for OER release. The Reuse & Repurpose phase involves validation of revised and remixed versions, uploading to repository and release of OER. Finally, the Evidence stage is concerned with tracking usage and providing usage statistics and reports.

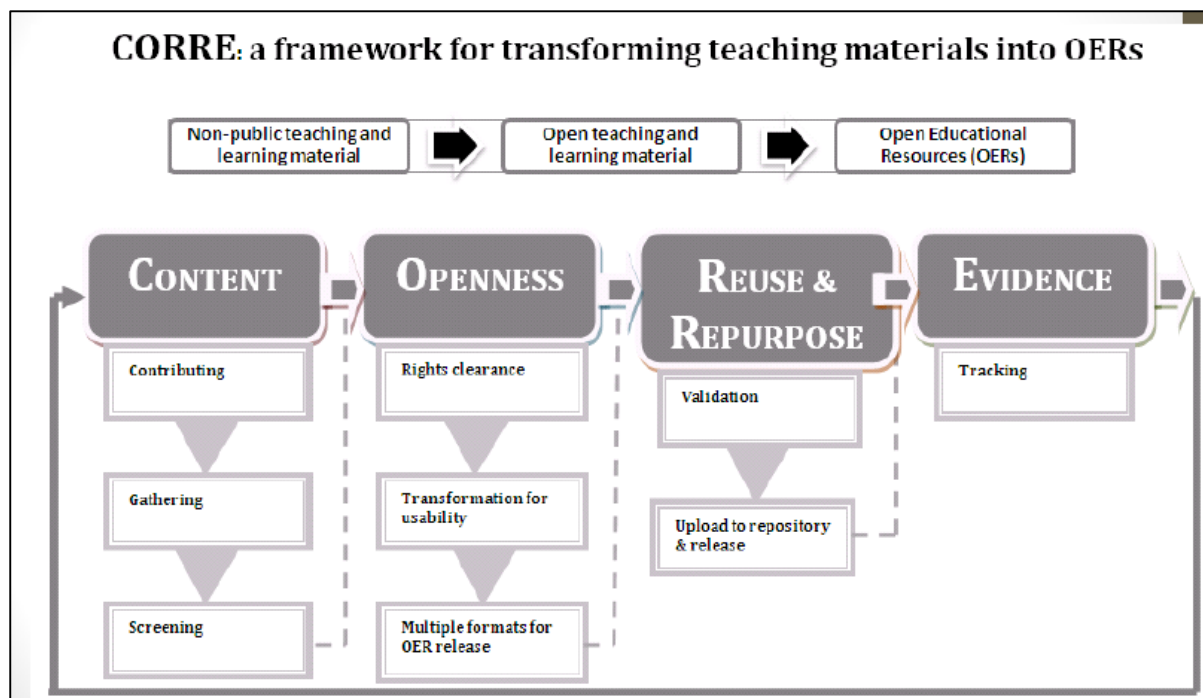


Figure 2.2: CORRE framework

Source: Nikoi, Rowlett, Armellini & Witthaus, 2011, p. 202

Leicester University successfully used the CORRE model to transform existing learning resources to OER. The roles and responsibilities of the resources involved in the project are depicted in Figure 2.3. Below are the five major categories of roles and responsibilities that can be identified:

- Academics are involved in contributing content and validation of content at the Reuse & Repurpose stage.
- The OER project manager is responsible for gathering content.
- The copyright administrator or librarian is responsible for gathering OER content.
- The learning technologist is responsible for multiple formats for OER release, updating the repository and release of OER.

- e) The OER educator, the Editorial Board or the Head of Department are responsible for screening and transforming OER for usability.

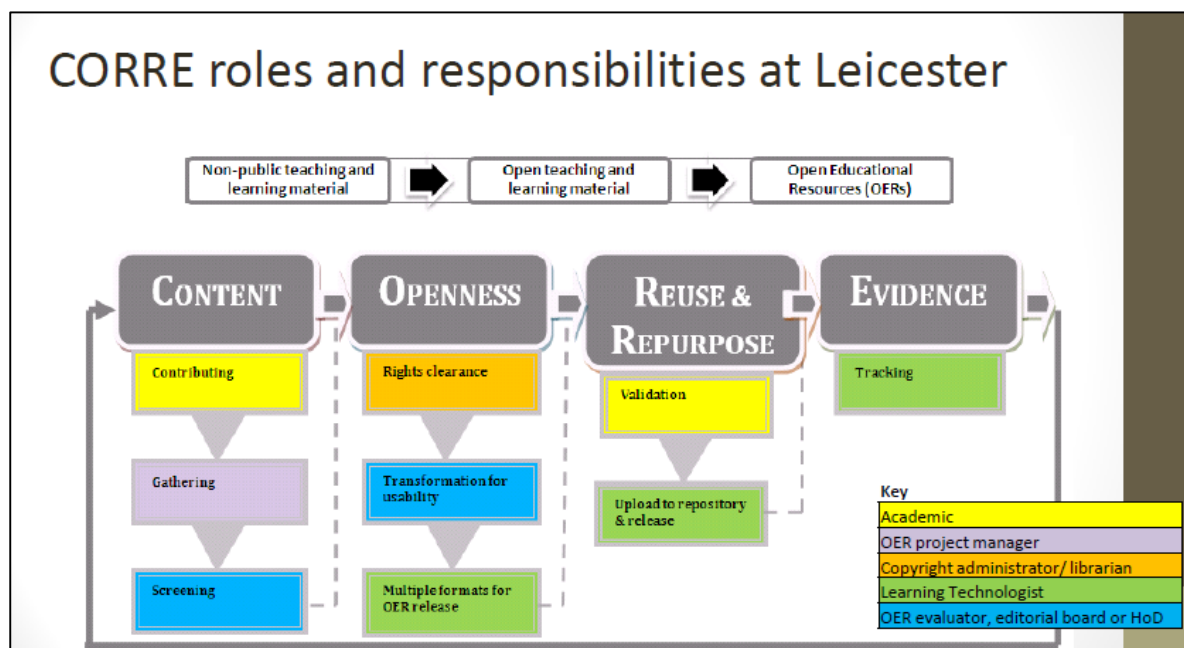


Figure 2.3: CORRE roles and responsibilities at Leicester

Source: Mawoyo & Butcher, 2012, p. 205

The CORRE model has extensive applications in different contexts. Table 2.4 depicts CORRE use at the Universities of Derby and Bath. The University of Bath applied both the adopted and adapted versions of CORRE. The Learning and Technology Enhancement office used CORRE to transform existing content into OER. On the other hand, the Division of Lifelong Learning adapted CORRE to create a framework for creating OER from scratch. The University of Derby used an untransformed version of CORRE to transform existing content in the Faculty of Law into OER. The University of Derby also used the transformed version of CORRE to create OER for hairdressing courses from scratch.

Table 2.4: Examples of CORRE application

Institution	Area	New/Existing	CORRE or Adapted CORRE
Bath	Learning & Teaching Enhancement Office	Existing	CORRE
	Division of Lifelong Learning	New	Adapted CORRE
Derby	Law	Existing	CORRE
	Hairdressing	New	Adapted CORRE

Source: Compiled from Witthaus, 2012

The CORRE model was initially designed to transform existing content into OER. There are several scenarios that call for the creation of OER. Consequently, The Universities of Derby and Bath separated and transformed the original CORRE model to create an adapted version to help them to create new OER. Figure 2.4 depicts the University of Derby's adapted CORRE model for the development of new OER. In this model, five categories of roles and responsibilities are identified:

- a) Academics are responsible for contributing and validating OER.
- b) The OER project manager is responsible for OER gathering and tracking actual OER usage.
- c) The copyright administrator or librarian is responsible for OER rights clearance.
- d) The learning technologist is responsible for screening; uploading to repository and release of OER on to the live platform.
- e) The developer is in charge of transformation for usability and multiple formats for OER release.

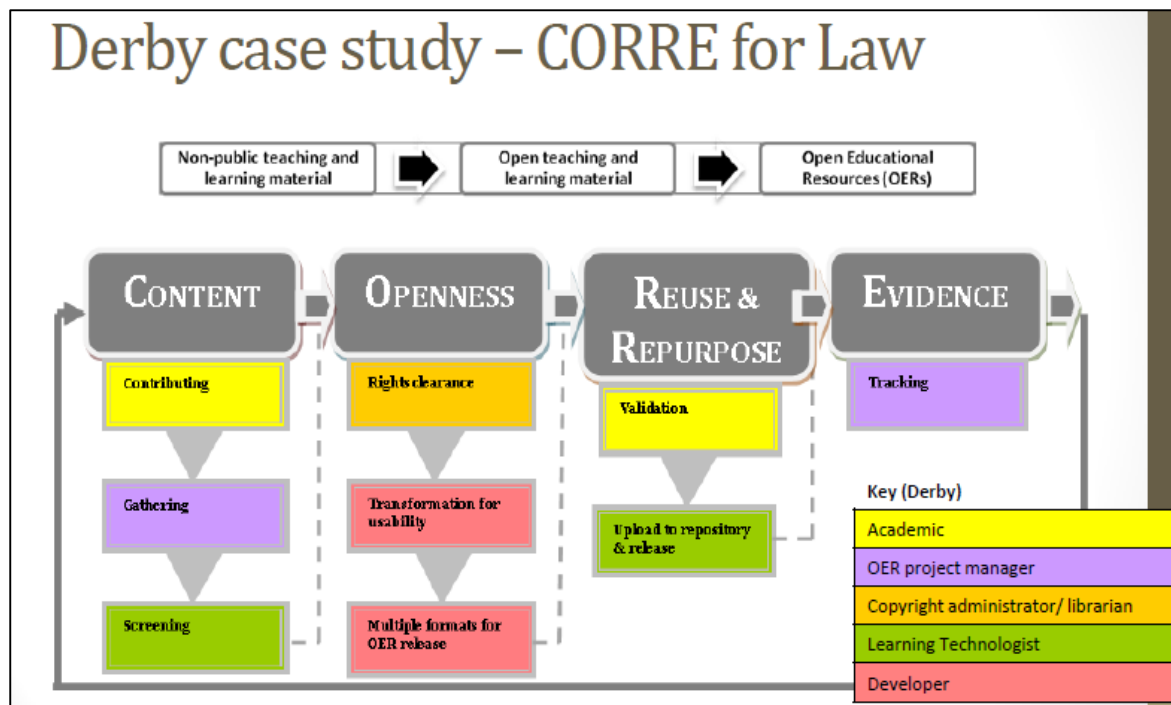


Figure 2.4: Adapted CORRE for creating new OER

Source: Nikoi et al., 2011, p. 203

The University of Bath also adapted the CORRE model to produce its own framework for producing new OER. Depicted in Figure 2.5 below are the six distinct roles and responsibilities that can be singled out in this adapted model:

- Academics/authors are responsible for authoring the OER content.
- The instructional designer is responsible for the structure and layout of the OER.
- The learning technologist is responsible for learning design.
- The programme head is responsible for unit evaluation and usability testing.
- The students are responsible for usability testing.
- The project manager is responsible for technical considerations, final OER validation and release.

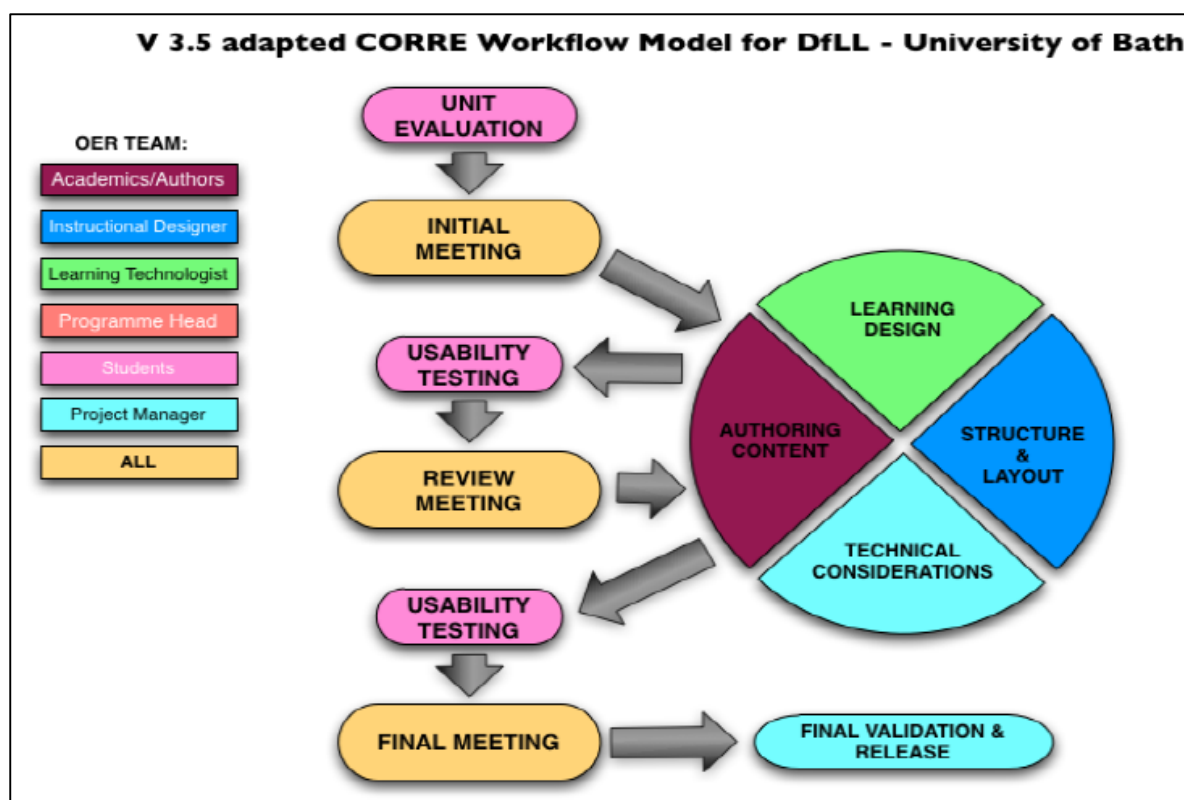


Figure 2.5: Adapted CORRE model at University of Bath

Source: Nikoi et al., 2011, p. 205

The DORRE framework (Figure 2.6) is another model that can be used to create OER. The existing content is characterised by three defining stages. First, the Design for Openness caters for both existing and new OER. The activities for existing OER entail gathering the OER, obtaining rights clearance, usability and accessibility testing and the final release of OER. Where new OER are involved, the first stage is Design for Openness and then development of the OER. Second, in the Reuse & Repurpose stage, multiple formats for OER release are produced, followed by validation and actual release of OER into the repository. Lastly, the Evidence stage is to track usage metrics and produce analytical reports and statistics.

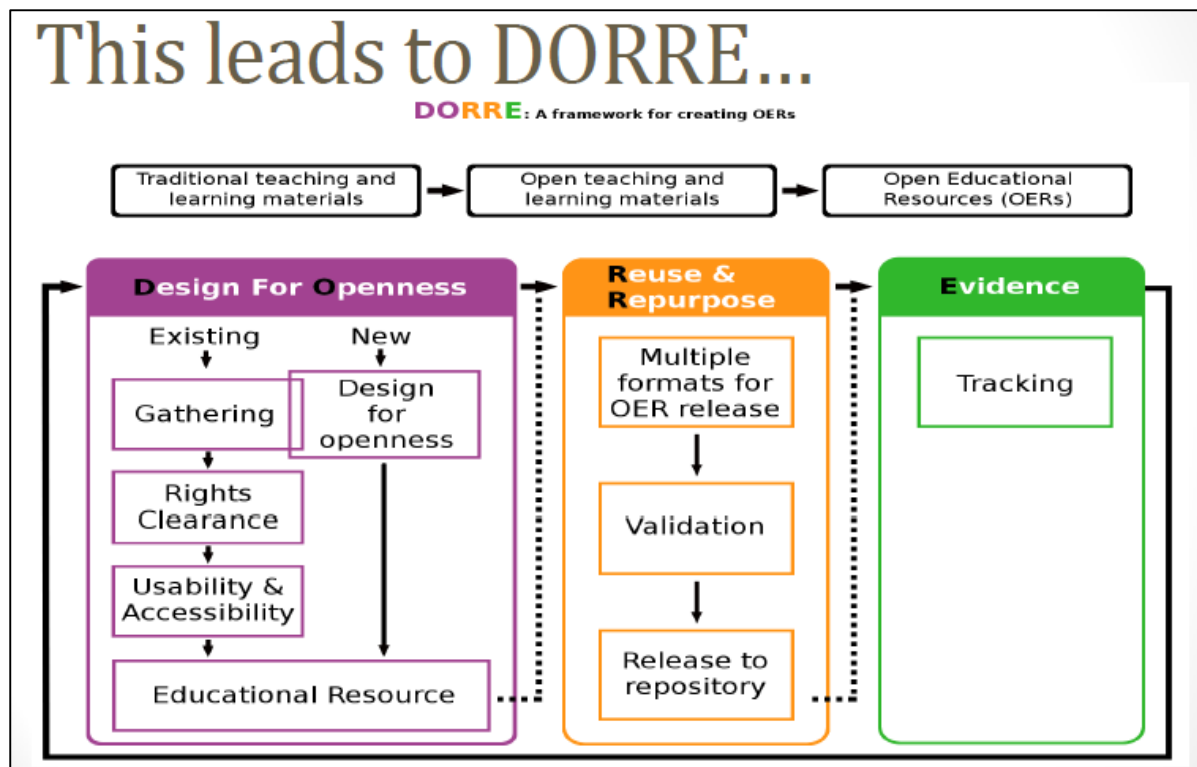


Figure 2.6: DORRE model, a derivative of CORRE

Source: Nikoi et al., 2011, p. 207

d) OER university model

The OER University model (Figure 2.7) has five defining characteristics:

- a) Learners access OER through a centralised repository.
- b) Open student support is provided through a pool of international academic volunteers.
- c) The participating institutions provide assessments for the learners.
- d) The participating institutions grant credit for courses.
- e) Learners are awarded a credible degree or credentials.

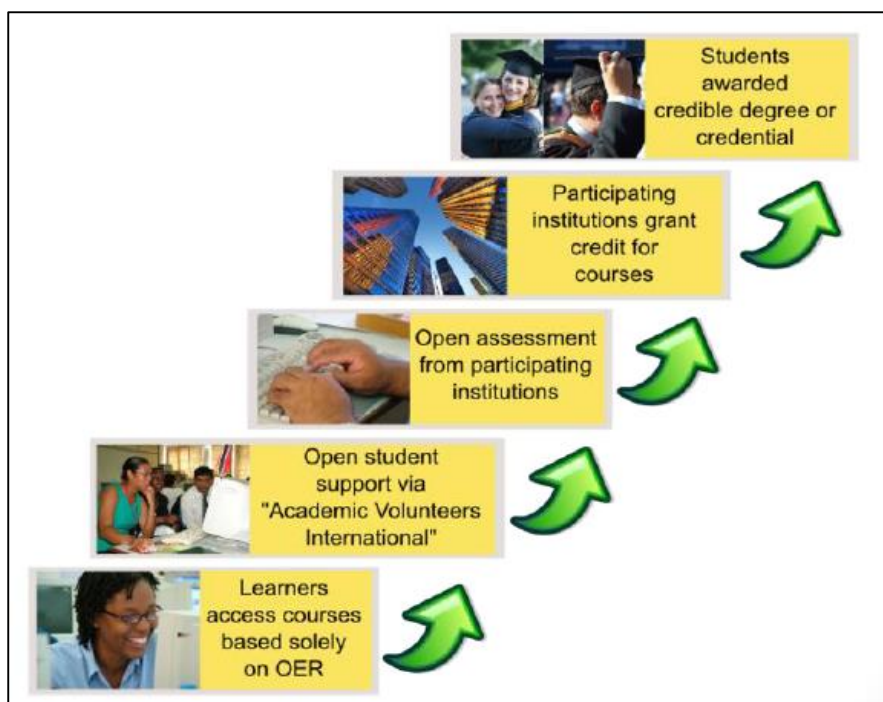


Figure 2.7: OER University model 9

Source: Taylor, 2007, p. 177

2.6.2 OER staffing models

It is worthwhile to note at this point that the sustainability and effectiveness of OER do not only depend on technical, funding and content models. Staffing is also important and, ultimately, ensures that the delicate balance of all the factors is meticulously considered and equilibrated together (Downes, 2007).

Paid and volunteer staff are the two main forms of staffing in OER projects. Several issues relating to the effectiveness and appropriateness of each staffing category arise. Motivation and incentives are required to keep them focused on the project. However, paid staff may not have the motivation and knowledge of sharing. In addition, it may be difficult to effectively introduce this concept and motivate all paid staff. Consequently, a volunteer staffing model is widely used in some large scale OER projects. MERLOT invites volunteer contributions and then sends the OER to a panel of OER professional peer committees. However, research reveals that only 14% of the MERLOT content is peer reviewed (Downes, 2007).

⁹ http://wikieducator.org/OER_university/About

Exploring OER staffing models can help to answer the following questions:

- i. How do we position and equip the project in terms of human resource complement and emerging technologies skills and competencies expected in a global context?
- ii. How do we acquire customisation capabilities to suit local requirements?
- iii. How do we develop a culture and environment conducive for OER?
- iv. How do we cater for the language to be both local and context sensitive, and for the capability to provision the OER in multiple languages? (Prasad, 2002; Downes, 2007).

However, where there are numerous and varied OER providers, a detailed research enquiry may help to expose the particularities that can help to improve the OER lifecycle. In the context of this case study, there is a limited number of OER providers and, therefore, there are no significant benefits of further exploring this line of research enquiry. Besides, this line of enquiry also has a strong connection to Human Resources, Sociology or Psychology and can be undertaken as an independent research. There is also no need for additional staff dedicated to OER in universities in developing countries, other than library support staff. OER are developed by academics to support their own courses, and the institution is obligated to create an enabling policy environment.

2.6.3 Online learning models

This section covers online learning models in detail, because in the recent years OER have become predominantly online learning resources hence; the way they are modelled online is important because it affects their adoption preferences and effectiveness. It is important to recognise that there are OER that are not necessarily used online. The internet, however, enhances access and dissemination of OER.

A synthesis of the instructional system design, constructivist learning models, learning environments models, model of online learning (Terry Anderson), Salmon's 5 stage model, online design model (Dabbagh & Bannan-Ritland, 2005), and problem-finding and problem-solving model is covered in this section as a comprehensive list of relevant theories and models identified during the literature review. These theories inform and guide the interpretation of field research findings and recommendations.

a) Model of online learning (Terry Anderson)

One of the most relevant and useful theories is the model of online learning developed by Terry Anderson in 2003. At the centre of this theory are the students, content and teachers. Usually, deep and meaningful learning takes place when interactions among students, content and teachers are maximised. These interactions, represented in Figure 2.8, are student to student, student to content, student to teacher, teacher to content, content to content and teacher to teacher. Anderson (2003) contends that, at the minimum, there must be teacher to student, student to student and student to content iterations. This assertion is logical because this is what is available in the traditional classroom, where the teacher interacts with students during teaching, and the students talk to each other and read the textbooks provided. In the traditional classroom with traditional teaching material, only the minimum iteration can be achieved.

Merging an effective online learning model with the correct OER technical, content, staffing and the funding models detailed earlier in the chapter creates a teaching and learning environment that makes it possible to achieve all the interactions of the Anderson model. This is not achievable in the traditional classroom setting. Furthermore, OER learning models are not just hype, but can merge and integrate well with some proven theories of teaching and learning that continue to champion the evolution of education across the globe in the 21st century and beyond. However, this does not happen automatically; it only happens because of conscious design effort by course instructors. An institution like Africa University could pin its hope on OER and promising theories like Anderson's model of online learning to revolutionise the teaching and learning experience. The Anderson model has great potential to address all forms of interactions in teaching and learning and is a perfect model of creating and sharing knowledge. These characteristics of the Anderson model fit well into the key tenets of an OER lifecycle. Therefore, integrating the Anderson model into the OER lifecycle logically leads to a more effective solution for addressing teaching and learning challenges.

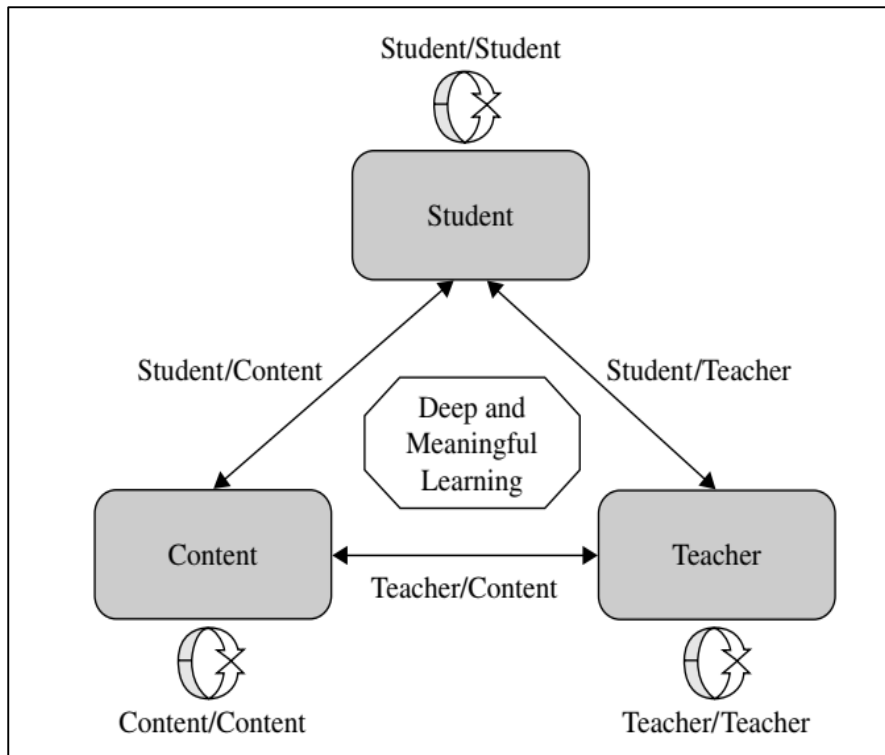


Figure 2.8: The model of online learning showing the types of interactions

Source: Anderson, 2003, p. 133

b) Problem-finding and problem-solving model

The problem-finding and problem-solving model (Figure 2.9) is premised on the wisdom of respectively identifying the causes of a problem and the set of instructions that can address it. The model includes the following set of instructions (Adapted from Smith & Ragan, 2005):

- i. Establish if there is a possible problem with the teaching and learning process
- ii. Determine if there are other applicable solutions
- iii. Ascertain if there is a set of instructions to address the learning gap
- iv. Identify and close the gap in instructions or create an innovative set of instructions

c) Discrepancy model

The goal of the discrepancy model is to ascertain the current status ('what is') and the ideal status ('what should be') by addressing the following questions:

- i. What are the goals?
- ii. To what extent have the learning goals been achieved?
- iii. What gaps exist between the current and expected states?

- iv. Which gaps are most critical?
 - v. Which gaps are caused by learning that can benefit from online learning intervention?
- (Adapted from Smith & Ragan, 2005)

d) Innovation model

This model calls for users to conjure creativity and innovation by exploring any possibilities or opportunities that exist and establishing where the activity can be enhanced or improved.

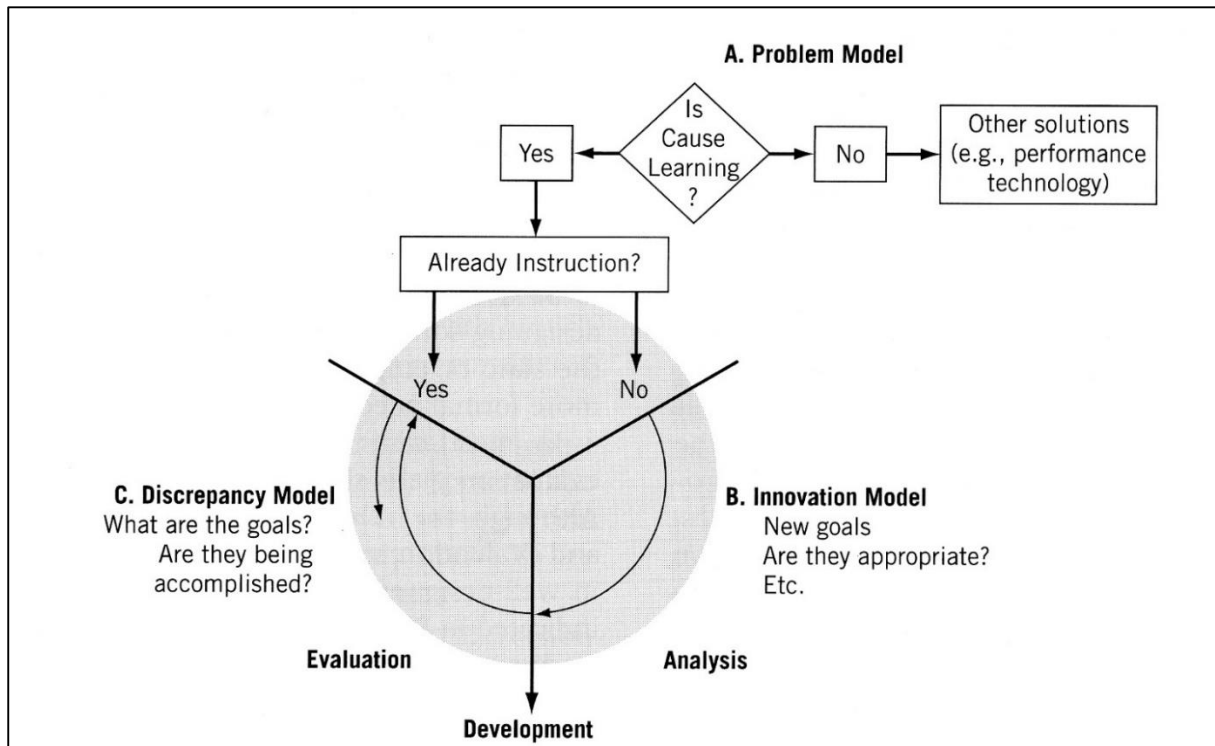


Figure 2.9: Problem-finding and problem solving model

Source: Smith & Ragan, 2005, p. 44

YouTube videos essentially use both the discrepancy and innovative models, based on the spirit of highlighting problems and providing concise instructions, based on the discrepancy and innovative models. YouTube videos have been increasingly adopted and used by Africa University students, and this can be taken as an indicator of the effectiveness of the discrepancy and innovative models. During 2016, the Africa University administration decided to limit the monthly data bundle size for each student, as a result of continuous and concurrent access of YouTube based educational resources.

An essential feature of the problem-solving approach is that it emphasises on stakeholder consultation at the onset of problems. After identifying the nature of the problems, stakeholders

then work together to elaborate instructions to close the gap, as depicted in Figure 2.10. Consequently, the process of OER development ought to start with identifying what the nature of the problem is and proceed to the innovation model or discrepancy model. This will guarantee the development of OER that address the needs of the stakeholders. The key stakeholders are the learners, the institutions and the educators, who all have to work together in the OER lifecycle.

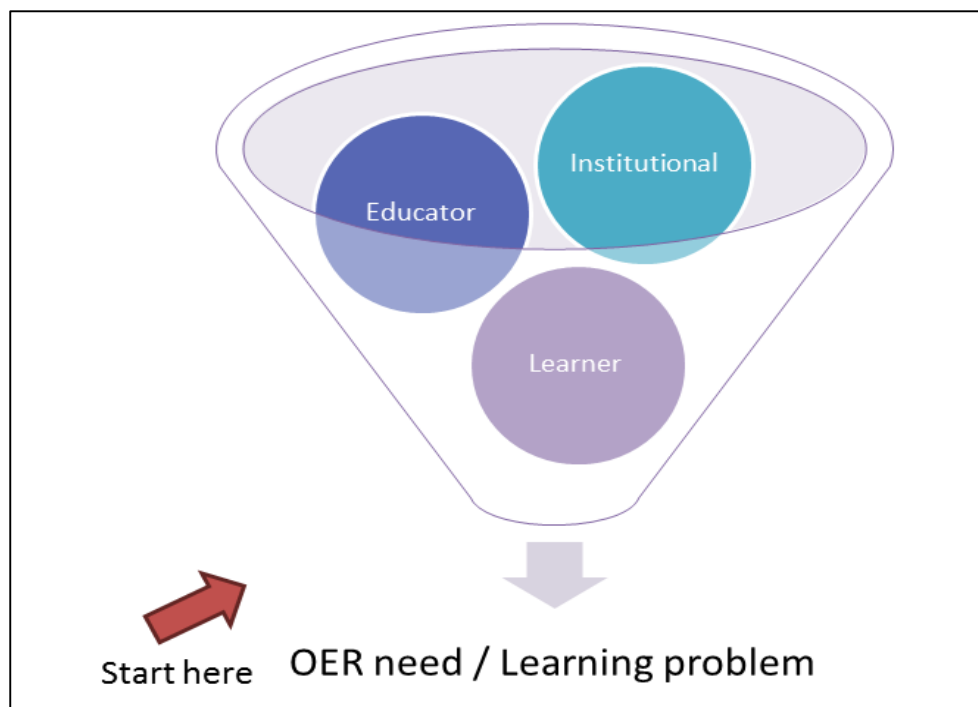


Figure 2.10: Start with stakeholder consultation

Source: Smith & Ragan, 2005, p. 46

The learner is at the centre of this research. This section looked at how learning theories could be leveraged to address teaching and learning challenges.

2.7 Emerging technologies as solutions to learning challenges

In Chapter 1 it was clarified that emerging technologies hold the solution to 21st century learning challenges and pedagogical transformation. It is anticipated that universities can greatly benefit from an exploration of literature to resolve some learning challenges using emerging technologies.

Various emerging technologies, such as Wiki, blogs, podcasts, Listserv and web conferencing, are considered in this section as solutions to learning challenges. The persistent problem that educators have relates to addressing teaching and learning challenges. The literature review showed that educational challenges include cost, access, availability and quality of educational materials. Emerging technologies can increasingly be used to address some of these educational problems. This section reviews some of the recent applications of emerging OER technologies in addressing teaching and learning challenges.

2.7.1 Emerging technologies and social learning

This section is a walkthrough of how emerging technologies can be used to address teaching and learning challenges, using the example of Africa University. I used social learning through student engagement in a CoP to illustrate how emerging technologies can universally be used to address specific teaching and learning challenges in higher education contexts.

Social learning has four components that can benefit lecturers. These components are learning as experience (lecturers discussing life experiences); learning as doing (lecturers talking about the activities and guiding principles of what people do); learning as belonging (community formation and people's participation in community makes them recognised); and learning as becoming (how learning changes a lecturer at a personal level) (Wenger, 1998, p. 5). A CoP provides an opportunity for people with the same interests to meet, discuss and share ideals and ideas and collaborate. The key to social learning is that people should actively participate in it and not merely absorb information from an 'expert' figure. Africa University students and staff are pan-African in nature, meaning that at any given time the student and staff body consists of no less than 28 distinct nationalities. Such a diverse staff and student body could benefit from well-structured CoPs.

Wenger, McDermott and Snyder (2002) define a CoP as a group of employees who share a common interest for a defined subject related to their work and who exchange information and knowledge across and beyond organisational boundaries, motivated to develop new knowledge or best practices through social interactions. The focus of a CoP is the practical aspects of a practice (McDermott, 2000). Importantly, the practice is shared among the members of the community. However, the most important components in a CoP are the community and the degree of participation by the members (Kimble et al., 2006 cited in Hara, 2009, p. 25). Ideally, a CoP can be established to allow lecturers to exchange their knowledge that is linked to

practice. When lecturers engage in a CoP to share teaching and learning experiences, it can be interpreted as a way of viewing learning as a social process (Wenger, 1998, p. 5).

a) Emerging technology tools in use

A study by Nistor, Baltes and Schustek (2012, p. 111) used an intranet-based FAQ interface to support a virtual CoP. Members were required to post questions and answers, to search for information or to read the available information. This interface could be found on the university's intranet. In their study of a K-13 education CoP, Schlager and Fusco (2006, p. 203) used the socio-technical infrastructure of a virtual environment called Tapped In¹⁰ to support the CoP by providing a platform for the community members to interact with one another. Verster (2011) created a social network for mathematical educators using the NING platform¹¹. This uses file, photo and audio uploads, blogs and text chats to facilitate real-time discussions and online meetings. It is a CoP for sharing mathematical resources and practices. It is free to create an account, but it requires a monthly subscription. McGee and Diaz (2007) examine the use of blogs, wikis, and podcasts and found that blogs are used as private journals to set learning goals and tasks. Blogs were also used in a study by Byington (2011). McGee and Diaz (2007) found that, on the other hand, Wikis are used as a personal space for content organisation and management and that podcasts are used to send instructional voice messages to users who can download them to their computers and phones. At Africa University, the MOODLE learning management system supports blogs, wikis and functionalities to upload and share audio and podcasts. There is a full time Educational Technologist who is responsible for capacitation of educators and learners in the use of ICT in education. Therefore, in terms of technologies required to support online CoPs, Africa University is well positioned to explore this opportunity gap. CoPs have potential application in the adoption of OER and this makes them particularly relevant in this study, where the primary concern is adoption of OER.

b) Challenges to teaching and learning

One of the reported problems at Africa University has been the lack of student engagement in large lecture situations. Clay and Breslow (2006) state that the lecturer's ability to engage and entertain students is a strong factor in students' decisions to attend a lecture. Most students

¹⁰ www.tappedin.org

¹¹ www.mathsliteracy.ning.com

have smart phones, tablets or other electronic devices and the university also has notebooks that students can borrow. As a result, the university has included the use of ICT resources in the performance development plans of every lecturer in order to increase student engagement in large classes. However, because some lecturers do not have the necessary pedagogical skills to use ICT in lectures, the argument is that they could develop a CoP to assist one another to develop strategies to use ICT in their teaching. This reasoning is based on the work of Ardichvili et al. (2003, cited in Smith, 2013, p. 403) that found that a CoP could function when members are drawn from existing collaborative networks. Such networks exist at Africa University because lecturers belong to a Teaching and Learning Forum, as well as to various networks such as the institution's e-learning task teams. Apart from that, the senior management of the university are committed to promoting innovative ways of teaching and learning. Therefore, collaboration is seen as one way of promoting innovations in teaching (Lee, 1991). Collaboration platforms can be instrumental in enhancing the adoption of OER among Africa University students, which is the fundamental concern in this study.

c) Inherent affordances of emerging technologies

The technology used to create a CoP requires certain affordances to be considered. Affordances are described as the functional properties that determine the possible utility of an object or environment (Lee, Pradhan & Dalgarno, 2008). Bower (2008) came up with a methodology for matching the affordance requirements of learning tasks with the affordances of the selected tool. In this case, the focus is not on the learning tasks, but on the ability to share ideas in order to solve a learning problem. This methodology can be used as a guide to inform the process of technology selection and learning design (Lee, Pradhan & Dalgarno, 2008). Bower (2008) and Lee, Pradhan & Dalgarno (2008) propose that the task has certain affordances, and that the affordances of the tool should meet the affordances of the task. The tools cannot directly cause learning to occur, but can afford certain learning tasks that can lead to learning or give rise to certain learning benefits (Lee, Pradhan & Dalgarno, 2008). So tools are used to solve certain learning challenges.

Bower (2008) says that a CoP requires specific affordances, such as media affordances, temporal affordances, and access-control affordances. In order for lecturers to share ideas, experiences, resources and information, media affordances are necessary, and the required affordances are text read ability (text), view ability, listen ability and watch ability, together with video produce ability. The five affordances cater for Wenger's (2001) facility

requirements of a document repository, a shared workspace for synchronous electronic collaboration, discussions or meetings, and a conversation space. In addition to the media affordances, temporal affordances need to be considered. Ideally, the lecturers need to have access to the resources anytime and anywhere. More importantly, when investigating a particular tool to use, lecturers should ensure that it has playback ability and record ability. Record ability is important as it allows lecturers to share their experiences with their community members. Besides, the ability to navigate is also a requirement for creating lesson plans. Essentially, tutors need browse ability, link ability and search ability. The ability to navigate is important since it allows lecturers to have search ability, read ability and watch ability. Lastly, the access-control affordances need to be considered. The tool that is selected must have permission ability. In other words, prospective members of the group need to be invited to be part of the group. Ideally, it requires a tool where access can be controlled and where the rights to be able to perform certain tasks are limited to group members.

I have established that a CoP can be an effective tool to enhance the adoption of emerging technologies and it uses the concept of affordances to show how emerging technologies can be used to support a CoP. The application of emerging technologies to support CoP on an ICT platform gives rise to the concept of an online CoP, which is more versatile and effective than a traditional CoP.

d) Selection of appropriate tools and justification for its use

The tools to create a CoP have to be able to foster mutual engagement, joint enterprise and shared repertoire (Wenger, 1998). Wenger (1998) proposes three interrelated dimensions that hold the constructs of community, practice and domain in balanced tension. Mutual engagement reflects the interactions that take place in a community whose goal is to negotiate meaning. Joint enterprise is the process of working together on a common project, in this instance, the use of ICT to teach large classes, and a shared repertoire of anything (pool of resources) that assists the members in negotiating meaning and creating knowledge. In practice, these three dimensions are interrelated and work as a process. Table 2.5 shows different emerging technology tools that have been used in previous studies. The tools are compared to the facility requirements of a CoP, as outlined and described earlier.

Table 2.5: Comparison of emerging technology tools

Tool	Conversation Space	Shared Workspace	Repository	Search Engine	Community Management Tools	Sub-Communities, Subgroup and Project Teams
Wiki	Available	Available	Available	Available	Not available	Not available
Blog	Available	Available	Available	Available	Available	Available
Podcasts	Not available	Not available	Available	Not available	Not available	Available
Listserv	Not available	Not available	Available	Not available	Available	Available
Web conferencing	Available	Available	Available	Available	Available	Available

The tools that can be used in this case are blogs and web conferencing. However, the use of web conferencing is constrained by the local environment. The reason is that web conferencing requires fast internet access. Unfortunately, Zimbabwe has high internet costs and limited bandwidth availability (Dodds, 2013). The tool consideration, therefore, has to be easy to access and must not require a lot of bandwidth to operate efficiently. In the case of Africa University, blogs can be used to create a CoP. A blog can be described as a type of a website that is powered by software that allows the frequent addition of content, similar to an online journal (Hill, 2006). Blogs are chosen because of their affordances to meet the affordance of the task and the CoP requirements advocated by Wenger (2001).

The above discussion on the possible application of Wiki, blogs, podcasts, Listserv, and web conferencing to support online CoP adds value to this study of finding ways of enhancing OER adoption as it sheds more light on how specific emerging technologies can be used to support a CoP. The next section details how a CoP can be used to address educational problems.

e) How CoP could address the educational problem

It is evident from the above discussion that CoP could help lecturers to solve their teaching challenges. This is a classic example of the application of emerging technology tools to resolve teaching and learning challenges. Grossman, Wineburg and Woolworth (2000), and Schlager and Fusco (2006) developed the Activity Theory Framework, which can be used to analyse an educational problem to show that a CoP can assist in providing solutions. The project (activity) is designed to assist lecturers (the subjects) to identify and use different methods and technologies (tools) that have not been part of their prior repertoire (the object). Consequently, the lecturers could take on new collaborative roles (division of labour) based on a set of rules.

Furthermore, lecturers could be encouraged to develop trust in and form a lasting community with one another in the hope that they will support one another (Outcome 1) in applying what they have learnt or experienced (Outcome 2) and disseminate the knowledge they will gain to other lecturers who may join the community later (Grossman et al., 2000; Schlager & Fusco, 2006, p. 209). This shows that the CoP could be used to address the educational problem of sharing knowledge. One of the benefits of being a member of a CoP is that it offers a platform to share ideas. Research has shown that when members are able to disseminate findings to their colleagues, it often leads to those colleagues changing their attitudes towards pedagogic practice and, in some cases, colleagues develop enthusiasm for their colleagues' work and offer advice (Jones, 2010, p. 278). Therefore, a CoP provides opportunities to share and source new ideas, and give advice to colleagues.

However, using technology to teach large classes is a new concept to many lecturers, and they may require assistance. This is particularly true at Africa University, from my experience as a researcher and lecturer there. There are also constraints in the local environment (human attitude and background, organizational culture) that may hinder the establishment of a CoP. A CoP is based on the premise that the members are self-directed and self-motivated (Kimble & Hildreth, 2006, p. 330). However, as CoP is a new concept, lecturers may be hesitant to be part of a community. In addition, if management tries to control what happens in the community, lecturers may view it as if it is being imposed on them and may resist becoming part of it. In most universities in Zimbabwe, including Africa University, there is high staff turnover. Therefore, new lecturers may not become committed to the CoP. On the other hand, some of the new lecturers could have knowledge about the application of ICT in large classes, but may be unwilling to share the knowledge. Lastly, because of the high staff turnover, there may be a lack of guidance from lecturers who are experienced in the area of interest.

f) How the CoP theory explains the use of ICT to address the educational problem

The three dimensions of mutual engagement, joint enterprise and shared repertoire are what hold the constructs of community, practice and knowledge in balanced tension, facilitated by the application of emerging technologies (Cassidy, 2011, p. 101). These three dimensions are necessary for a CoP to be effective. Generally, mutual engagement reflects the interactions between community members as they try to negotiate meaning (Cassidy, 2011, p. 101). Emerging technologies could act as enablers to help negotiate meaning by providing a

permanent online presence (Dotsika, 2006, p. 259). Consequently, technology acts as the enabler in linking the different lecturers, who have different timetables and commitments, to share practice. CoP theory is concerned with linking people with a similar interest, and technology permits this to occur. Therefore, the linking of lecturers enables them to share practice through iteration. The iteration is possible as technology provides a conversation space, asynchronous and synchronous communication, and a document repository (Patrick, Cox & Abdullah, 2006, p. 166). Ideally, these features promote collaboration, which is the joint enterprise. Collaboration is possible through the social interface provided by technology, in this case the blog. Finally, technology provides a permanent repository for the knowledge and artefacts created by the community. This repository will contain valuable knowledge that a newcomer (lecturer) can use.

Technology also plays a part in supporting the different stages of a CoP lifecycle (Dotsika, 2006, p. 259) through the provision of information technology enabling technologies. McDermott (2000) lists five stages of a CoP namely: planning, starting up, and growing, sustaining/renewing and closing. In this example, at the planning stage, technology can be used to inform the lecturers about the blog, for instance, a link to the blog can be emailed to the lecturers. In the starting up stage, technology can be used to form the framework and create the context (Dotsika, 2006, p. 259). The main role of technology will be for file transfer or to create an information repository. In the growing stage, when the lecturers are collaborating, the blog technology can provide analytical and decision-making tools and feedback facilities as the lecturers share information. In the sustaining stage, technology can be used to provide resources and services such as videos and RSS feeds, which can be obtained from the blog. Finally, in the closing stage, technology can provide a permanent repository (in this case, the blog archive) that newcomers can use in future. This shows that technology can support a CoP by allowing a group of lecturers who have a common interest to exchange information and knowledge across Africa University boundaries with the aim of developing best practices.

The argument in this section is that the issue of student engagement could be addressed by establishing an online CoP for lecturers. The blog was identified as the best tool to create a CoP at resource constrained institutions. Introducing a CoP will ensure more collaboration and interaction among the lecturers. The conditions at Africa University are conducive for the creation of a CoP because the lecturers are already in collaborative networks and there is commitment from senior management for innovative teaching and learning initiatives. Therefore, according to Wenger et al. (2002), senior management at Africa University should

advertise the benefits of the CoP to the lecturers who may then join and contribute to it. In addition, management should appoint a leader for the CoP to ensure that resources are made available. A CoP enables professional development and opens up opportunities for lecturers to share their experiences and influence new members in the community by providing guidance.

The different types of technological affordances discussed thus far have the potential to support both teaching and learning challenges and the inception and operation of a CoP. It has also been established that a CoP can be used to enhance the adoption of OER and support innovative teaching and learning. Africa University stands to benefit from the great potential of emerging technologies to address the prevalent diverse educational challenges and apply CoP to enhance OER adoption and explore innovative pedagogy. It is against this background that selected emerging technologies and the concept of CoP were discussed in detail in this research.

2.7.2 Emerging technologies and mathematics learning

This section looks at how emerging technologies can be used to resolve the challenge of teaching and learning Mathematics. The research evidence provided later in this section illustrates that the Mathematics pass rate is generally low across all countries in Africa.

A pass in Mathematics is a pre-requisite for university admission. However, because of high national failure rate in Mathematics, many applicants do not have the required minimum pass in Ordinary Level Mathematics. To assist the aspiring candidates, Africa University instituted a policy to admit applicants without the minimum pass in Ordinary Level Mathematics and allow them to take a pre-university Mathematics course. University level Mathematics courses are a requirement for most degree programmes in the College of Business, Peace Leadership and Governance, where this research was undertaken. The failure rate in both pre-university and university level Mathematics, compared to other courses, is high at Africa University. Mathematics courses are offered each semester to allow repeat students to immediately retake the course; this helps to reduce the backlog of repeat students. The teaching and learning of Mathematics at Africa University is a significant challenge and this section explores how emerging technologies are being used and may be used to address the teaching of Mathematics at both pre-university and university levels. The challenge of Mathematics teaching is not unique to Africa University; it extends to national and regional levels.

Education policy makers and researchers in South Africa have identified low mathematic skills as a problem in that country. The value of Mathematics is mentioned in many official reports. For instance, the South African Development Indicators Report published by the Department

of Performance Monitoring and Evaluation (2010) views Mathematics as essential for national development. Moreover, full and successful development of a country is only possible if its people have the necessary skills to contribute to the development of knowledge, infrastructure, the economy and other vital areas (Department of Performance Monitoring and Evaluation, 2010). The Department of Social Development (2010) and the United Nations Development Programme (2011) also published reports that highlight the importance of Mathematics in developing a country. Therefore, Mathematics is seen as a key requirement in developing both a country and an individual learner, as once empowered with mathematical skills, an individual is better able to become a critical citizen (Ernest, 2007).

However, the level of Mathematics skills remains a serious problem in South Africa. The Departments of Basic Education and Higher Education (2010) state that there are not enough learners within the school system with good Mathematics and Physical Science results. This directly results in skills shortages, particularly in the medical and financial management sectors (Pandor, 2017). Furthermore, the South African Development Indicators Report states that in the reports that were analysed, South Africa performs poorly in Mathematics and Science when compared to other countries (Department of Performance Monitoring and Evaluation, 2010). The Department of Basic Education (2011) further reports that the number of students taking Mathematics has decreased by 25% from 2008 to 2011. Ndlovu (2011, p. 419) adds to the debate by stating that, with a Mathematics pass rate of 29% in 2010, South Africa had too few students completing high school with good enough Mathematics and Science passes to be admitted for further studies in science, engineering and technology careers at vocational and university level. MacFarlane (2011) and F. Parker (2012) both state that the poor educational performance and the lack of learner readiness to study at tertiary level are linked to poor Mathematics proficiencies. This is supported by Amin (2012), whose National Benchmark Tests Project-based report reveals that engineering students at the University of Cape Town performed as follows:

Only 7% achieved a mark at proficient level, 73% performed in the intermediate category and those at the bottom of this category needed an intervention programme. A further 20% of the students were found to have only very basic mathematical skills and required an extended programme to improve their skills (p. 274).

Mathematics performance is, thus, a problem in South Africa and the causes of such poor student performance are vast. In 2011, the then Minister of Science and Technology, Naledi Pandor, said that the poor performance could be directly linked to the poor quality of

mathematics teaching in schools (Pandor, 2011). One of the reasons given for this was the insufficient pedagogical knowledge by the teachers (Pandor, 2008). This is supported by Bloch (2011), who says that, in addition to poor teaching, many of the teachers are ill-prepared and under-prepared in aspects such as creating lesson plans. Amin (2012) further adds that there is a shortage of adequately qualified teachers and a lack of resources at the schools attended by most learners in South Africa.

The challenge of Mathematics teaching and learning has been sufficiently exposed as a significant institutional challenge at Africa University and as a national and regional challenge too. There is increasing research evidence that emerging technologies can be applied to the problem of Mathematics learning. Therefore, educators must be provided with ongoing support in the teaching of Mathematics, and this support should include access to resources, as well as opportunities to learn and share with their peers.

In response to the problem in the area of Mathematics, various researchers have proposed the use of social networks to provide assistance to both learners and teachers. Verster (2011) created a social network for mathematical educators using the NING platform¹². This network allows for file, photo and audio uploads, blogs, and a text chat to facilitate real-time discussions and online meetings. Butgereit (2011) refers to 'Dr Math', a text-based chat service created on Mxit (a text-based chat service that uses a cell phone). In Dr Math pupils use their cell phones to ask questions and discuss their Mathematics homework. Wodzicki et al. (2011) reports on the use of StudiVZ, a German student directory, which allows students of the same discipline to organise their own learning groups and discuss course material by establishing appropriate subject interest groups. Koenders (2006), in a study of an authentic online learning environment in university introductory biology, used discussion boards to help students to learn biology. McGee and Diaz (2007) look at the use of wikis, podcasts and blogs. Kabilan et al. (2010) focuses on using Facebook to teach English in institutions of higher education. Ivana and Gachago (2012) investigated how social media could be used to enhance student engagement at a University of Technology in South Africa. Khan and Sheikh (2015) investigated how a university could use the Facebook tools, features and resources for information and support.

¹² www.Mathematicsliteracy.ning.com

Emerging technologies have great potential to address Mathematics teaching and learning challenges, including OER. For Africa University, this creates the possibility of OER adoption to address Mathematics educational challenges at high school and university levels.

The preceding literature review sections looked in detail at: (1) Variables that influence adoption of OER (2.4.1 Affordances of OER, 2.4.2 OER awareness, 2.4.3 OER support and training, 2.4.4 OER stakeholders, 2.4.5 OER barriers); (2) Variables that influence actual use of OER (2.5.1 OER funding models, 2.5.2 OER technical models); and (3) Variables that influence the pattern of OER usage (2.6.1 OER content models, 2.6.2 OER staffing models, 2.6.3 Online learning theories and models). This research is about adoption of emerging technologies at the point of interpreting results the gap on critical success factors that influence adoption and use of OER emerging technologies surfaced. The following section dwells on OER emerging technologies adoption and use critical factors and was useful in illuminating some conclusions and recommendations.

2.8 OER emerging technologies adoption and use success factors

This study is a post-implementation review of an OER intervention at Africa University. During the course of the research, significant OER practice issues were revealed from the analysis of qualitative data, thus, motivating the addition of this literature review section. The section looks at OER best practice guidelines. These are expected to be useful for guiding recommendations in this study. Since the beginning of the OER movement, a lot of funding has been dedicated to research on how best OER can be used to address the challenge of educational resources, the quality and equity of education, and even as an opportunity to introduce new pedagogies. There are no legislated guidelines, but OER research publications by UNESCO (2012a; 2012b; 2015; 2015a; 2015b), the Hewlett Foundation (June 2013; Oct 2013; Nov 2013) and CWL (2012; 2015), among others, reveal a trend of research findings that can easily be classified under a common title of ‘OER Best Practices and Guidelines’. In addition, UNESCO (2015a) and CWL (2012; 2015b) used stakeholder categories to unbundle their comprehensive set of ‘OER best practices and recommendations for higher education contexts: Guidelines for governments, institutions, academic staff, student bodies, and accreditation and quality assurance bodies’. There are also guidelines and recommendations

for government institutions, individual institutions, educators, learners, development agencies and all other forms of stakeholders that have taken interest in creating and providing OER.

(UNESCO, 2015a; CWL. 2012; 2015b)

2.8.1 Success factors for governments

Government plays an important role in education, ranging from regulation, development and approval of curriculum, to actual financing of higher education. In Zimbabwe, for example, until the late 1990s every university student was funded by the government. The practice was stopped because the cost was too high to sustain both in terms of escalating costs and increased demand for higher education sponsorship. The government is also responsible for sourcing funding through bilateral agreements with development agencies like UNESCO, UNICEF and USA-AID. Consequently, in this context, it is suggested that governments should do the following:

- a) Create policies to support use of OER in higher education*** (UNESCO, 2015a; CWL. 2012; 2015b)

As an initial step, the Zimbabwean government should get involved in OER movements and publicity campaigns and move on to a fully-fledged national OER programme and policy framework. Issues of access, quality and equity of educational resources and, ultimately, the provision of education can be potentially addressed by embracing OER.

- b) Consider adopting Open Licensing frameworks*** (UNESCO, 2015a; CWL. 2012; 2015b)

Copyright and licensing issues have been a major challenge since the upsurge of technology centric solutions at the turn of the 21st century. Essentially, Open Licensing holds the key to addressing this challenge, particularly in the area of educational resources. However, its potential has not yet been fully explored since the agenda of Open Licensing is often being pushed by movements without formal government backing. Therefore, government should embrace Open Licensing as an integrated framework of a national intellectual property rights (IPR). In Africa there is the Africa Intellectual Property Organisation, which has a mandate to support intellectual property across the African continent. Such organisations and national governments should embrace and integrate Open Licensing to promote Open Access and OER.

c) Consider adopting open standards (UNESCO, 2015a; CWL. 2012; 2015b)

Just like the internet did not gain widespread popularity and adoption until universal hardware and software protocols were introduced, Open Access cannot happen in higher education institutions without an initiative to craft appropriate open policy frameworks. Ideally, the standards should cover all academic materials produced by governments, universities, open publishers and content aggregators. This will help to promote academic research and publications and the growth of Open Access and OER.

d) Contribute to raising awareness of key OER issues (UNESCO, 2015a; CWL. 2012; 2015b)

Awareness is crucial in the acceptance and use of any emerging technology or innovation. In Africa, public health campaigns did not gain popularity until they became integrated as formal government campaign programmes. Therefore, government ought to be officially involved and should aggressively take part in national campaigns to educate the nation on such issues as Open Access, OER, Open Licensing, IPR, Open Education and open learning.

e) Promote national ICT/connectivity strategies (UNESCO, 2015a; CWL. 2012; 2015b)

Internet connectivity is still very low in developing countries, although it is growing at exponential rates; therefore, governments must always embrace strategies to increase internet connectivity. In the earlier discussions, it was noted that OER are predominantly electronic educational resources and access depends on internet connectivity. The objective of this research was to use OER to address access of educational resources by the underprivileged hence; it entails taking internet connectivity to the underprivileged. In Zimbabwe, the least privileged communities are normally found in the most remote areas that are far from roads, electricity and telecommunication infrastructure. The Zimbabwe government lacks infrastructure development funds and, therefore, effective strategies are needed. India adopted strategies to promote internet access by introducing community internet access points. The Indian government imposed a rural infrastructure quota for every new applicant of a telecommunications licence. This strategy worked well as it took internet connectivity to remote areas.

f) Support the sustainable development and sharing of quality learning materials (UNESCO, 2015a; CWL. 2012; 2015b)

The sustainability of OER is important. This does not refer only to the sustainability of the repositories, but also to the sustainability of the OER development process and quality. The problem with OER projects is the top-down approach where OER funding and technical and content models originate from the top as some form of preconceived OER solution in support of the mission and vision of the funders. However, these funding models cannot be guaranteed because of the possible change of the mission, vision and priorities of the funding organisation. The relevance of OER content is a key defining feature of quality and, in many cases, top-down OER technical and content models do not allow for the infusion of local content, thus, impacting on the quality. Therefore, a bottom-up approach to OER intervention, as articulated in Chapter 1, is recommended.

2.8.2 Success factors for higher education institutions

Providing resources through libraries, bookshops, and subscriptions to online learning is one of the main challenges and responsibilities that higher education institutions have. An appropriate OER strategy presents a perfect opportunity for higher learning institutions, like Africa University, to address this challenge more cost effectively. An institutional OER policy creates cheaper ways of getting resources to educators and learners. It also creates a culture of creating and sharing knowledge within the institution and the outside world, as students and teachers participate in the free and open OER cycle. Contemporary e-learning theories like Anderson's theory of online learning have proven that sharing is the essence of learning. OER adoption and use have been noted to take place without institutions bothering to adopt an OER policy. Consequently, in this context, it is suggested that higher education institutions should take the following steps:

a) Develop institutional strategies for the integration of OER. (UNESCO, 2015a; CWL. 2012; 2015b).

The institutionalisation of any education process, tool, technique or solution is inevitable if universal adoption is expected. It is therefore recommended that institutions should have Open Licensing, Open Access and OER integrated into a portfolio of complementary policies. The development of these policies must include key global guidelines and stakeholders.

b) *Provide incentives to support investment in the development, acquisition and adaptation of high quality learning materials.* (UNESCO, 2015a; CWL. 2012; 2015b).

In order to support development, acquisition and adaptation of high quality OER, academic institutions should incorporate the following in their policies:

- i. a thorough process of identifying and customising OER already in circulation and creating new OER in response to demand;
- ii. institutional guidelines to encourage OER publication;
- iii. cultivate an OER research culture and usage guidelines;
- iv. encourage and scaffold students to embrace Open Licensing and publish in the Open Access and OER cycles with the support of their educators;
- v. incorporate OER into performance appraisal;
- vi. establish a framework of OER internal and external collaboration;
- vii. integrate some form of recognition and reward in OER design, development, acquisition, and customisation.

Currently, Africa University has no incentives to promote development, acquisition and adaptation of teaching and learning materials. The Africa University administration could precipitate creation, adoption and use of OER if they consider some form of incentive.

c) *Recognise the important role of educational resources within internal quality assurance processes.* (UNESCO, 2015a; CWL. 2012; 2015b).

Official recognition of OER as a solution for teaching and learning is not yet common or well-defined at government and institutional levels in most developing countries like Zimbabwe. It is, therefore, recommended that institutions establish internal processes and procedures for formal validation and quality attribution to the OER adopted in mainstream teaching and learning. Most importantly, it is prudent to work with the government to formalise the quality and recognition of OER.

d) *Consider creating flexible copyright policies* (UNESCO, 2015a; CWL. 2012; 2015b).

Many copyright issues arise in educational institutions. However, most institutions do not have well-defined intellectual property policies. This ought to be addressed by introducing

enforceable IPR policies, privacy policies, legal contracts and employment clauses. Not considering IPR could affect the functioning of students, academics and institutions. Africa University is still in the process of crafting a comprehensive intellectual property policy and whether or not this will adequately address issues related to OER could not be ascertained at this stage. The fact that Africa University has channelled resources towards creating an intellectual property policy is encouraging.

e) Undertake institutional advocacy and capacity building (UNESCO, 2015a; CWL. 2012; 2015b).

In most cases, OER advocacy and capacity building are not adequately addressed. In an OER survey conducted by the Hewlett Foundation in November 2013, it was revealed that a surprising 20% of senior professors professed ignorance of OER. Consequently, an effective OER communication package must be adopted at institutional level and it could be a perfect opportunity to bring in external sponsors using win-win sponsorship deals. OER capacity building for educators, learners and administrators is crucial. It should be noted that, training should be continuous and consistent; however, it should not make the common mistakes of being discrete, inconsistent and repetitive.

f) Ensure ICT access for staff and students (UNESCO, 2015a; CWL. 2012; 2015b).

OER are mostly delivered online and depend on access to ICT and the proficiency of the users, in this case, mainly educators, learners and administrative staff. Institutions should have supportive emerging technology tools for web authoring, editing and content management, and templates for designing, creating and providing OER. This will result in the institution having its own well-branded OER platform and gaining an audience and positive ratings. Continuous good quality training for students and academic staff must be provided, and the institution should hire experienced trainers to address researched and confirmed training gaps for academic staff and students.

g) Develop institutional policies and practices to store and access OER (UNESCO, 2015a; CWL. 2012; 2015b).

OER require access, storage and provision of the right platform, skills, processes and procedures. An effective strategy is required and in some countries like India and Vietnam

OER stakeholders have partnered to create national OER strategies that have pooled together resources and expertise. MIT's Open Courseware is a good example of institutional policies and practices to create, store and provide OER access.

h) Review institutional OER practices periodically (UNESCO, 2015a; CWL. 2012; 2015b).

The success of OER is dependent on the continuous update of the system and this cannot happen if institutional OER practices are not periodically reconsidered for required meaningful change and improvement. Review activities can include assessment of the extent to which OER are being used as teaching and learning resources in official curriculum programmes among higher education institutions in the country. The review should also include evaluating the efficacy of the institution in terms of real tangible benefits like improved pass rate, reduced dropout rates, reduced cost, and general improvement and education efficiency ratios.

2.8.3 Success factors for academic staff

Academic staff holds the key to mainstreaming OER. Although curricula and recommended reading materials should be decided on by the course coordinator or at the department level, it should be done in close consultation with the teaching staff. The decision for academic staff to be active, adopt and use OER in the absence of an OER policy or staff evaluation criteria that motivates OER through some form of recognition may not be impactful. UNESCO (2015) reports that OER challenge educators in the following ways:

- i. "Time constraints in preparing curriculum and selecting, adapting and/or developing teaching and learning materials and assessment tools;
- ii. Access to high quality, relevant teaching and learning materials;
- iii. The need to address the often diverse needs of their learners and demonstrate gender sensitivity;
- iv. Changing teaching and learning environments (from teacher-centred to learner-centred approaches);
- v. Increased student access to online materials, collaborative networks and online publishing opportunities;
- vi. Legal requirements to broaden access;
- vii. The need to cover a broad and growing knowledge base;
- viii. The need to update their ICT skills regularly;

- ix. High student expectations; and
- x. Ever-increasing enrolments in many jurisdictions” (p. 9).

In this context, it is suggested that academic staff in higher education institutions should take the following steps:

a) *Develop skills to evaluate OER* (UNESCO, 2015a; CWL. 2012; 2015b).

Skills to evaluate OER are necessary since they are created and provisioned from multiple sources and, in most cases, without prior rating or evaluation. Academics can develop these skills by exploring existing OER and benchmarking them with their own curricula. A good network of peers is necessary and a CoP will be very helpful. There are a number of infomediaries that provide independent comparisons, ratings or opportunities to rate or recommend resources. However, there is a general tendency for these infomediaries not to work with traditional publishers because there is currently a well-defined business model that allows each party to recoup some financial gain. OER business models are still evolving, particularly where marketing and advertising are concerned. Because OER are generally not for profit ventures, integration is difficult.

b) *Consider publishing OER* (UNESCO, 2015a; CWL. 2012; 2015b).

All academic staff members produce teaching content in various forms. Most lecturers copy and paste initial content from traditional printed materials and, over time, they elaborate and transform this content into something that carries their own IPR. Lecturers, therefore, can benefit by developing their teaching content as OER, rather than working on teaching content for years and then have no input entitlement to it. By embracing Open Licensing and Open Access, lecturers can easily convert course outlines, information booklets, readers and handouts, and lecture presentations and notes into OER.

c) *Assemble, adapt and contextualise existing OER* (UNESCO, 2015a; CWL. 2012; 2015b).

OER are diverse, continuously growing and evolving sets of educational material. They originate from different contexts and need to be effectively pooled together for the purpose of a particular community or target group. Once pooled together, they must be customised or adapted to suit the teaching and learning goals. Customisation of OER also entails adding a component of local content, such as case studies or examples. The future of OER lies in the

ability to incorporate local content (Wiley, 2010). Many OER are ineffective because of poor assembly and poor or non-existent contextualisation. There is also the challenge of poor integration, which is a learning design issue.

d) Develop the habit of working in teams (UNESCO, 2015a; CWL. 2012; 2015b).

Learning is a social process, and social engagement could translate directly into more effective learning. In this journey of OER adoption and use, lecturers are encouraged to develop a habit of working as a team. A practical interpretation of TEAM is: Together, Each, Achieves, More. It is important to note that teamwork and experience exchange are essential and that CoPs are the most documented ways for professionals to share experience. CoPs involving time commitment should engage, respond and cultivate interactions from diverse team members. However, expectations and motivations could differ and may require effective moderation, leadership and investment in time. One alternative is to use emerging technologies, as detailed earlier, to develop an online CoP. There are many instances where Facebook, blogs, podcasts and a variety of social media solutions have been used to effectively support an online CoP.

e) Seek institutional support for OER skills development (UNESCO, 2015a; CWL. 2012; 2015b).

It has been found that skills development has two flaws: the recipients underrate the amount of knowledge that must be transferred to them and get comfortable with casual engagement with the content; and the institutions neglect their responsibility to identify training gaps and take the stewardship of effectively closing the gaps. Therefore, lecturers should seek formal OER training and institutional support for team collaboration and training.

f) Encourage student participation (UNESCO, 2015a; CWL. 2012; 2015b).

Student involvement in the OER lifecycle is important because it completes the ecosystem, making it more vibrant and compliant. It is compliant because, in some cases, students stand to lose their IPR in the work they do in self-directed studies and group presentations. It seems lecturers and institutions are unfair and non-compliant, especially to the contributions of these students. Students' work is sometimes published as someone else's work in later years. There is need for the creation of an OER lifecycle platform where students can give feedback on the OER produced by lecturers, or create their own material and share it as OER.

- g) *Promote OER through publishing about them*** (UNESCO, 2015a; CWL. 2012; 2015b).

There is much that remains unknown about OER practical usage experience, customisation, student involvement and acceptance and usage behaviour. If academic staff takes an active role in promoting OER through publishing their OER experiences in journal articles and e-learning magazines, it can result in increased adoption and use. OER movements have been accused of overselling the capabilities of OER (UNESCO, 2015a, 2015b; CWL, 2015); consequently, publications based on field evidence may promote OER adoption and use. Research by academics leads to more effective use of the resources.

- h) *Provide feedback about and data on the use of existing OER*** (UNESCO, 2015a; CWL. 2012; 2015b).

A big challenge to OER adoption and use remains proof of performance. Consistent and continuous feedback on OER field performance in meeting the goals and needs of learners and educators is needed.

- i) *Update knowledge of IPR, copyright and privacy policies*** (UNESCO, 2015a; CWL. 2012; 2015b).

Knowledge of IPR is important to protect the efforts of academic staff. The institution should have an IPR policy to fairly and equitably address the interests and gains of the lecturer. Academics should be educated on how IPR policies influence their work activities and affect their rights. Concerns of inequity must be effectively represented and appropriate policy adjustments must be effected as well. Such inequities, like failure to protect IPR interests and gains of the lecturer, may be a major motivator or deterrent in the effective usage of OER. At Africa University, for example, the lack of an IPR policy was a problem in relation to the handling, storage and publication of teaching content developed over time by Africa University lecturers. These include course modules developed by individual lecturers, that have been in circulation for years without IPR or financial recognition to the originating academics.

2.8.4 Success factors for student bodies

Students are important stakeholders in the quality of educational resources that are used in their teaching and learning activities. Consequently, students need to understand OER processes and

be given directions on how they can work together with the academic staff, with the support of the institution, to bridge the gap of educational resources. In some institutions, such as the University of Cape Town, academic staff has teamed up with students to convert the existing pool of resources into OER so as to improve the quality of teaching and learning resources.

a) *Understand and advocate for the issues of OER* (UNESCO, 2015a; CWL. 2012; 2015b).

The UNESCO (2016a) document gives guidelines for OER and strongly recommends student bodies to use the document and several other equivalent and complementary publications to enhance their understanding of OER. Understanding OER should be projected to students by governments, institutions, lecturers, and quality assurance bodies, because they are better placed to play an advocacy role. In fact, issues of OER advocacy often go unnoticed or unresolved because of ignorance or lack of OER advocacy awareness. There are a number of OER student advocacy policies, processes and procedures that are being discussed and published. For example, if a university chooses to offer free education using OER that deviate from a current normal regime, what are the rights of the students? What role can the student body play? Therefore, student bodies need to understand these developments, and should add their voice. Clearly, students need to be part of the process for it to succeed.

b) *Encourage their members to publish work as OER* (UNESCO, 2015a; CWL. 2012; 2015b).

Students must understand and embrace Open Licensing concepts and should start early in their learning trajectory to participate in the OER lifecycle by publishing their work as OER. In this way, students can make a significant contribution to the volume, quality, diversity and inclusion of OER. In addition, students can work with lecturers to improve the quality of OER by commenting and editing them. They can also create and publish their own OER as personal and group work developed during self-directed study and group efforts.

c) *Take an active role in assuring the quality of OER through social networks* (UNESCO, 2015a; CWL. 2012; 2015b).

Social networks are crucial in determining acceptance and usage of any innovation or practice. Students should bring and share their OER experiences on social media networks that they

frequently use as part of their learning platforms. This can provide some form of quality assurance, audit trail and evaluation platform.

d) Recognise that ICT are an increasingly important part of the higher education experience and are often crucial for students with special educational needs (UNESCO, 2015a; CWL. 2012; 2015b).

Student representative bodies are there to serve the interests of students, and they often face challenges that cannot be resolved using traditional tools and solutions (non-digital solutions). Therefore, emerging technologies present solutions to people with disabilities, financial and geographical challenges. Student representative bodies must, therefore, recognise that emerging technologies like OER are important and effective in addressing the special educational needs of students.

e) Encourage student participation in activities to support OER development (UNESCO, 2015a; CWL. 2012; 2015b).

OER need a lot of support to encourage learners' involvement in OER promotion, publicity and sustainability campaigns. Most OER are privately funded and their sustainability cannot be guaranteed. Student involvement allows them to lobby the government to openly embrace OER to move towards a public funding model to guarantee sustainability. Those who drop out from school could learn through OER. Already, there are a lot of instances where students could not afford official textbooks and resorted to using OER. At Africa University, there is evidence of reliance on YouTube OER in the form of short videos that address discrepancy learning through innovative illustrations.

2.8.5 Success factors for quality assurance bodies

Quality assurance organisations or bodies that perform accreditation of academic qualifications to guarantee international recognition look at the curriculum, teaching and learning facilities resources, and the models of delivery. For countries like Zimbabwe, the evaluation of teaching and learning facilities resources is mainly based on Traditional Teaching Materials from recognised publishing houses. Some countries may struggle with both budget and foreign currency to import the books and most students will be unable to afford them as well. Therefore, these bodies need to make some important OER decisions. Research has shown that, with or without a deliberate OER policy, OER support, adoption and use are inevitable among students

and staff. As a result, some institutions have proceeded to commission OER degrees. In this context, it is suggested that quality assurance and recognition bodies should take the following into consideration:

a) Develop their understanding of how OER impact quality assurance and recognition (UNESCO, 2015a; CWL. 2012; 2015b).

The standards and benchmarks of most accreditation and quality assurance bodies are centred on traditional publishers and printed materials. They are yet to develop an understanding of OER and their impact on the quality of education. There is increasing adoption of OER, with some institutions launching full-fledged OER degrees. This calls for quality assurance bodies to develop their understanding of how OER impact quality assurance and recognition. What complicates the position of most accreditation and quality assurance bodies is that they are quasi-government entities, often established through acts of parliament with a conservative management regime. They also receive funding from traditional publishers. Therefore, the whole process is compromised and prejudiced, thus, calling for a paradigm shift.

b) Engage in debates on OER, in particular on copyright (UNESCO, 2015a; CWL. 2012; 2015b).

The current position in most quality assurance and accreditation bodies is that they are not sponsoring and contributing to OER debates. They need to shift their approaches and priorities and start to influence policies for Open Access and OER and address opportunities and challenges that may arise.

c) Consider the effects of OER on quality assurance and recognition (UNESCO, 2015a; CWL. 2012; 2015b).

The proof of performance for OER is as old as online learning. Most countries and professional accreditation bodies have not yet recognised online learning as a part of traditional classroom learning. However, exceptions are beginning to emerge. There are now quality assurance bodies in Africa that recognise online learning, for example, the Centre of Higher Education South Africa has developed quality guidelines for online learning. As a result, there is a need to embrace and recognise the impact of OER across all spheres of teaching and learning processes, procedures and practices. Earlier in this chapter, I explained how OER are helping

to reduce the cost of books, dropout rates, and the overall cost of education, while also improving education efficiency ratios.

d) *Accept OER as good practice in quality assurance and recognition* (UNESCO, 2015a; CWL. 2012; 2015b).

As alluded to earlier, the acceptance of OER use in mainstream teaching and learning as a good practice by leading quality assurance bodies is still pending. This ought to happen as a matter of urgency. Such recognition could allow the integration of OER with the quality assurance practices of institutions. This will seamlessly integrate external monitoring and evaluation with institutional quality assurance practices. In addition, to accept OER as good practice in quality assurance and recognition, a comprehensive set of skills and competencies required by stakeholders for effective, design, development, and distribution of OER should be provided. Appendix C is a detailed outline narrative of OER core skills and competencies. Just like a business procedure or municipal bylaws, these can be referenced and quoted, to corroborate the recommendations made in Chapter 7, in the original text and context, as published by UNESCO (2015a) and CWL (2015).

2.9 Summary

The following six literature themes gave a firm understanding of the fundamental tenets of OER adoption and use:

- 1) **OER research gap:** The OER research gaps identified in the literature review include: innovation, beyond formal education, sustainability, policy research, access and use, effectiveness, development, implementation, and infrastructure. The section looked at how this study is located in light of the identified gaps. Despite the significance of existing OER research, a lot of areas remain unresearched, particularly in the context of Zimbabwe and Africa University, and this motivated this research.
- 2) **Variables that influence adoption of OER:** The literature review revealed several variables that influence the adoption of OER. The influence and significance of these variables vary from one context to another. Among the factors cited in the literature are OER awareness, OER support and training, OER stakeholders and OER adoption barriers. This study investigated whether these factors were relevant to Africa University or not, as well as their manifestation among students at the university.

- 3) **Variables that influence actual use of OER:** The identified related variables were: OER funding, technical, content and staff models. A study of OER interventions would be incomplete without a synthesis and understanding of these models, as they are important determinants of how OER are ultimately accepted and used.
- 4) **Determinants of actual OER use pattern:** Two determinants were identified:
 - i) OER staffing: In OER, the two main types of staffing models are paid and volunteer staff. Several issues relating to the effectiveness and appropriateness of each staffing category arise. Exploring OER staffing models can help to answer the challenges on consistent use or utility of OER.
 - ii) Online Learning Theories and Models: This section covered online learning models in detail because in this study OER are online learning resources and the way they are modelled is important because it affects their adoption preferences and effectiveness. These theories informed and guided the interpretation of the field research findings and recommendations.
- 5) **Emerging technologies and learning challenges:** Various emerging technologies were considered in this section as solutions to learning challenges, notably Wiki, blogs, podcasts, Listserv and web conferencing.
- 6) **OER emerging technologies adoption and use success factors:** UNESCO and CWL used five stakeholder categories to publish a comprehensive set of OER best practices and recommendations for the higher education context:
 - i) Success factors for governments;
 - ii) Success factors for institutions;
 - iii) Success factors for academic staff;
 - iv) Success factors for student bodies; and
 - v) Success factors for accreditation and quality assurance bodies.

This study adopted these best practices to a large extent and some of the recommendations are illuminated by them.

Chapter 3: Theoretical Framework

3.1 Introduction

I had to identify a set of well-defined constructs that suggested logical propositions for the relationship between the research concepts and provided a logical way of analysing and interpreting the research results (Kawulich, Garner & Wagner, 2009; Garner, Wagner & Kawulich, 2009). In order to do this, I needed a clearly articulated theoretical framework. There is evidence that it is more difficult to interpret research that is not hinged on a well-defined theoretical framework (Kripanont, 2007). Consequently, theories and models are paramount to answering research questions.

This chapter focuses on the selection, evaluation and justification of the adopted theoretical framework in order to explain and understand the relationships between variables; provide a research model or map; specify relationships between variables; and explain and predict research variables. The current research was concerned with the adoption of OER as emerging innovative technologies. It also tapped into the rich body of literature on theories of diffusion of innovation and emerging technologies acceptance models. The analysis, synthesis, and selection of possible theoretical frameworks are presented and the chosen theoretical framework is identified. The UTAUT2 model was chosen as the theoretical framework for this study. The model acts as a lens for analysing and interpreting the findings.

3.2 Theoretical approaches adopted in prior OER studies

Some authors referred to in this literature review do not recommend any specific methodology (Sclater, 2010; Sclater, 2011; Beggan, 2010). Some of the authors share common understanding and interpretation of the various approaches to OER research enquiry. The Activity Theory (AT) was used by McAndrew (2006) to investigate how OER are adopted and how this influences the OER life cycle. The Activity Theory was also used by Hodgkinson-Williams and Paskevicius (2012) to investigate how teaching materials at the University of Cape Town are transformed into OER. Another application of Activity Theory is found in the works of McAndrew (2006) and Hodgkinson-Williams and Paskevicius (2012), where it is applied to investigate individual actions in the OER adoption and use process. Another useful model is Engeström's (2011) three layers of causes of human actions. This was applied in a study to understand the action of post graduate students involved in an OER life cycle at the

University of Cape Town. Another OER research (Hodgkinson-Williams & Gray, 2008) used Archer's (2008; 2010) SR theoretical framework to conduct research on OER policy issues.

Browne, Holding, Howell and Rodway-Dyer (2010) suggest that an economic strategic model should be used to study OER because of the inherent concept of supply and demand related to OER.

Some researchers notably (Percy & Van Belle, 2012; Mtebe & Raisamo, 2014) used the unified theory of acceptance and use of technology (UTAUT), to conduct OER adoption research in sub-Saharan Africa. The approach was predominantly quantitative in nature and was effective in identifying the barriers and not very effective in explaining and identifying solutions. A mixed method approach is adopted in this research to provide explanatory power and derive more useful solutions and recommendations.

Harley (2011) borrowed ideas of other researchers (Richardson, 1986; Rogers, 1995) to investigate OER sustainability issues in the health sector in Southern and West Africa. Stacey (2010) used diffusion of innovation theory (Rogers, 1995) also to investigate OER sustainability and proposed some possible OER sustainability models. Hodgkinson-Williams and Paskevicius (2011) used the diffusion of innovation theories (Moore & Benbasat, 1991; Rogers, 1995), to investigate OER adoption and use at the University of Cape Town in South Africa.

The theory of motivation by Herzberg was used by Pegler's (2012) to explore what motivated lecturers to participate in the OER life cycle i.e. what motivated lecturers to create, use and distribute OER. The social exchange theory was used by Van Acker, Van Duuren, Kreijns and Vermeulen (2013) to research on the different forms of OER adoption and use motivating factors.

3.3 The adopted theoretical framework

The technology acceptance model UTAUT2 was selected as the theoretical framework for this research. From the earlier definition of emerging technologies given in Section 1.2, OER are viewed as a set of innovative emerging technologies introduced in a setting of government, educators, learners and educational institutions, making it a typical scenario of diffusion of innovation or technology acceptance to be researched. Theories of diffusion of innovation have been widely used to respond to research questions on the acceptance and usage of emerging technologies (Ghobakhloo, Zulkifli & Aziz, 2010; Jayasingh & Eze, 2010; Kripanont, 2007; Venkatesh, Morris, Davis & Davis, 2003; Wu, Tao & Yang, 2007). However, the UTAUT2 (depicted in Figure 3.2 and introduced in Section 1.7) is the basis of all theoretical propositions and causal-comparisons investigated in this research. The UTAUT has found increasing application in adoption and use of technology research in recent years. Many researchers (Mtebe & Raisamo, 2014, Percy & Belle, 2012) have used the UTAUT in OER research in higher education institutions in sub-Saharan Africa. Mtebe and Raisamo (2014) used the first generation UTAUT model at universities in Tanzania to establish factors that influence educators to accept and use OER. The sample size was 104 educators from six universities in Tanzania, and the validity parameters, Cronbach's Alpha Coefficients, were within the set critical limits and the model was able to explain 70% of the variations. The research by Mtebe and Raisamo (2014) gave useful recommendations on the basis of UTAUT constructs that relate very well to the practical reality of accepting and using OER. Percy and Belle (2012) used the UTAUT model to identify the motivators and de-motivators on the adoption of OER using a sample of 544 researchers from East, West and Southern Africa and achieved positive validity and explanatory outcomes. This previous research gives assurance that the UTAUT provides a solid base of measuring the use and acceptance of technology. It follows that the UTAUT2, a direct improvement of the UTAUT, brings higher predictive and explanatory power to this research.

The first generation UTAUT model (Figure 3.1) and the second generation UTAUT2 model (Figure 3.2) are represented diagrammatically below, and the respective constructs are discussed.

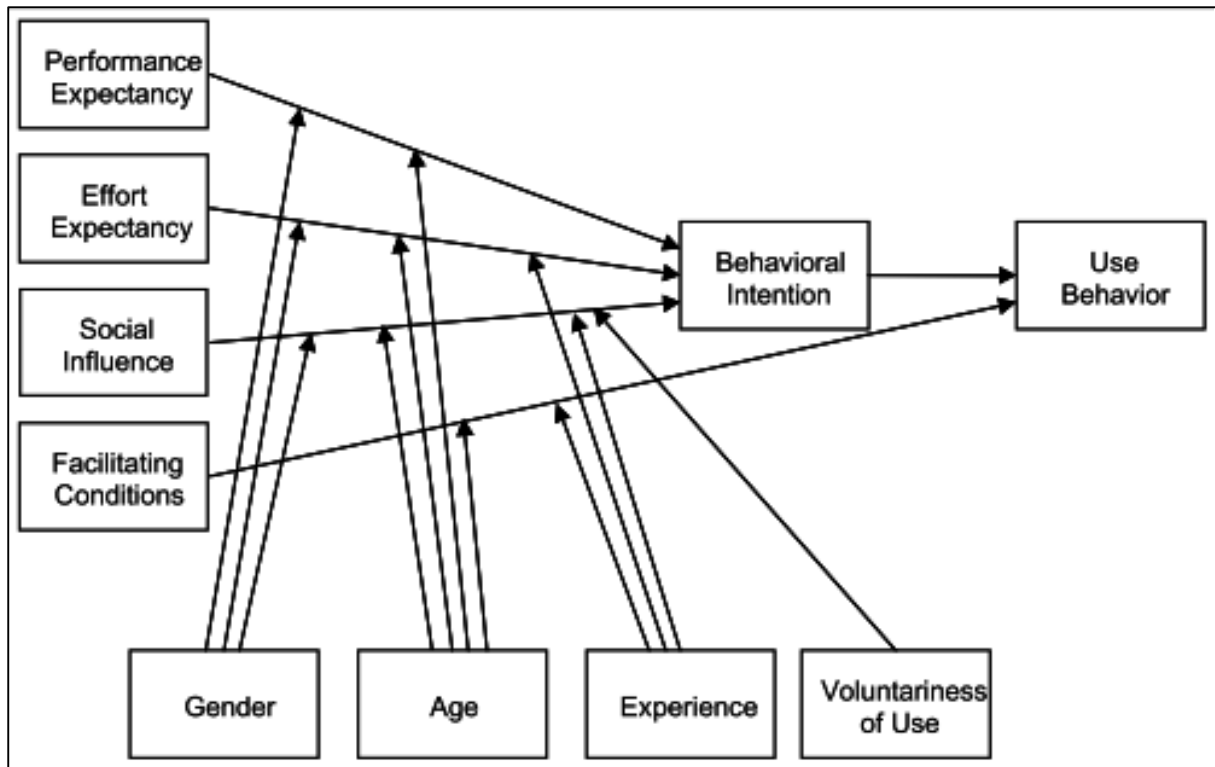


Figure 3.1: UTAUT model

Source: Venkatesh et al., 2012, p. 160

The first generation UTAUT was created by Venkatesh et al. (2003) with Effort Expectancy, Performance Expectancy, Facilitating Conditions and Social Influence as the determinants of adoption and actual use of technology or innovation, as depicted in Figure 3.1.

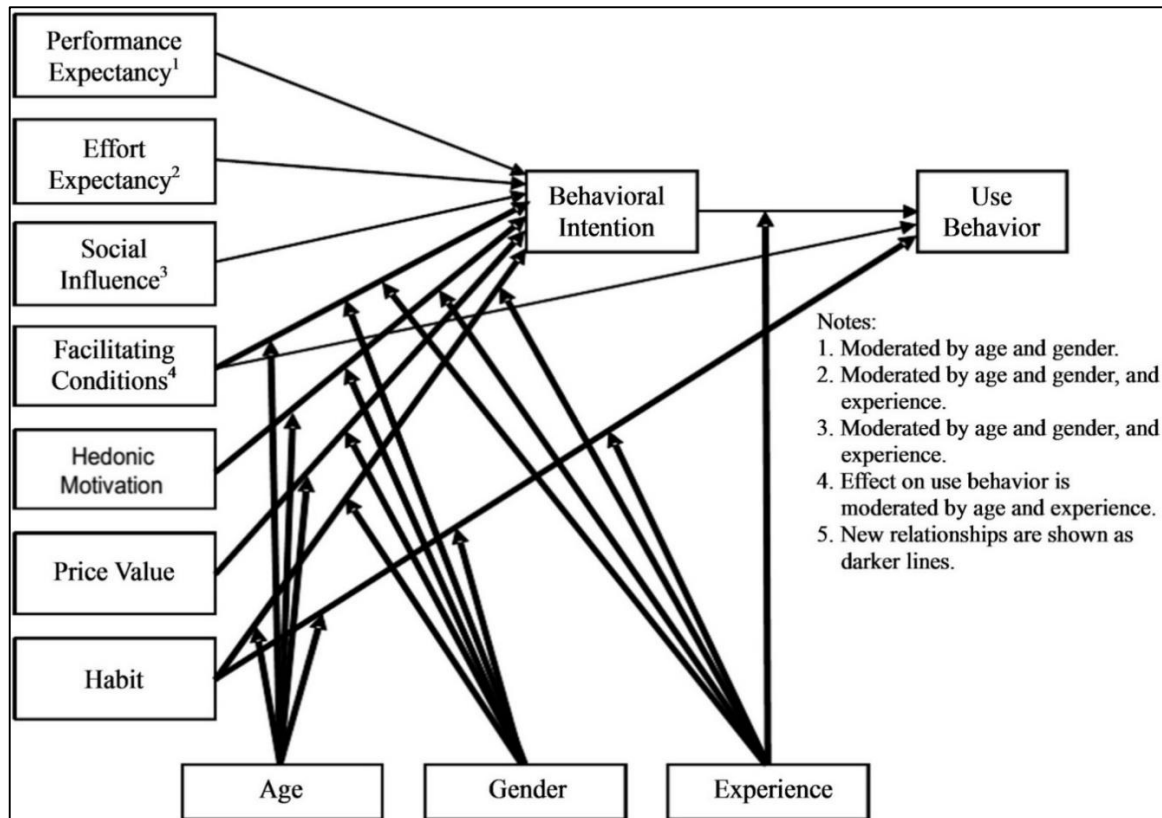


Figure 3.2: UTAUT2 model

Source: Venkatesh et al., 2012, p. 447

- Performance Expectancy (PE)** is the anticipated set of advantages that will accrue to task performance as a result of adopting the technology (Venkatesh et al., 2003). The perceived set of benefits from using OER is measured by this construct.
- Effort Expectancy (EE)** is the perceived amount of effort required to learn and be proficient in using the technology (Venkatesh et al., 2003; 2012; Zhou, Lu & Wang, 2010). In this research, EE refers to the anticipated effort to search for OER resources and select and adapt them to meet the current user requirements.
- Social Influence (SI)** is the perceived influence of the opinions of important peers for electing to use or not to use the emerging technology (Venkatesh et al., 2003; 2012). This research sought to measure how Africa University students were influenced by the opinions of their colleagues on whether they chose to adopt OER or not. SI is an essential measure at Africa University, considering the multi-cultural diversity of the institution.
- Facilitating Conditions (FC)** refer to the extent of satisfaction with conditions, support structures and facilities required to scaffold the adoption of the innovation (Venkatesh

et al., 2003; 2012). Among other things, this research sought to ascertain the level of satisfaction with prevailing Facilitating Conditions among the Africa University students. Africa University has invested much in ICT laboratories and smart classrooms, including the launch of a language laboratory in 2017 to promote the learning of foreign languages. An e-learning policy was approved and adopted in 2016. The measure of Facilitating Conditions at Africa University presents an opportunity to compare theory and reality.

In 2012, Venkatesh et al. (2012) made some modifications and improvements to the UTAUT model, based on their research findings from an information systems adoption research in Hong Kong. Three additional constructs: Hedonic Motivation, Price Value and Habit were added.

- a) **Hedonic Motivation (HM)** is a measure of satisfaction derived from using a particular set of technology or innovation (Brown & Venkatesh, 2005; Venkatesh et al., 2012). It may also be referred to as the affect value (affection) derived from using the particular innovation or emerging technology. HM is perceived to be a significant pre-condition to inspire Behavioural Intention (adoption). In a study involving students, motivation is an important measure, for example, where it varies across age, gender and experience, we can get insights on how to plan interventions. Therefore, Hedonic Motivation could affect both Behavioural Intention and effective Use of OER.
- b) **Price Value (PV)** is a measure of the actual cost of using technology or innovations and of what the user perceives to be the actual cost (Venkatesh et al., 2012). Cost is relevant to Africa University, since students have a limited monthly free bandwidth allocation and, if exhausted, they have to meet the extra requirements using their pocket money. On the other hand, the EcoSchool OER project is not entirely free; there is a nominal monthly fee for the devices acquired under the scheme, as detailed in Section 1.4. Where OER research is concerned, this variable has generally been left out because of the sponsored nature of OER offerings, which makes them practically free. In this research, as alluded to in Section 1.4, there are some costs that are associated with the purchase of data/voice and mobile devices. Although the costs have been kept at a minimum, the concept of free OER does not apply in this study.
- c) **Habit (HT)** is a measure of previous use or experience with the technology or innovation (Kim & Malhotra, 2005; Venkatesh et al., 2012). It is deemed to influence both Behavioural Intention and actual Use behaviour of the new technology. This study

sought to establish if Africa University students had OER habits that may have significantly influenced OER adoption and the actual usage pattern.

Linking the UTAUT2 constructs to the study context to derive relevant hypotheses was aided by a literature review of corresponding studies, as illustrated in Table 3.1. A related study by Raman and Don (2013) on the adoption and use of the MOODLE learning management system by university students derived a set of 15 hypotheses after eliminating irrelevant options (Table 3.1). The same set of hypotheses was found to be relevant to this study. Two additional hypotheses were included in this research to cover the third research question that did not directly concern the UTAUT2 variables. In Chapters 5, 6 and 7, a detailed account of the data analysis of each hypothesis and how it was used to answer each research question is given.

Table 3.1: Corresponding UTAUT2 hypotheses

Hypothesis	Relationship
H1	PE→BI
H2	EE→BI
H3	SI→BI
H4	FC→BI
H5	HM→BI
H6	HM→BI
H7	FC→U
H8	H→U
H9	BI→U
H10	PE→BI →U
H11	EE→BI →U
H12	SI→BI →U
H13	FC→BI →U
H14	HM→BI →U
H15	H→BI →U

Source: Raman & Don, 2013, pp. 162–163

The study by Raman and Don (2013) did not include Price Value, because it was based on MOODLE learning management system, which is downloadable for free, with optional registration. In this study, although OER are free by definition, there is an intrinsic or perceived value associated with accessing and using OER. This value comes from the cost of acquiring

the gadget and data bundles, as already highlighted in Section 1.4. A logical combination of UTAUT2 variables yielded 18 possible hypotheses, as depicted in Table 3.2.

Table 3.2: Possible UTAUT2 hypotheses

Hypothesis
H1: PE→BI Performance Expectancy significantly influences Behavioural Intention
H2: EE→BI Effort Expectancy significantly influences Behavioural Intention
H3: SI→BI Social Influence significantly influences Behavioural Intention
H4: FC→BI Facilitating Conditions significantly influences Behavioural Intention
H5: HM→BI Hedonic Motivation significantly influences Behavioural Intention
H6: H→BI Habit significantly influences Behavioural Intention
H7: PV→BI Price Value significantly influences Behavioural Intention
H8: FC→U Facilitating Conditions significantly influence actual Use
H9: H→U Hedonic Motivation significantly influences actual Use
H10: BI→U Behavioural Intention significantly influences actual Use
H11: PV→U Price Value significantly influences actual use
H12: PE→BI→U Performance Expectancy significantly influences Behavioural Intention which in turn significantly influences actual Use
H13: EE→BI→U Effort Expectancy significantly influences Behavioural Intention which in turn influences actual Use
H14: SI→BI→U Effort Expectancy significantly influences Behavioural Intention which in turn influences actual Use
H15: FC→BI→U Facilitating Conditions significantly influences Behavioural Intention which in turn influences actual Use
H16: HM→BI→U Hedonic Motivation significantly influences Behavioural Intention which in turn influences actual Use
H17: H→BI→U Habit significantly influences Behavioural Intention which in turn influences actual Use
H18: PV→BI→U Price Value significantly influences Behavioural Intention which in turn influences actual Use

3.4 Evaluation of diffusion of innovation theories

Diffusion of innovation theories and models have evolved over a long period of time as a series of persistent empirical research work aimed at validation and improvement. Revalidation of theories is important as, over time, some theories prove to be imprecise. This section is a documented systematic synthesis and analysis of candidate theories, a process that led to the selection of the UTAUT2 as the theoretical framework. The goal is to give the reader a concrete justification of the adopted theoretical framework and to allow me to identify gaps in the theories. Therefore, a brief genesis of the diffusion of innovation set of theories is given. It started in the field of Psychology in 1980 when Ajzen and Fishbein originated Theory of Reasoned Action. Ajzen (1985) improved the Theory of Reasoned Action to the Theory of Planned Behaviour, which was in turn used as the basis of Decomposed Theory of Planned

Behaviour by Taylor and Todd in 1995. Theories and models are subject to continuous improvement as universities, foundations and philanthropists continuously channel funds towards research. In 1985, Davis Jr., a researcher in the field of information systems, developed the Technology Acceptance Model (TAM) as another independent improvement of the Theory of Reasoned Action (Davis, 1989). In 2000, Venkatesh and Davis, also information system researchers, developed a second generation TAM, code-named TAM2, which was transformed to UTAUT (Venkatesh et al., 2003) and UTAUT2 (Venkatesh et al., 2012). The development of UTAUT also included the fusion of the Diffusion of Innovation theory, proposed by Rogers in 1983. The Diffusion of Innovation theory is based on three other theories: Social Cognitive Theory (Rogers, 1983), Motivational Model (Deci & Ryan, 1985) and Model of PC Utilisation (Triadis, 1979).

A detailed synthesis and analysis of theories of diffusion of innovation and technology acceptance models makes it possible to identify windows of opportunities to independently improve these models. However, in this chapter I seek to distil a theoretical framework for this study from the wide range candidate theoretical frameworks. Unbounding the components of each theory can reveal omissions to the keen researcher. Specifically, this research focused on using the UTAUT2 to explain current phenomena. If the UTAUT2 model does not provide an adequate framework to analysing and interpreting results, the alternative candidate theoretical frameworks discussed in this chapter can provide an alternative lens of analysis and interpretation. The UTAUT is a superior theory of diffusion of innovation, which is created by amalgamating the key tenets of the eight existing theories and models of diffusion of innovation outlined above. However, it can be concluded from the reviewed literature and the summary in Table 3.2 that UTAUT has the highest explanatory power (up to 69% of variance in the adoption and use of technology). A detailed analysis and comparison of all the models is presented in the following sections to substantiate how I selected the ideal theoretical framework for this research.

Table 3.3: Technology acceptance theories/models comparison

Theory/Model Explained		Constructs (Independent Variables)	Moderators	Variance (R ²)
1. Theory of Reasoned Action		1. Attitude toward behaviour 2. Subjective norm	1. Experience 2. Voluntariness	0.36
2. Technology Acceptance Model	a. TAM2	1. Perceived usefulness 2. Perceived ease of use 3. Subjective norm	1. Experience 2. Voluntariness	0.53
	b. TAM (including gender)	1. Perceived usefulness 2. Perceived ease of use 3. Subjective norm	1. Gender 2. Experience	0.52
3. Motivation Model		1. Extrinsic motivation 2. Intrinsic motivation	None	0.38
4. Decomposed Theory of Planned Behaviour	a. Theory of Planned Behaviour (including voluntariness)	1. Attitude toward behaviour 2. Subjective norm 3. Perceived behavioural control	1. Experience 2. Voluntariness	0.36
	b. Theory of Planned Behaviour (including gender)	1. Attitude toward behaviour 2. Subjective norm 3. Perceived behavioural control	1. Gender 2. Experience	0.46
	c. Theory of Planned Behaviour (including age)	1. Attitude toward behaviour 2. Subjective norm 3. Perceived behavioural control	1. Age 2. Experience	0.47
5. Combined TAM and Theory of Planned Behaviour		1. Attitude toward behaviour 2. Subjective norm 3. Perceived behavioural control 4. Perceived usefulness	1. Experience	0.39
6. Model of PC Utilisation		1. Job-fit 2. Complexity 3. Long-term consequences 4. Affect towards use 5. Social factors 6. Facilitating Conditions	1. Experience	0.47
7. Innovation Diffusion Theory		1. Relative advantage 2. Ease of use 3. Result demonstrability 4. Triability 5. Visibility 6. Image 7. Compatibility 8. Voluntariness of use	1. Experience	0.40
8. Social Cognitive Theory		1. Outcome expectation 2. Self-efficacy 3. Affect 4. Anxiety	None	0.36
9. Unified Theory of Acceptance and Use of Technology (UTAUT)		1. Performance expectancy 2. Effort expectancy 3. Social influence 4. Facilitating Conditions	1. Gender 2. Age 3. Experience 4. Voluntariness	0.69

Source: Adopted from Samaradiwakara & Gunawardena, 2014, p. 30

3.4.1 Theory of Reasoned Action

The Theory of Reasoned Action, arguably the first theory that sought to explain technology acceptance, was developed by social psychology researchers. Its origins date back as far as 1918–1970, when researchers were curious to explain the behaviour of an individual as a function of attitude. The Theory of Reasoned Action is premised on the conviction that an individual is rational and processes available information systematically to arrive at a decision. It capitalises on the fact that humans take into account the outcomes of their actions before they behave in a particular way (Ajzen & Fishbein, 1980). The emphasis of this theory is on Behavioural Intention, as opposed to attitude. The theory contends that the way a person behaves is determined by his/her intentions. It categorically assumes that behaviour is completely under the control of an individual. As a result, the theory can only be used to explain the voluntary actions and behaviours of an individual. The application of the theory fails when it comes to the involuntary or reflex actions, which are common among humans (Ajzen & Fishbein, 1980). The theory is limited to the assumption of correspondence between action and behaviour (Ajzen, 1985), and this correspondence does not universally hold. In other words, the assumption that every action leads to a corresponding behaviour and vice versa is not universally true in real life.

3.4.2 Theory of Planned Behaviour

This theory is considered a practical improvement of the Theory of Reasoned Action. The theory was postulated by Ajzen in 1985 because of the inherent limitations in the Theory of Reasoned Action. Its core objective is to determine what motivates an individual to adopt a particular behaviour. The theory also addresses issues of voluntary actions, which are not addressed in the Theory of Reasoned Action. This limitation is addressed by adding a new variable, Perceived Behaviour Control (Ajzen, 1991). Critics of the Theory of Planned Behaviour contend that the theory has some glaring oversights and limitations. There are other variables like Perceived Moral Obligation and Moral Identity that potentially influence the behaviour and intentions of an individual. The Theory of Planned Behaviour hinges on the assumption that the behaviour of an individual is voluntarily and deliberately planned, an assumption that does not explain irrational behaviour (Ajzen & Fishbein, 1980). There is a need to account for the motivation of the individual to take action; individuals need to be inspired to take certain actions. Another limitation is the assumption that individuals have

identical beliefs (Taylor & Todd, 1995). This direct limitation is equally applicable to the Theory of Reasoned Action and the Theory of Planned Behaviour.

The Perceived Behaviour Control variable that was introduced to address the concerns of involuntary actions has inherent problems because several constructs, variously referred to as concepts, beliefs or factors are aggregated into one variable, making it a challenge to pick specific constructs (Taylor & Tod, 1995). It can be discerned that the Perceived Behaviour Control variable is an imprecise measure and it causes possible bias. This brings to the fore the limitations of the Theory of Planned Behaviour. These limitations precipitated the development of the Decomposed Theory of Planned Behaviour. The Decomposed Theory of Planned Behaviour is the result of separate work by Taylor and Todd (1995) and Pavlon and Fygenston (2006). The theory is an extension of the Theory of Planned Behaviour that decouples it into individual detailed components. The theory borrows constructs, concepts, factors or beliefs from the Diffusion of Innovation Theory. Taylor and Todd's (1995) extension of the Decomposed Theory of Planned Behaviour is premised on key notions of TAM. However, Pavlou and Fygenston's (2006) work added a new dimension to the Theory of Planned Behaviour.

3.4.3 Technology Acceptance Model (TAM)

TAM is universally perceived as an information systems theory. TAM is a diffusion of innovation theory that models how users adopt emerging technologies, fundamentally based on Perceived Ease of Use and Perceived Usefulness. The following are some of the major limitations of TAM:

- a) TAM measures usage on the basis of feedback from respondents. Critics argue that self-reporting of usage is not a true reflection of actual usage (Legris, Ingham & Collette, 2003).
- b) TAM does not provide detailed guidelines that relate usage of technology to effective design, development and implementation of the technology.
- c) TAM does not give appropriate feedback that can enhance adoption (Davis, Bagozzi, & Warshaw, 1989)
- d) There are weaknesses in the explanatory power of TAM and some studies have revealed inconsistent relationships among TAM constructs (Venkatesh et al., 2003).

However, through continuous research efforts, TAM has evolved over the past 20 years. Han (2003) reveals the progression of TAM from adoption, validation, and extension. The outcomes

of other researches revealed another instance of TAM evolution, categorised into introduction, validation, extension and elaboration (Lee, Kozar & Larsen. (2003). Moreover, TAM2 (Venkatesh & Davis, 2000) is the outcome of the work to extend and improve TAM. The extension includes two new constructs: Perceived Usefulness and Usage Intention. Perceived Usefulness is an attempt to explain changes over time, as technology users find it useful. This new model also accommodates the Social Influence construct.

3.4.4 Innovation Diffusion Theory

The Innovation Diffusion Theory was developed by Rogers in 1995, after conducting a prolonged analysis of thousands of innovation studies. From the studies, Rogers identified five constructs that influenced individuals' acceptance of emerging technologies: Relative advantage, complexity, compatibility and reliability. Rogers (1995) contends that up to a maximum of 87% variation in the rate of acceptance of emerging technologies can be accounted for by these five constructs. The relative advantage and perceived complexity identified by Rogers (1995) equate to Perceived Usefulness and Ease of Use (constructs in TAM). Therefore, the two researchers were in agreement about the two constructs, thus, TAM and the Innovation Diffusion Theory are complementary models (Chen, Gillenson & Sherrell, 2002). However, other theorists view the Innovation Diffusion Theory as a way of implementing change or making new ideas acceptable to candidate users. Some critics of the Diffusion of Innovation Theory argue that it lacks details of how attitude progresses into acceptance or rejection of decisions and how innovation can be integrated in the process (Chen et al., 2002). The decision to reject the innovation can occur at any point of the knowledge-reinforcement progression or continuum. Critics (Karahanna, Straub & Chervany, 1999) argue that Innovation Diffusion Theory does not clarify or include how technology attributes are leveraged to provide scaffolding during this knowledge-reinforcement path.

3.4.5 The Social Cognitive Theory

The Social Cognitive Theory was originally conceived as a Social Learning Theory by Albert Bandura in the 1960s. Since then, the Social Learning Theory has evolved and was proposed as the Social Cognitive Theory in 1986. The theory contends that the process of learning happens through socialisation and, for this to happen, there is a dynamic and reciprocal interaction involving the learner, the environment and behaviour (Bandura, 1989; 2005). In terms of limitations, the theory assumes a direct and reciprocal relationship between the

environmental conditions and behaviour of an individual. In other words, changes in the environment are assumed to automatically lead to changes in the behaviour of an individual. In real life, this assumption does not universally apply (Bandura, 2006; Marakas et al., 1998). Critics of the Social Cognitive Theory also argue that it is loosely organised as it singularly depends on the assumed dynamic and reciprocal interplay involving only the individual, behaviour and the environment.

3.4.6 The Motivational Model

According to Venkatesh and Speier (1999), the Motivation Theory has been researched and applied in different contexts, and there are several variants and applications. The Motivational Model has two main constructs. The first construct is extrinsic motivation, which is the belief that engaging in certain behaviour, for example using a new technology, will result in observable improved task outcomes. The second construct is intrinsic motivation, which is the conviction that individuals can adapt a behaviour or activity spontaneously without due consideration of the benefits (Igbaria, 1996). However, the motivation concept, although easy to understand and apply in all instances of adoption, remains too simplistic on its own to cater for all the variables that effectively influence decisions to accept and use technology.

3.4.7 The Model of PC Utilisation

The Model of PC Utilisation is a derivative of Human Behaviour Theory. It was proposed by Thompson, Higgins and Howell (1991) and relates to the use of a Personal Computer (PC) by a worker in an organisation. The theory contends that the use of the PC by the organisation does not flow from a corporate decision, but it is determined by a worker's consideration of the following variables: Job-fit, complexity, long-term consequences, effect towards use, social factors and facilitating conditions. The definitions of the variables are summarised in Table 3.4.

Table 3.4: Model of PC Utilisation constructs

Construct	Definition
Job-fit	"The extent to which an individual believes that using a technology can enhance the Performance of his or her job."
Complexity	"The degree to which an innovation is perceived as relatively difficult to understand and use."
Long-term	"Outcomes that have a pay-off in the future."
Affect Towards	"Feelings of joy, elation, or pleasure, or depression, disgust, displeasure, or hate associated by an individual with a particular act."
Social Factors	"Individual's internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations."
Facilitating	"Provision of support for users of PCs may be one type of facilitating condition that can influence system utilization."

Source: Sharma & Mishra, 2014, p. 22

It can be noted that all the Model of PC Utilisation variables in Table 3.4 are adequately covered by the four UTAUT variables: Performance Expectancy, Effort Expectancy, Facilitating Conditions and Social Influence. Importantly, the new variables: Hedonic Motivation, Price Value, and Habit, which were introduced in the UTAUT2, are a significant improvement. They clearly take the UTAUT2 a step above the other technology acceptance models considered in this research.

3.5 Research model confirmation

The process of validating existing diffusion of innovation theories, also called technology acceptance models, was used to arrive at the theory with sufficient constructs and explanation potential to address the research problem. The initial literature review showed that technology acceptance models have been used in adoption studies of ICT tools and solutions. The goal was to identify technology acceptance theories that have been recently applied in OER adoption studies in a developing country context like Zimbabwe. The best corresponding study was by Mtebe and Raisamo (2014). The study was conducted in higher education institutions in Kenya and investigated OER adoption by university lecturers. The first generation UTAUT model was used. This is how my validation process started for the UTAUT model. I conducted an extensive literature review to validate the UTAUT model by benchmarking its key tenets with those of other technology acceptance models. The findings of this validation exercise are depicted in Figure 3.3.

From literature review, I managed to confirm that UTAUT was a superior model, as it was derived from the integration of eight technology acceptance models. The models that make up the UTAUT model are: (i) TAM, Innovation Diffusion Theory, (ii) Theory of Reasoned Action, (iii) Motivation model, (iv) Theory of Planned Behaviour, (v) Combined TAM and Theory of (vi) Planned Behaviour, (vii) Model of PC Utilisation, and (viii) Social Cognitive Theory.

From the detailed literature review of the eight models that make up this chapter, I could confirm that Effort Expectancy, Performance Expectancy, Social Influence and Facilitating Conditions are validated technology acceptance independent variables that affect OER adoption. In Figure 3.3, I included the annotation of equivalent constructs from other technology acceptance models. The UTAUT model was found to be inadequate and the second generation UTAUT2 model was introduced. The progression from the UTAUT to the UTAUT2 introduced three new variables namely: Hedonic Motivation, Price Value and Habit. The Price Value variable particularly stands out because OER are not completely free at Africa University. The UTAUT2 has a sufficient number of variables to be mapped to the problem statement. The analysis of the data collected against the UTAUT2 independent and dependant variables constitutes solutions to the research problem.

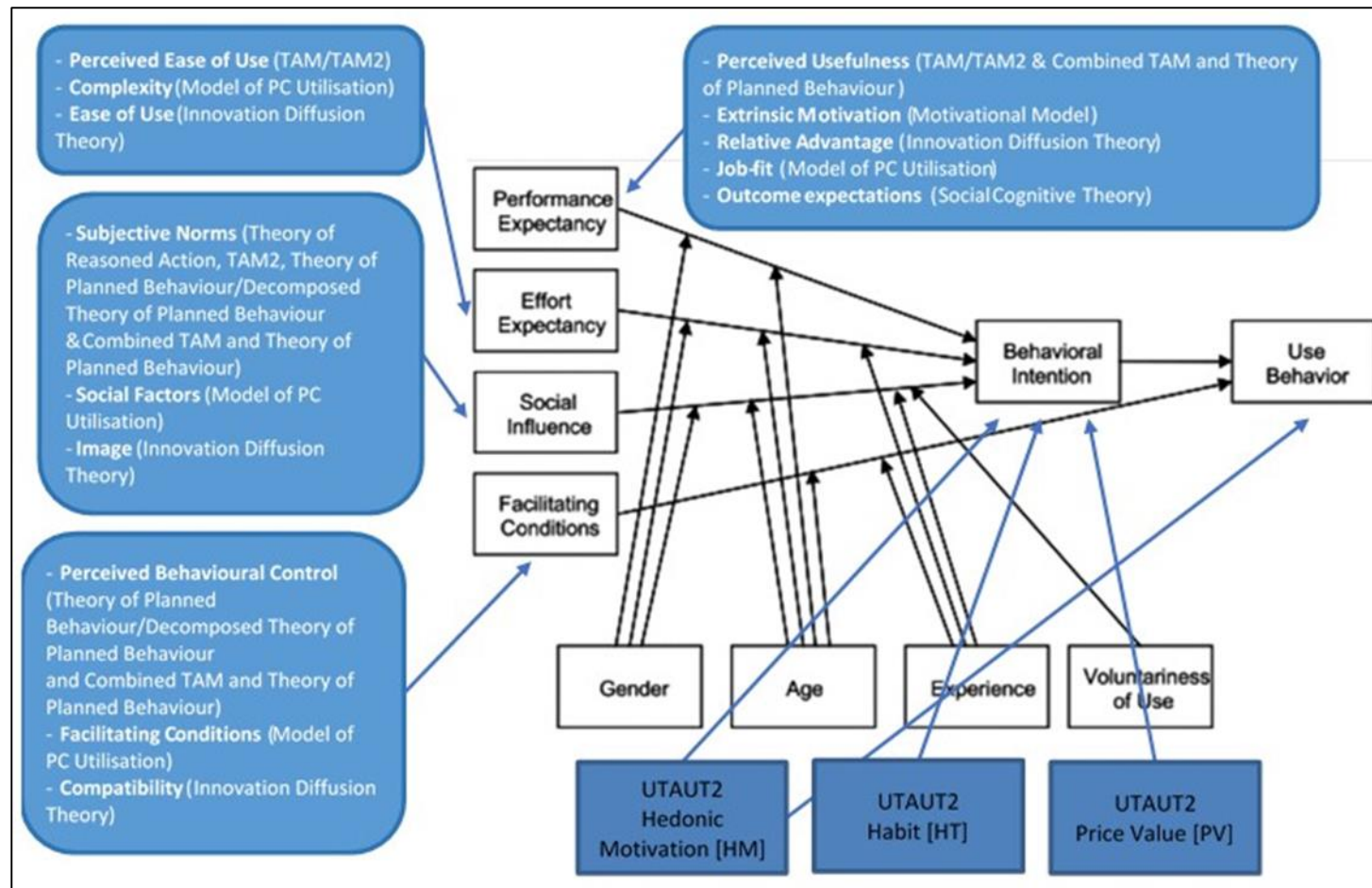


Figure 3.3: Validated research model

3.6 Summary

The UTAUT was developed as a comprehensive integrated model for better understanding consumer acceptance toward new technology or system. The second generation of the Unified Theory of Acceptance and Use of Technology (UTAUT2) is introduced as a theoretic basis. The UTAUT2, a theoretic framework derived from a fusion of eight diffusion of technology and innovation models namely: (i) TAM, Innovation Diffusion Theory, (ii) Theory of Reasoned Action, (iii) Motivation model, (iv) Theory of Planned Behaviour, (v) Combined TAM and Theory of (vi) Planned Behaviour, (vii) Model of PC Utilisation, and (viii) Social Cognitive Theory; is a powerful predicting framework proposed by Venkatesh et al. 2012. The UTAUT2 can effectively explain and analyse people's technology acceptance behaviours for novel information technology (IT) products. Consequently, this research introduced the UTAUT2 as an analytic model.

This chapter reviewed the most recent literature on UTAUT (Unified Theory of Acceptance, and Use of Technology) and UTAUT 2(Unified Theory of Acceptance, and Use of Technology) 2 by focusing on the findings and recommended future research. The papers, proceedings and dissertations included in the analysis identified UTAUT and UTAUT2 as the focus of their studies. This search was supplemented by various websites which host scientific journals such as Emerald, Science Direct and Google Scholar. The studies examined works which employed UTAUT and UTAUT 2 by focusing on findings on the core constructs of UTAUT to predict Behavioural Intentions. The results confirmed previous studies that the four constructs of UTAUT contributed to Behavioural Intention even though Performance Expectancy (PE) seemed to be the most significant contributors. Findings also suggest UTAUT2 has been more explanatory and list the suggestions for future works which have been adopted in this research. The recommendations adopted include the use of mixed research method and the adaptation of the UTAUT research instruct to the context of the OER research at Africa University.

Despite some weaknesses in the theoretical propositions of technology acceptance theories and models, the UTAUT2 emerged as an improved theory that can serve as a useful tool to evaluate adoption and use of OER in this research. The model has also been used fairly recently in the adoption of emerging technologies research. The identified set of hypotheses helped to reveal important context specific findings. From the findings, the researcher derived context specific

recommendations and contributions to the existing and evolving body of knowledge of OER adoption and use in developing contexts. The detailed analysis and synthesis of technology acceptance theories presented helped to inform the interpretation of results and the recommendations. In general, the chapter also provided a basis for future research on the evaluation of technology acceptance models. The next chapter is the research methodology.

Chapter 4: Research Method

4.1 Introduction

The aim of this research was to determine the factors that influence the adoption of OER among Africa University students and make recommendations for improvement. The second generation UTAUT model was used as the theoretical framework. The ontological and epistemological underpinnings that guided the research are included. The selection of adopted methods is clarified and justified. In this chapter, the research questions are related to the research process and procedures. The research design is outlined and described, notably focusing on how the research participants were selected, and how the analysis and synthesis of data were conducted. The chapter also details how validity issues and ethical considerations were addressed in this research.

4.2 The critical realist perspective

This research adopted critical realism as the research perspective. Critical realism was preferred because it does not restrict us to theorising about the world based what we physically see and observe, like positivism theories do. Instead, critical realism endeavours to identify the causal mechanisms in the process of analysing and understanding society. In critical realism there are three layers of reality; the empirical (based on what we experience), the actual (based on events) and the real (mechanisms that explain the actual and empirical). The critical realist perspective is premised on the presupposition that “there is a world existing independently of our knowledge of it” (Sayer, 2000:2). The fact that we are not able to physically observe some events does not mean that they do not exist. In our world there is a set of events that exists although we generally lack knowledge of them. Critical realists guard against a phenomenon known as epistemic fallacy, which limits people to believe that what they think is all there is in the world. Critical realism provides a theorising agency because it considers agents to have a central role in determining their needs and aspirations (Bhaskar, 1986). In this research, my interest was to study the variables that influence the adoption and use of OER. These variables were not physically observable, but it did not mean that they do not exist. The underlying basis for the actual events surfaced and were organised through UTAUT2 variables. The realist notion of causality helped to explain why, in certain circumstances, the causal powers of UTAUT2 variables may or may not be triggered (Sayer, 1992).

The philosophy underlying mixed methods research can either be pragmatism or critical realism (Creswell, 2009; Tashakkori & Teddlie, 2015; Wahyuni, 2017; Yin, 2014). A pragmatic research philosophy is premised on the application of what works, using diverse approaches, giving primacy to the importance of the research problem and question, and valuing both objective and subjective knowledge (Morgan, 2007). This research focused on how UTAUT2 variables influence the adoption of OER among Africa University students. The research was neither concerned with everything that works nor with diverse approaches, therefore, it was not appropriate to adopt the pragmatic perspective.

Critical realism has a bearing on both causality and validity, which were handled in this research. According to Zachariadis, Scott and Barrett (2013), “in practical terms, the CR [critical realist] position on causality means that a different mode of inference needs to be adopted in order to explain events by postulating (and identifying) mechanisms ... which are capable of producing them” (p. 4). The UTAUT2 was used as the mode of inference to explain the adoption and use of OER among Africa University students. This approach is known as retrodution¹³, which is “the provisional adoption of a hypothesis, because every possible consequence of it is capable of experimental verification, so that the persevering application of the same method may be expected to reveal its disagreement with facts, if it does so disagree” (Peirce, 1896, p. 168).

Critical realism is suitable for this research because of its conviction and embodiment of reality and because it supports the view that the world is an instance of occurrence independent of humanity’s thoughts and interpretations of it. Critical realism allows researchers to distinguish between what is realistic, what is actually prevalent, and what is discerned from empirical research. More importantly, critical realism is entirely different from other research perspectives that interpret the world as consisting of objects (or events) whose features are transparent and can be easily observed. This is also a multi-disciplinary research that brings together aspects of social science and information systems, and the realist perspective is confirmed to transcend the fields of natural and social sciences (Barrett et al., 2010). This is a relevant corresponding attribute that further merits the realist perspective as the most suitable paradigm for this study.

¹³ <http://www.commens.org/dictionary/entry/quote-lessons-history-science-5>

4.3 The mixed methods research design

I used a mixed methods approach, because both the qualitative and quantitative methods of collecting data were relevant to my study, and one method could not adequately address all the research questions. The solution was to compare and relate qualitative and quantitative data, as illustrated in Figure 4.1. Importantly, mixed methods research now has extensive applications in the field of education. Until recently, many educational research studies relied on a single paradigm, either qualitative or quantitative. In the USA, for example, education effectiveness research was mainly qualitative, and that on school improvement was mainly quantitative. Relying on separate paradigms resulted in limited dialogue between the two types of research that are supposed to complement each other, that is, school improvement research made less use of education effectiveness research (Tashakkori & Teddlie, 2015). In 2015, a mixed methods approach was adopted to improve the effectiveness of the outcomes of the research (Tashakkori & Teddlie, 2015; Sammons, 2010).

I used a convergent parallel mixed methods research design. As depicted in Figure 4.1, I integrated concurrent quantitative and qualitative data, separately analysed them and then fused the results. Quantitative data were collected using the adapted UTAUT2 questionnaire that was used to answer the sub-research question: RQ1: How do the UTAUT2 variables significantly influence Africa University students' mainstream adoption of OER in their learning process?; RQ2: How do the UTAUT2 variables significantly influence actual OER use behaviour among Africa University students?; RQ3: What is the prevailing OER usage pattern among Africa University students? The qualitative data that were collected using documents, interviews and archival records, were used to validate outcomes from statistical inference derived from quantitative data analysis in response to research questions. A combination of qualitative and quantitative data was used to answer the main research question RQ0: How and why did OER adoption and use occur the way they did among students at Africa University?

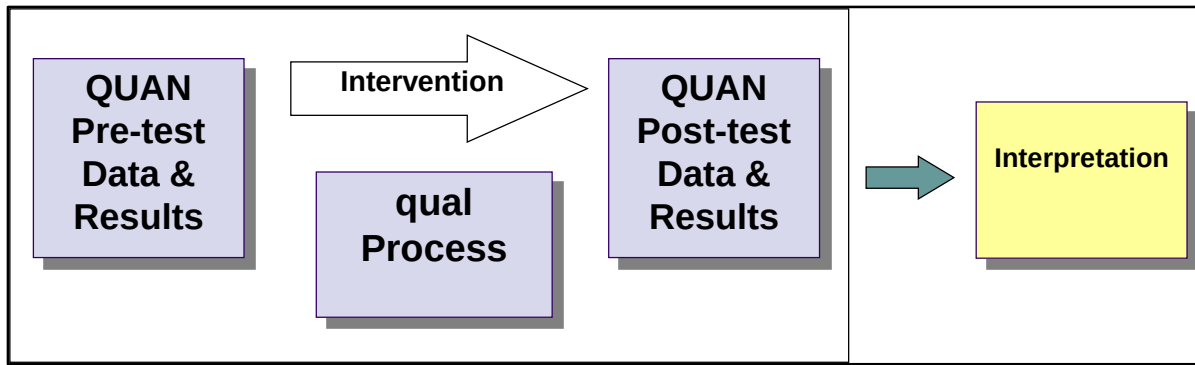


Figure 4.1: Embedded nested design

Source: (Yin, 2014, p. 220)

An embedded (or nested) design (Figure 4.1) was used. The term ‘concurrent’ indicates that both qualitative and quantitative data were collected at the same time. However, in concurrent nested studies, one of the methods dominates while the other one is embedded, or nested. In this study, the quantitative method was dominant and was supplemented by the qualitative method.

In Figure 4.2, further execution details are illustrated. Each box in the diagram represents a stage and the arrows show a logical progression from one stage to the next. The first step was the identification of the research question: Why and how did OER adoption and use occur at Africa University. The combination of “why” and “how” makes it a ‘composite’ research question and, according to *The Manual of Mixed Methods Research* (Tashakkori & Teddlie, 2015), such questions require mixed methods to be sufficiently answered. The main component of the research is quantitative (QUAN) to verify the UTAUT2 theoretical propositions through deductive reasoning, as detailed in Section 3.2. To enhance the description, understanding or explanation, a supplementary qualitative (qual) component was performed using inductive reasoning. Please note that the notation QUAN (quantitative) is in capital letters and qual (qualitative) is in small letters to emphasize that quantitative is the main component of the research (Tashakkori & Teddlie, 2015). However, some quality concerns have been raised about qualitative data, as expressed here by Wahyuni (2017):

Qualitative research has been criticised as lacking generalisability. It must be noted that not all research findings should be generalised. The fact that we cannot generalise qualitative findings does not make qualitative research suspect. Proponents of the quantitative tradition believe that research should rely heavily on reliability and validity to ensure its replicability and generalizability (p. 77).

These research quality issues have been mitigated by combining the two approaches.

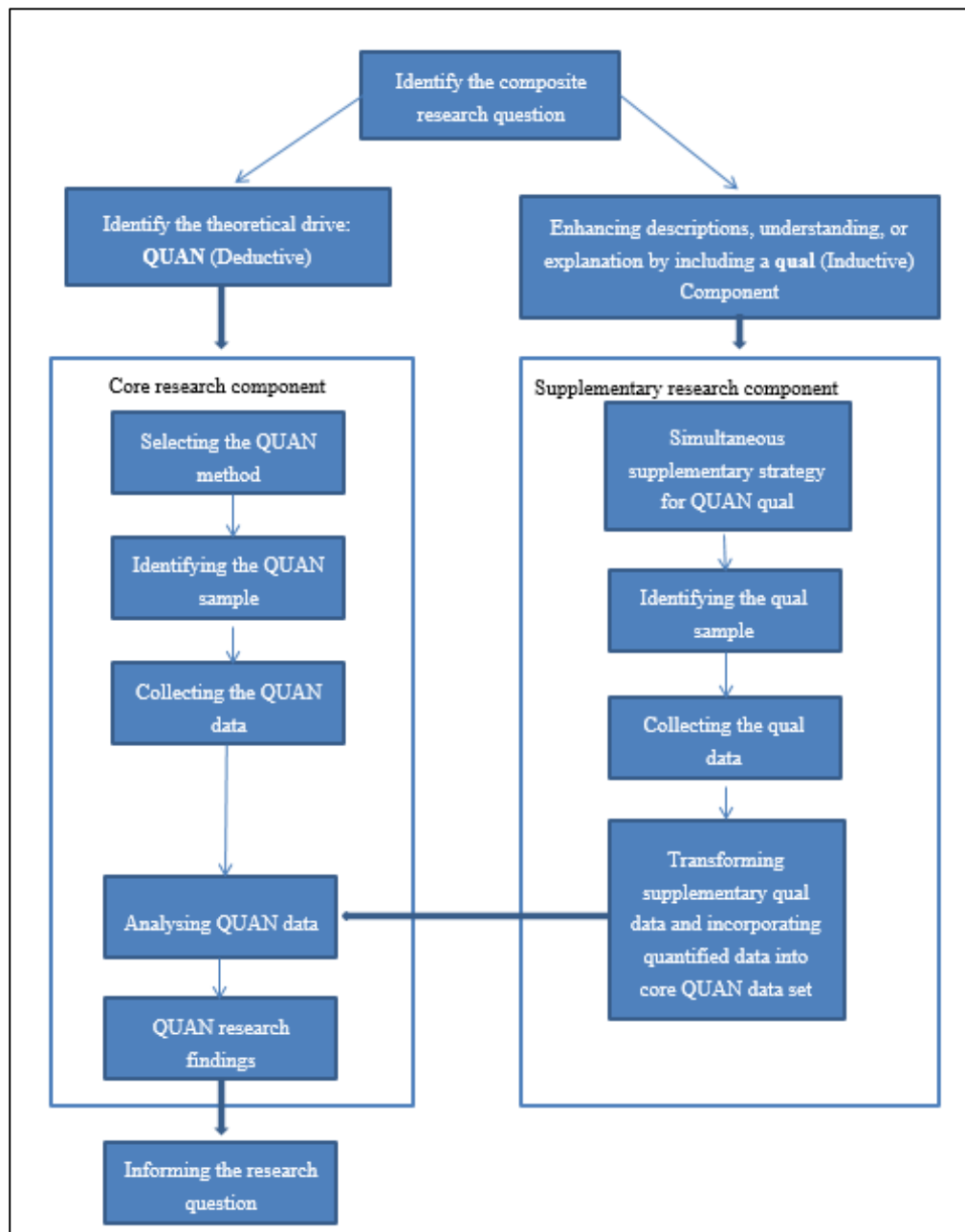


Figure 4.2: The QUAN-qual research convergent design

Source: Tashakkori & Teddlie, 2015, p. 343

Universally defined, “research designs clarify research questions, define relevant data, data to be collected and how data will be analysed to derive the results” (Yin, 2014, p. 29). The primary goal of picking a research design is to avoid a mismatch between data collected and the research questions. The research design provides a logical connection of field data, the problem statement, as articulated by the research questions, and the conclusions and recommendations.

Tashakkori & Teddlie (2015) posit that:

Mixed method design consists of one project, known as the core project, which is a complete method in itself, and a second project consisting of different type of data analysis that is incomplete, that is not comprehensive or publishable apart from the main project (p. 340).

The additional component serves to validate the findings from the core segment of the study. Therefore, the core segment in this study was quantitative data collected using the adapted UTAUT2 psychometric questionnaire. The complementary components of the research were interviews, analysis of documentation archival records. It is important to note that the mixed methods differ from multi-methods in that “multiple methods design consists of two or more studies using different methods, which address the same research questions or programme goal” (Tashakkori & Teddlie, 2015, p. 341).

4.4 The case study research approach

In this study, I used the case study research method, with Africa University as the case. The advantage of case studies is that they allow the researcher to investigate the phenomenon under investigation in depth. Such in-depth analysis of phenomena generates data that yield a nuanced understanding of the phenomena in context. In most cases, a case study is used when a complex social phenomenon must be explained. Using one research site, instead of several universities, enabled me to gain deep insights into the factors that affect the adoption of OER and usage characteristics within the specific context of Africa University. In other words, the case study method enabled me to reveal the pertinent truth in its entirety.

At Africa University, there is a complex social phenomenon arising from a national OER project rolled out by Econet Wireless Zimbabwe at the institution and concurrently at all other universities in the country to resolve the impending challenge of access to educational resources. However, the uptake and use of these freely available educational resources has been slow, contrary to the logical expectation of mass adoption. Therefore, the low adoption and adherence to the OER intervention created a complex social phenomenon that can only be explained after conducting a detailed case study to understand why the adoption of EcoSchool OER is slow at Africa University, and how the adoption of OER occurred in the context of this high education institution. According to Yin (2014), “The essence of a case study is that it tries to illuminate a decision or set of decisions, why they were taken, how they were implemented, and with what result” (p. 15). Accordingly, this research sought to illuminate a set of decisions regarding OER

adoption by Africa University students, why the decisions were taken, and how they influence OER adoption.

Regarding the epistemological orientation, Yin (2014) describes the case study method to be inclined to the realist school of thought, that is, in case study research there is a belief in a single reality devoid of the influence of the researcher or observer. Realism is at variance with the relativist perspective, which accommodates multiple interpretations of findings, depending on the individual making the research enquiry and the people that provide the data.

4.5 Population and sampling

The initial considerations were population and sampling. Population is the full collection or list of possible objects about which data will be gathered in a research. The entities must have similar characteristics, for example, educators, learners, books and administrators (Yin, 2009). For this study, the population was the Africa University students, academic and administrative staff during the academic year July 2017–July 2018.

Probability sampling was used to collect data for the quantitative component of the study to accommodate external validity “when implementing probabilistic sampling design, the researcher’s objective is to make external statistical generalizations” (Tashakkori & Teddlie, 2015, p. 245). In other words, using the sample data, the researcher can make conclusions that apply to the population from which the sample is drawn. Both sample size and randomisation are equally important in meeting the generalisation requirement. Stratified random sampling was used to collect the principal quantitative data sample that was used to perform causal comparatives on the basis of the UTAUT2 research model. The student population was stratified into first, second, third and fourth years, and post graduate students. For causal-comparative, a minimum sample of 51 participants was required for a one-tailed test hypothesis, and 64 participants for a two-tailed test hypotheses (Onwuegbuzie et al., 2014; Tashakkori & Teddlie, 2015). Guided by a minimum sample size of 51 participants, I wanted to achieve as large a sample size as possible. Accordingly, 100 questionnaires were given to class representatives to distribute randomly and then return them to the researcher. Four class representatives were involved one for each year of study specifically 1st year, 2nd year, 3rd year and 4th year. A total of 400 questionnaires were distributed during the registration week. A total of 370 questionnaires were successfully collected back. This is how an effective sample size of 370 participants for the quantitative component of the research was achieved. The parallel

qualitative data collection was done through interviews, and a sample size of 5–9 participants, as recommended by Tashakkori and Teddlie (2015). This sample size is not fixed and it varies according to the study.

Purposive stratified convenience sampling was used to select interview participants from each of the five categories. Five students, one from each of the following categories: first year, second year, third year, fourth year, and post graduate were interviewed. Using a list of class representatives that contained contact numbers, I was able to book a telephone interview using the WhatsApp social media platform. I was able to quickly explain the purpose and possible duration of the interview. The selection criterion was first available respondent per strata.

4.6 Data collection/generation methods

The data collection process started with the collection of quantitative data and the initial analysis informed the collection of qualitative data. This interactive approach of data collection improved the complementarity of the data sets.

4.6.1 Questionnaire

The adapted UTAUT questionnaire was the principal data collection tool. The tool was preferred because data from questionnaires can be analysed quickly in an objective way, and questionnaires also allow data to be collected in the absence of the researcher. The adapted UTAUT questionnaire used is included in Appendix A p.198. The questionnaires consisted of closed ended questions and they were used to collect quantitative data.

4.6.2 Pilot testing

A pilot study was conducted to ensure that the questionnaire met expectations, assumptions, reliability and validity, (Bryman & Bell, 2007; Malhotra & Birks, 2007). A random sample size of 10 was determined on the basis of recommendations of a minimum pilot sample size of 10 participants by Saunders, Lewis and Thornhill (2007). The feedback from pilot testing was that the questionnaire was too long. This was a valid comment because the original questionnaire combined the psychometric questionnaire and interview questions. To address the problem, the psychometric questionnaire and interview questions were separated and administered separately.

4.6.3 Gathering data from documentation

In this thesis, the term documentation refers to a set of documents on paper, online or on digital or analogue media, such as audio tape or CDs. The documentation included e-learning policy, quality assurance policy, and training and capacitation workshops. Relevant documents from 2014 up to the data collection window (July 2017–July 2018) were considered. The data collected using documents illuminated the usage characteristics of OER adoption and validated recommendations applicable to Africa University. Data were also collected through analysis of references of honours and master's research projects that were submitted for final examination during the January-June 2018 semester. Analysing reference lists gave useful insight into the extent to which Africa University students use OER in research. In the reference lists, I looked for references to EcoSchool OER repository and any other OER repository.

The qualitative data input documents were institutional ICT Policy, Quality Policy, E-learning Policy, Performance Target Forms, Performance Evaluation Forms, Network Resources Utilisation Reports, and Dissertations/Theses. A summary of the provided documentation is presented in Table 4.1.

Table 4.1: Documentation available

Document reference	Content
Africa University ICT Policy	Learning management system, support services, security and privacy, data usage, computer labs, smart classrooms
Africa University Quality Policy	Teaching, learning, evaluation and assessment standards
Africa University Distance Learning Policy	Bridging the learning distance using e-learning, online classroom presence
Africa University Educator Performance Target Forms	Teaching, research, teaching load, outreach and personal initiatives
Africa University Performance Evaluation Forms	Teaching, research, teaching load, outreach and personal initiatives
Network Resources Utilisation Reports	Network resource utilisation data, and statistics of OER resources
Dissertations/Theses	Complete reference list and citations of educational resources used in the research

4.6.4 Archival records of network usage reports

These provided resource utilisation and network usage reports by Africa University students from the time of intervention to the data collection week. The exercise provided a longitudinal view of events, as opposed to a snapshot. OER usage characteristics were portrayed mainly in graphical form in these reports. The reports were available after special clearance was granted

by the Research and Ethics Committee. The reports did not show individual user details, but only the aggregate frequency of access to the most common resources, and this clears the possibility of any unethical conduct.

4.6.5 Interviews

According to Cohen, Manion and Morrison (2007), data collection using interviews “enable[s] participants - be they interviewers or interviewees - to discuss their interpretations of the world in which they live, and to express how they regard situations from their own point of view” (p.75). Another advantage is that the interviewer controls the process and has the opportunity of probing further to gain deeper understanding of complex issues.

Structured questions interviews were used. The interview briefing addressed anticipated concerns on confidentiality and anonymity. Permission to record the interview was sought from the participants before commencement of the interviews. All the participants preferred unrecorded interviews. I used the following guidelines from Wahyuni (2012) for my interview notes:

There are three types of memos or notes that can be recorded for an interview: observational, methodological and theoretical ... Observational memos, also known as field notes, are used to describe the situation during the interview. Methodological memos are the records of any issues and concerns regarding the methods used. Theoretical memos focus on what themes and findings emerged from the interview process (pp. 74–5).

The time frame for conducting the interviews was a maximum of 10 minutes, after which a closing debrief was conducted to give room for independent comments and contributions. The interviews were also used to request any information that may add value to the research, for example, magazines and internal reports. These secondary data were obtained to triangulate findings in order to answer the research questions (Wahyuni, 2012, p. 75).

As stipulated by Tashakkori and Teddlie, 2015, when the main component of the research is quantitative, the interviews are confirmatory in nature, and the questions used must not deviate from the main research instrument questions. It is recommended to answer the same questions in a different way. The interview questions used in this research were developed after the analysis of quantitative data. The Communalities table (Table 4.4 in Section 4.7) shows the extraction capacity of each research instrument item that was used to pick the item with greatest

extraction coefficient for each research construct. For example, the first construct Performance Expectancy has three evaluation items PE1: *I find OER useful in my studies* (0.774), PE2: *Using OER helps me accomplish learning activities* (0.894), and PE3: *Using OER increases my academic productivity* (0.864). The extraction power of each item is shown in the communalities table, in this case PE2: *Using OER helps me accomplish learning activities* (0.894) has the highest rate of 0.894 (89.4%). In addition, Item PE2 was transformed into one follow up interview question: ‘Comment on the help of OER in accomplishing teaching/learning activities?’ The process was repeated for each of the nine research constructs (Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Habit, Price Value, Behavioural Intention, and Use). The complete set of interview questions is shown in Table 4.2. The table shows each construct, with the one qualitative interview question that was used to qualitatively validate the perceived impact of each construct with respect to the use, intention or actual use of OER among Africa University students.

At my first attempt to request permission to record an interview, I was surprised by the casual question: ‘Why would it be necessary?’ I then reverted to the approach of discussing the questions without recording and making an interview record sheet available to the participants, to be completed in their own words, allowing them to email it back to me. It turned out that the written responses after the interview discussion provided more information.

Table 4.2: Interview questions

Research Construct	Question
Performance Expectancy	Comment on the help of Open Educational Resources in accomplishing learning activities.
Effort Expectancy	Do you consider Open Educational Resources navigation to be clear and understandable?
Social Influence	Do you believe social peers influence students to use Open Educational Resources?
Facilitating Conditions	Would you say having the necessary prior knowledge influences students to use Open Educational Resources?
Hedonic Motivation	Do you think that students enjoy using Open Educational Resources? Please comment.
Price Value	Marketing and advertising campaign project Econet Wireless Zimbabwe EcoSchool Open Education Resources initiative has good value for money to learners and educators. Please comment.
Habit	Some say students are driven to use Open Educational Resources by a common habit. Can we say students are significantly driven by habit to use OER?
Behavioural Intention	Is it correct to assume in general that students plan to use Open Educational Resources, e.g. YouTube videos, frequently?
Use	Students use Open Educational Resources frequently. What is your opinion on that?

The interview record sheet in Figure 4.3 was produced using the interview questions in Table 4.2. The interviews were conducted telephonically and each participant completed and emailed the interview record sheet to me.

Open Educational Resources (OER) are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge. OER are offered for free through a public domain or under a license that permits their free use and customization by others.

Research Construct	Question
<i>Performance Expectancy</i>	<i>Comment on the help of Open Educational Resources in accomplishing learning activities?</i>
<i>Effort Expectancy</i>	<i>Do you consider Open Educational Resources navigation to be clear and understandable?</i>
<i>Social Influence</i>	<i>Do you believe social peers influence students to use Open Educational Resources?</i>
<i>Facilitating Conditions</i>	<i>Would you say having the necessary prior knowledge influences students to use Open Educational Resources?</i>
<i>Hedonic Motivation</i>	<i>Can it be said that students enjoy using Open Educational Resources, please comment?</i>
<i>Price Value</i>	<i>Marketing and advertising campaigns project Econet Wireless Zimbabwe EcoSchool Open Education Resources initiative as good value for money to learners and educators. Please comment?</i>
<i>Habit</i>	<i>Some say students are driven to use Open Educational Resources by a common habit. Can we say students are significantly driven by habit to use OER?</i>
<i>Behavioural Intention</i>	<i>Is it correct to assume in general that students plan to use Open Educational Resources e.g. YouTube videos frequently.</i>
<i>Use</i>	<i>'Students use Open Educational Resources Frequently' what is your opinion on that?</i>

Figure 4.3: Interview record sheet

4.7 Data analysis

Analysing theoretical propositions was the primary strategy used to analyse data in this study. The theoretical propositions were that Effort Expectancy, Performance Expectancy, Facilitating Conditions, Social Influence, Price Value, Hedonic Motivation, and Habit are the primary determinants of Behavioural Intention and actual Use behaviour for OER at Africa University. The influence of these seven constructs were affected by moderating variables such as age, gender and experience. The analysis validated the manifestation of these propositions in the context of Africa University using qualitative, quantitative and a combination of the two measures (mixed methods), as detailed in the data analysis in Chapter 6.

4.7.1 Quantitative data analysis

Confirmatory factor analysis and the chi-square test were used to analyse the quantitative data. The analysis of quantitative data was used:

- 1) To support or not support alternative hypotheses: H1: *Performance Expectancy significantly influences Behavioural Intention*; H2: *Effort Expectancy significantly influences Behavioural Intention*; H3: *Social Influence significantly influences Behavioural Intention*; H4: *Facilitating Conditions significantly influence Behavioural Intention*; H5: *Hedonic Motivation significantly influences Behavioural Intention*; H6: *Habit significantly influences Behavioural Intention*; and H7: *Price Value significantly influences Behavioural Intention*. The outcome was used to respond to RQ1: How do the UTAUT2 variables significantly influence Africa University students' mainstream adoption of OER in their learning process?
- 2) To support or not support alternative hypotheses: H8: *Facilitating Conditions significantly influence actual Use*; H9: *Hedonic Motivation significantly influences actual Use*; and H10: *Behavioural Intention significantly influences actual Use*. The outcome provided a response to RQ2: How do the UTAUT2 variables significantly influence actual OER use behaviour among Africa University students?
- 3) To support or not support alternative hypotheses: H11: *There is no significant use of EcoSchool OER resources among Africa University students*; and H12: *There is significant use of other forms of OER among Africa University students*. The outcome provided a response to RQ3: What is the prevailing OER usage pattern among Africa University students?

a) Testing for significance confirmatory factor analysis of Hypotheses H1–H10

Confirmatory factor analysis was the main quantitative data analysis method used in this study. Data were first tested for conformity to factor analysis and then some reliability statistics for the measurement items were computed. Again, this is complementary to the reliability and validity measures detailed earlier in this chapter. Confirmatory factor analysis can be described as a statistical technique used to verify the structure of a set of observed factors or variables (independent variables). It provided a set of functions to test the hypotheses on the relationship between the observed variables, Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Habit, Price Value, and the unobserved variables Behavioural Intention and Use. I used the knowledge of the UTAUT2 to postulate the relationship pattern, derive hypotheses corresponding to the problem statement, and test them for statistical significance.

The distinction between confirmatory factor analysis and exploratory factor analysis is an orderly simplification of interrelated variables or factors. Exploratory factor analysis has been used to explore the possible underlying factor structure of a set of observed variables without imposing a preconceived structure on the outcome. It was not appropriate to use exploratory factor analysis because the underlying relationship of factors has been well-defined in the adopted UTAUT2 theoretical framework. In addition, factor analysis is a Dimension Reduction solution provided under the SPSS ‘Analyse’ menu options. Consequently, the factor analysis conformity test was achieved with the following tables extracted from IBM SPSS: Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Barlett’s Test of Sphericity (Table 4.3), Communalities (Table 4.4), total variance explained (Table 4.5), Rotated Component Matrix (Table 4.6). For a sample size to conform to minimum requirements for factor analysis, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy must be at least 0.6 and the value in Table 4.3 is 0.699. Furthermore, Bartlett’s Test of Sphericity requires the approximated chi-square value (approx. chi-Square = 16816.642) to be greater than the degree of freedom (DF = 435) and the significance value (Sig = 000) to be less than 0.05; all these conditions were met. The above test statistics confirmed that the sample size met the necessary and sufficient conditions required for a confirmatory factor analysis sample.

Table 4.3: Measure of Sampling Adequacy

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.699
Bartlett's Test of Sphericity	Approx. chi-square	16816.642
	DF	435
	Sig.	0.000

The Communalities table (Table 4.4) shows the extraction capacity of each research instrument item. If the extraction capacity of any item is less than 0.5, the item is deemed a weak measure and must be removed from the research instrument. Extraction ratings indicate that only HT3: *I must use OER* had an extraction value below 0.450. However, this value is significantly close to 0.50, and hence, it is safe to say all evaluation items met the minimum extraction capacity required. The research instrument was adopted from the tried and tested UTAUT2 questionnaire. The pilot testing only involved testing the clarity of the questions and slightly improving the wording of the item OER, as a better extraction value that could be achieved for this item in future research.

Table 4.4: Communalities

Evaluation Item	Initial	Extraction	Evaluation Item	Initial	Extraction
PE1. I find OER useful in my studies	1.000	0.774	HM1. Using OER is fun	1.000	0.786
PE2. Using OER helps me accomplish learning activities	1.000	0.894	HM2. Using OER is enjoyable	1.000	0.885
PE3. Using OER increases my academic productivity	1.000	0.864	HM3. Using OER is very entertaining	1.000	0.890
EE1. Learning how to use OER is easy for me	1.000	0.770	PV1. EcoSchool OER is reasonably priced	1.000	0.881
EE2. OER navigation is clear and understandable	1.000	0.898	PV2. EcoSchool OER is a good value for money	1.000	0.962
EE3. I find OER easy to use	1.000	0.760	PV3. At the current price, EcoSchool provides a good value	1.000	0.955
EE4. It is easy for me to become skilful at using OER	1.000	0.716	HT1. The use of OER has become a habit for me	1.000	0.819
SI1. People who are important to me think that I should use OER	1.000	0.847	HT2. I am addicted to using OER	1.000	0.683
SI2. People who influence my behaviour think that I should use OER	1.000	0.909	HT3. I must use OER	1.000	0.450
SI3. People whose opinions that I value prefer that I use OER	1.000	0.878	BI1. I intend to continue using OER in the future	1.000	0.893
SI4. Use of OER by lecturers influences me to use OER	1.000	0.831	BI2. I will always try to use OER in my learning activities	1.000	0.938
FC1. I have the resources necessary to use OER	1.000	0.743	BI3. I plan to continue to use OER frequently	1.000	0.846
FC2. I have the necessary knowledge to use OER	1.000	0.815	U1. I have been using OER	1.000	0.826
FC3. OER are compatible with other learning materials I use	1.000	0.713	U2. I use OER frequently	1.000	0.879
FC4. There are knowledgeable people to assist with OER	1.000	0.718	U3. I use a variety of OER	1.000	0.790

Table 4.5 shows total variance explained. It shows seven components that explain a variation greater than 1% as follows: Component 1 = 10.678%, Component 2 = 4.230%, Component 3 = 2.798%, Component 4 = 2.444%, Component 5 = 1.952%, Component 6 = 1.376%, and Component 7 = 1.141%. This brought the total variance explained by these components to 82.0325%. Only these components were considered in this study. Components 8–30 progressively explained diminishing values of variance that constituted an acceptable error rate below 18%. The maximum error for using both the UTAUT2 questionnaire and factor analysis procedure is 30%. The seven components described above corresponded to the seven

observable constructs (Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Habit and Price Value) in this research. The Rotated Component Matrix (Table 4.6) depicts the relationship between research instrument items and the seven factors identified by SPSS Dimension Reduction function. It is clear from Table 4.6 how the effect of each measurement item is distributed across the seven factor analysis components.

Table 4.5: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.678	35.592	35.592	10.678	35.592	35.592	4.374	14.578	14.578
2	4.230	14.101	49.693	4.230	14.101	49.693	4.228	14.093	28.671
3	2.789	9.296	58.989	2.789	9.296	58.989	3.581	11.935	40.607
4	2.444	8.147	67.135	2.444	8.147	67.135	3.460	11.532	52.139
5	1.952	6.508	73.643	1.952	6.508	73.643	3.370	11.235	63.374
6	1.376	4.585	78.229	1.376	4.585	78.229	2.896	9.654	73.028
7	1.141	3.803	82.032	1.141	3.803	82.032	2.701	9.004	82.032
8	0.942	3.139	85.170						
9	0.885	2.950	88.120						
10	0.738	2.462	90.582						
11	0.562	1.873	92.454						
12	0.383	1.278	93.733						
13	0.340	1.132	94.864						
14	0.306	1.019	95.883						
18	0.124	0.414	98.303						
27	0.018	0.060	99.911						
28	0.016	0.055	99.966						
29	0.008	0.026	99.992						
30	0.002	0.008	100.000						

Extraction Method: Principal Component Analysis

Table 4.6: Rotated Component Matrix

	Component							Component							
	1	2	3	4	5	6	7		1	2	3	4	5	6	7
PE1. I find OER useful in my studies	0.785	-0.041	-0.019	0.076	0.320	0.091	0.198	HM1. Using OER is fun	0.400	0.065	0.131	0.056	0.244	-0.002	0.736
PE2. Using OER helps me accomplish learning activities	0.886	0.082	0.091	0.051	0.234	0.148	0.120	HM2. Using OER is enjoyable	0.016	0.165	0.372	0.174	0.099	0.078	0.820
PE3. Using OER increases my academic productivity	0.875	0.053	0.140	-0.036	0.234	0.142	0.018	HM3. Using OER is very entertaining	-0.011	0.208	0.268	0.124	0.022	0.103	0.865
EE1. Learning how to use OER is easy for me	0.072	0.160	-0.081	0.728	0.406	-0.010	0.196	PV1. EcoSchool OER is reasonably priced	0.177	-0.095	-0.098	0.089	0.049	0.905	0.039
EE2. OER navigation is clear and understandable	0.122	0.321	0.029	0.868	0.121	0.089	0.058	PV2. EcoSchool OER is good value for money	0.188	-0.087	-0.026	0.036	-0.005	0.958	0.015
EE3. I find OER easy to use	0.190	0.315	0.246	0.733	0.081	0.143	0.009	PV3. At the current price, EcoSchool provides good value	0.138	0.080	-0.113	0.034	-0.104	0.947	0.091
EE4. It is easy for me to become skilful at using OER	0.681	0.184	-0.031	0.335	-0.188	0.258	-0.058	HT1. The use of OER has become a habit for me	0.541	0.364	-0.029	0.537	0.038	0.028	0.319
SI1. People who are important to me think I should use OER	0.063	-0.128	0.850	0.176	0.156	-0.186	0.116	HT2. I am addicted to using OER	0.132	0.487	0.200	0.473	0.101	-0.145	0.366
SI2. People who influence my behaviour think I should use OER	0.139	0.111	0.848	0.176	0.250	-0.002	0.254	HT3. I must use OER	0.300	0.157	0.143	0.419	0.187	0.073	0.315
SI3. People whose opinions I value prefer that I use OER	0.015	0.345	0.850	-0.088	-0.054	-0.062	0.149	BI1. I intend to continue using OER in the future	0.205	0.110	0.194	0.285	0.830	0.025	0.172

Table 4.6 Continued															
	Component							Component							
	1	2	3	4	5	6	7		1	2	3	4	5	6	7
SI4. Use of OER by lecturers influences me to use OER	0.002	0.196	0.865	-0.022	0.071	-0.045	0.192	BI2. I will always try to use OER in my learning activities	0.150	0.161	0.122	0.116	0.924	-0.010	0.089
FC1. I have the resources necessary to use OER	0.670	0.451	0.058	0.265	-0.032	0.111	0.053	BI3. I plan to continue using OER frequently	0.138	0.184	0.058	0.088	0.880	-0.079	0.041
FC2. I have the necessary knowledge to use OER	0.636	0.577	-0.021	0.264	-0.031	0.082	-0.013	U1. I have been using OER	0.072	0.639	0.111	0.413	0.464	-0.016	0.116
FC3. OER are compatible with other learning materials I use	0.225	0.773	0.124	0.056	0.104	-0.088	0.168	U2. I use OER frequently	0.105	0.762	0.068	0.411	0.329	-0.008	0.075
FC4. There are knowledgeable people to assist with OER	0.047	0.668	0.401	0.202	-0.064	-0.011	0.253	U3. I use a variety of OER	0.106	0.798	0.090	0.275	0.236	-0.019	0.055
Extraction Method: Principal Component Analysis															
Rotation Method: Varimax with Kaiser Normalization															
a. Rotation converged in seven iterations															

b) Chi-square test for significance of Hypotheses H11 and H12

The chi-square test was used to test H11: *There is no significant use of EcoSchool OER resources among Africa University students* and H12: *There is significant use of other forms of OER among Africa University students* for significance at 95% confidence level. Hypotheses H11 and H12 responded to the third research question RQ3: What is the prevailing OER usage pattern among Africa University students? The chi-square test is an inferential statistics technique used to test the significance of statistical difference between the two alternatives. The formula used is:

$$\chi^2 = \sum \frac{(f_e - f_o)^2}{f_e} \quad \begin{array}{l} f_e = \text{expected frequencies} \\ f_o = \text{observed frequencies} \end{array}$$

A Microsoft Excel spreadsheet was used to calculate the test statistics for the two hypotheses by specifying the range of expected frequency and observed frequency to the built-in chi-square test function in Excel. The test statistic was calculated instantly. Details of chi-square test are presented in Section 6.3.

4.7.2 Qualitative data analysis

In line with the critical realist perspective that informs the adopted mixed methods research design, the qualitative data analysis served two purposes:

- 1) To provide an alternative deeper explanation of the UTAUT2 variables (Danermark, 2002; McEvoy & Richards, 2006).
- 2) To confirm the research findings and address trustworthiness (McEvoy & Richards, 2006; Venkatesh et al., 2013).

This approach of supplementing quantitative data with qualitative data worked well, but there was a risk of information overload. It took a lot of effort to streamline the information to maintain relevance. The process of qualitative data analysis involved examining plausible rival explanations that arose from the literature review and the qualitative data. The data analysed included the interviews, archival records, and the documentation described in detail in Section 4.8.2. Pattern matching logic is a conventional technique used in case study research. It compares an empirically based pattern (one based on your data collection) with one based on the theoretical proposition. Using pattern making logic, I compared the UTAUT2 propositions

with the patterns that emerged from actual data collected in the field. In the process, I identified the relationships of the dependent (Behavioural Intention and actual Use) and independent variables (Performance Expectancy, Effort Expectancy, Facilitating Conditions, Social Influence, Habit, Hedonic Motivation, and Price Value). I also used explanation building to explain how and why something happened. It started as a narrative of the cause and relationship effect and moved gradually from imprecise statements to reflect more theoretically significant propositions based on the UTAUT2 model. Explanation building was an interactive process consisting of the initial explanatory proposition, comparison of findings and revising the initial proposition.

4.7.3 Mixed data analysis

In mixed data analysis the ultimate step of data analysis is data integration. I mainly did this using IBM SPSS and AMOS graphics software. According to Tashakkori and Teddlie (2015):

Integration can be said to occur to the extent that different data elements are combined throughout a study in such a way as to become interdependent in reaching a common theoretical or research goal, thereby producing findings that are greater than the sum of such parts (p.220).

Effective data coding and capturing into the SPSS and AMOS graphics software helped to produce mixed methods visual displays through data visualisation tools and techniques. Data visualisation is the mapping of data into Cartesian space, integrating a person's creativity and expertise into the knowledge discovery process, thus allowing a symbiosis of conceptual power with visual potential (Tashakkori & Teddlie, 2015). In the mixed data analysis, I used experience and knowledge to produce visuals that portray both the meaning and context required to respond to the composite research questions.

Section 6.5 complements this section through sequencing the mixed data analysis processes that led to the development of integrated visuals.

4.8 Reliability and trustworthiness

Reliability validates the data collection procedures to confirm if they can be repeated and still yield the same results. To address reliability, my approach was to minimise errors and biases in the study (Yin, 2014). I used documentation and audit trails to allow independent execution

of the research process by someone else. I created a database in the SAKAI learning management system with folders to store all the tools and feedback at every important stage of the research. Yin (2014) recommended a case study protocol or case study database. I used a case study database in this research because it was readily available in the learning management system SAKAI.

Trustworthiness protocols were used to validate the qualitative data to ensure its credibility (Guba, 1981; Yin, 2014). As measures of trustworthiness, stratified purposive convenience sampling was used so that the right research sites and participants were selected. This ensured that the participants were able to elaborately respond to the interview questions. The data collected was from the case study environment, the Africa University campus, to capture the reality. I collected data using multiple data collection tools, including interviews, observations and analysis of documentation. Using multiple data sources fosters trustworthiness because it allows methodical triangulation of the data.

4.8.1 Reliability of measures

The test used to test reliability is the Cronbach's alpha internal consistency reliability test. It averages all possible halves, can be used for dichotomous and continuous scaled variables and uses the coefficient alpha. Cronbach's alpha is an estimate of internal reliability, an indicator of consistency, not a measure of homogeneity, a measure ranging from 0.00 to 1.0, and it can be negative. A value close to 0 means no consistency, a value of 1 means perfect consistency, and a value of 0.7 or greater means the questionnaire item scores are reliable. This corresponds to an error rate of 30% or less. In Table 4.7, the minimum Cronbach's alpha value is 0.793, which is the internal reliability measure for the Habit constructs. I can therefore note the maximum reliability error rate of 20.7% against a precedence of 30% from previous research that have used the UTAUT2 model. This shows a high level of reliability in this study.

Table 4.7: Cronbach's alpha reliability measures

Research Construct	Survey Questionnaire Items	Cronbach's Alpha Reliability Statistics
Performance Expectancy	PE1. I find OER useful in my studies PE2. Using OER helps me accomplish learning activities PE3. Using OER increases my academic productivity	0.921
Effort Expectancy	EE1. Learning how to use OER is easy for me EE2. OER navigation is clear and understandable EE3. I find OER easy to use EE4. It is easy for me to become skilful at using OER	0.823
Social Influence	SI1. People who are important to me think I should use OER SI2. People who influence my behaviour think I should use OER SI3. People whose opinions I value prefer that I use OER SI4. Use of OER by lecturers influences me to use OER	0.921
Facilitating Conditions	FC1. I have the resources necessary to use OER FC2. I have the knowledge necessary to use OER FC3. OER are compatible with other learning materials I use FC4. There are knowledgeable people to assist with OER	0.830
Hedonic Motivation	HM1. Using OER is fun HM2. Using OER is enjoyable HM3. Using OER is very entertaining	0.879
Price Value	PV1. EcoSchool OER is reasonably priced PV2. EcoSchool OER is good value for money PV3. At the current price, EcoSchool provides good value	0.959
Habit	HT1. The use of OER has become a habit for me HT2. I am addicted to using OER HT3. I must use OER	0.793
Behavioural Intention	BI1. I intend to continue using OER in the future BI2. I will always try to use OER in my learning activities BI3. I plan to continue using OER frequently	0.946
Use	U1. I have been using OER U2. I use OER frequently U3. I use a variety of OER	0.960
Combined 7 Constructs	Combined 30 items	0.928

Table 4.8: Item-total statistics

	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted		Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
PE1. I find OER useful in my studies	160.37	559.936	0.521	0.926	HM1. Using OER is fun	161.17	549.854	0.571	0.925
PE2. Using OER helps me accomplish learning activities	160.38	559.375	0.612	0.925	HM2. Using OER is enjoyable	160.73	558.944	0.564	0.925
PE3. Using OER increases my academic productivity	160.30	562.856	0.523	0.926	HM3. Using OER is very entertaining	160.79	560.778	0.513	0.926
EE1. Learning how to use OER is easy for me	160.84	554.528	0.565	0.925	PV1. EcoSchool OER is reasonably priced	162.41	575.147	0.224	0.930
EE2. OER navigation is clear and understandable	160.81	548.840	0.643	0.924	PV2. EcoSchool OER is good value for money	162.08	574.809	0.209	0.931
EE3. I find OER easy to use	160.46	559.881	0.660	0.925	PV3. At the current price, EcoSchool provides good value	161.98	571.899	0.225	0.931
EE4. It is easy for me to become skilful at using OER	160.41	567.083	0.470	0.926	HT1. The use of OER has become a habit for me	161.42	533.263	0.749	0.922
SI1. People who are important to me think I should use OER	160.71	573.625	0.311	0.928	HT2. I am addicted to using OER	161.62	537.335	0.657	0.924
SI2. People who influence my behaviour think I should use OER	160.65	557.221	0.589	0.925	HT3. I must use OER	160.84	558.734	0.580	0.925
SI3. People whose opinions I value prefer that I use OER	160.52	572.153	0.377	0.927	BI1. I intend to continue using OER in the future	160.59	556.118	0.632	0.925
SI4. Use of OER by lecturers influences me to use OER	160.42	570.912	0.395	0.927	BI2. I will always try to use OER in my learning activities	160.55	563.479	0.527	0.926

Table 4.8 Continued									
	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted		Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
FC1. I have the resources necessary to use OER	160.88	548.241	0.658	0.924	BI3. I plan to continue using OER frequently	160.54	567.604	0.450	0.927
FC2. I have the necessary knowledge to use OER	160.84	550.732	0.644	0.924	U1. I have been using OER	161.18	531.215	0.713	0.923
FC3. OER are compatible with other learning materials I use	160.56	564.356	0.578	0.925	U2. I use OER frequently	161.13	535.015	0.717	0.923
FC4. There are knowledgeable people to assist with OER	160.74	548.107	0.572	0.925	U3. I use a variety of OER	160.93	543.266	0.634	0.924

The combined reliability for all the items is 0.928 (Table 4.3). Table 4.8 shows possibilities of improving this reliability by testing the deletion of each item and re-measuring the reliability. It can be noted from Table 4.4 that if we delete PV1: 'EcoSchool OER is reasonably priced', the reliability increases from 0.928 to 0.930. If we delete PV2: 'EcoSchool OER is good value for money' and PV3: 'At the current price, EcoSchool provides good value', the reliability increases from 0.928 to 0.931. This confirms that Price Value is not a reliable measure of OER adoption at Africa University.

4.9 Validity

Construct validity is concerned with the identification of correct operational measures for the concepts being investigated. Critics of case study research contend that often no sufficient operational measures are identified (Yin, 2014). The measures in this research were derived from the seven constructs of the UTAUT2, namely Effort Expectancy, Facilitating Conditions, Performance Expectancy, Social Influence, Hedonic Motivation, Price Value and Habit. These measures have been used in OER adoption research studies in sub-Saharan Africa before (Mtebe & Raisamo, 2014). Construct validity is often compromised in case study research because of the tendency to confirm preconceived ideas, and for this reason, researchers are discouraged from starting these studies before identifying a clear theoretical framework (Yin, 2014). UTAUT2 was identified as the theory for guiding this study and Chapter 3 is dedicated to the theoretical framework underpinning this research. Construct validity is, therefore, adequately considered, addressed and mitigated in this study.

External validity identifies the domain to which the research findings can be mapped, including the scope of generalisation. The study focuses on analytic generations that shed light on the strength of UTAUT2's theoretical propositions, and this raises external validity issues. Data collection in this study was limited to Africa University and this may raise external validity issues when applying and generalising the findings of this research to other universities. The selection of an appropriate sampling procedure was used to mitigate the impact of external validity. I used a fairly large sample size of 375 participants (370 quantitative + 5 qualitative) against the acceptable minimum sample size of 51 participants (Onwuegbuzie, Jiao & Bostick, 2014; Tashakkori & Teddlie, 2015). The large sample size allows room for some statistical generalisations. Because of the significantly large sample size, the findings of this research could be extended to other universities in Zimbabwe.

Internal validity was not a concern in this study as it applies to quasi-experiments. It is concerned with validating cause and effect relationships of variables and applies to explanatory studies.

The adopted critical realist perspective has a strong influence on how validity issues were handled in this research. Validity issues were split into quantitative and qualitative research components because the adopted mixed methods research detailed in the following section entailed the use of both approaches. The validity of the quantitative research component was addressed, as summarised in Table 4.9.

- a) Design validity is categorised into internal and external validity. The critical realist interpretation of internal validity is “actual events are manifestations of the particular generative mechanism in the context of the field” (Zachariadis et al., 2013, p. 6). The UTAUT2 was identified and justified as the generative mechanism of adoption and use of OER by students at Africa University. The meaning of external validity from the adopted critical realist perspective is “the likelihood that similar or related events that occur (or might occur) in other settings are caused by the generative mechanism that caused the actual events in the field” (Zachariadis et al., 2013, p. 6). The use of a fairly large sample of 375 students was used to provide external validity. Administrative, time and budget constraints restricted the study to only Africa University.
- b) Measurement validity is split into reliability and construct validity. Reliability, in the adopted critical realist perspective, means “the measurements used in the extensive methods do not have measurement error” (Zachariadis et al., 2013, p. 6). Cronbach’s alpha internal consistency reliability test was used and the minimum Cronbach’s alpha value was 0.793. This shows high level of reliability in this study.
- c) Inferential validity refers to statistical conclusion validity. In the adopted critical realist perspective this means “findings from statistics can provide information about the relationships of events observed in the empirical domain (not causal assumptions)” (Zachariadis et al., 2013, p. 6). Every conclusion provided is supported by a hypothesis tested at 95% significance level. A complementary qualitative research component was used to confirm statistical conclusions. SPSS was used to perform the statistical analysis of the research data.

The adopted critical realist philosophy was also applied to address the following three validity categories in qualitative research (Table 4.10).

- a) In qualitative research, design validity is split into descriptive validity, credibility and transferability. In the critical realist perspective, descriptive validity and credibility are merged and interpreted as “explanations of mechanisms in action and the conditions with which they are interacting; appreciation of the field by identifying, prioritizing, and scoping boundaries of the study” (Zachariadis et al., 2013, p. 6). This qualitative component of the research was introduced to confirm accuracy in the UTAUT2 and provide more explanations. Transferability is interpreted as “the idea that similar or related events that occur (or might occur) in other settings are caused by the generative mechanism that caused the actual events in the field” (Zachariadis et al., 2013, p. 6). A minimum acceptable sample size of five was used for the complementary qualitative research component. When minimum sample sizes are met, transferability of results in similar contexts is possible.
- b) Measurement validity is split into theoretical validity, consistency and plausibility. In critical realism, theoretical validity means “theory is used to help hypothesize about the mechanisms and provide explanations for the events that have occurred” (Zachariadis et al., 2013, p. 6). UTAUT2 is well known and created from a fusion of eight technology acceptance theories. Consistency is defined as “the ability to verify inquiry steps in retroductive analysis” (Zachariadis et al., 2013, p. 6). Document archives and a research database created in SAKAI, interview record sheets and participants are available. Plausibility in the adopted critical realist perspective refers to “whether data that are empirically available give valid knowledge about the actual manifestation of the alleged generative mechanism in the field” (Zachariadis et al., 2013, p. 6). The essence of the complementary research was to ensure plausibility of the research findings.

Inferential validity is split into interpretive validity and confirmability. The adopted critical realist perspective jointly addresses the two categories with a common interpretation as “findings from statistics can provide information about the relationships of events observed in the empirical domain (not causal assumptions)” (Zachariadis et al., 2013, p. 6). Analysis of documentation provided and archival records was conducted to verify participants’ views.

Table 4.9: Validity of the quantitative research component

Validity Type	Conventional Description	Critical Realism	Critical Realist Influence in this Research
Design Validity	Internal validity: The observed correlation between variables of interest in a causal effect.	Actual events are manifestations of the particular generative mechanism in the context of the field.	UTAUT2 was identified and justified as the generative mechanism of adoption and use of OER by students at Africa University.
	External validity: The cause–effect relationship goes beyond the variation of samples, settings, and treatment variables, thus results can be generalised.	The likelihood that similar or related events that occur (or might occur) in other settings are caused by the generative mechanism that caused the actual events in the field.	The fairly large sample of 375 students was used to provide external validity. Administrative, time and budget constraints restricted the study to Africa University.
Measurement Validity	Reliability: The variables used in the model do not have measurement error.	The measurements used in the extensive methods do not have measurement error.	Cronbach’s alpha internal consistency reliability test was used. The minimum Cronbach’s alpha value was 0.793. This shows a high level of reliability in the study.
	Construct validity: The variables indicate what they are intended to measure (consistent with the theoretical description).	Whether data that are empirically available give valid knowledge about the actual manifestation of the alleged generative mechanism in the field.	The UTAUT2 constructs EE, PE, FC, SI, HT, HM, PV and U have been tested in related information systems research and achieved acceptable error rates (Venkatesh et al., 2013; Mtebe & Raisamo, 2015).
Inferential Validity	Statistical conclusion validity: Statistics are appropriate and findings from the statistical analysis are adequate to construct a narrative.	Findings from statistics can provide information about the relationships of events observed in the empirical domain (not causal assumptions).	Every conclusion provided is supported by a hypothesis tested at 95% significance level. A complementary qualitative research component was used to confirm statistical conclusions. SPSS was used to perform statistical analysis of research data.

Source: An annotation of the original table in Zachariadis et al., 2013, p. 6

Table 4.10: Validity of the qualitative research component

Validity Type	Conventional Description	Critical Realism	Critical Realist Influence in this Research
Design Validity	Descriptive validity: Accuracy of events, objects, behaviours, and settings reported.	Explanations of mechanisms in action and the conditions with which they are interacting;	This qualitative component of the research was introduced to confirm accuracy in the UTAUT2 and provide more explanations.
	Credibility: Results from the participants of the research are believable.	appreciation of the field by identifying, prioritising, and scoping boundaries of the study.	
	Transferability: Results can be generalised and transferred to other settings.	The idea that similar or related events that occur (or might occur) in other settings are caused by the generative mechanism that caused the actual events in the field.	A minimum acceptable sample size of five was used for the complementary qualitative research component.
Measurement Validity	Theoretical validity: The theoretical explanation developed fits the data.	Theory is used to help hypothesize about the mechanisms and provide explanations for the events that have occurred.	UTAUT2 is well known and created from a fusion of eight technology acceptance theories.
	Consistency: Verifying the steps of the qualitative research process.	The ability to verify inquiry steps in retroductive analysis.	Document archives and research database created in SAKAI. Interview record sheets and participants are available.
	Plausibility: Findings of the study fit the data from which they are derived.	Whether data that are empirically available give valid knowledge about the actual manifestation of the alleged generative mechanism in the field.	The essence of the complementary research was to ensure plausibility of the research findings.
Inferential Validity	Interpretive validity: Interpretation of participants' views are accurate.	Findings from qualitative research can provide information about the mechanisms that cause the Confirmability events at the empirical level.	Analysis of provided documentation and archival records was conducted to verify participants' views. Interviews confirmed views by others.
	Confirmability events at the empirical level: The results are confirmed by others.		

Source: An annotation of the original table in Zachariadis et al., 2013, p. 6

4.10 Minimising bias and conducting research ethically

Minimising bias falls under the umbrella of research ethics. As this was a case study, I was apprehensive of the expectation to have a fair understanding and knowledge of the phenomena under investigation before embarking on the research. However, this knowledge is often the source of premeditated ideas, causing research bias (Yin, 2014). Objectivity was maintained to

avoid bias in this regard. Objectivity is something I have gained over time throughout my academic and working experience. Bias is also caused by a lack of tolerance to contrary evidence that may emerge from the research, and Yin (2014) recommends that this can be avoided by reporting findings at the data collection stage to friends and research colleagues because they are more likely to offer alternate interpretations and explanations. At the Witwatersrand School of Education, Wednesdays are set aside for researchers to make presentations to their colleagues and other guests. I used this platform to present field findings at the data collection stage to avoid bias.

Institutional review boards are the most commonly used steps for protecting human subjects in research (Yin, 2014). The research proposal was presented for review and was approved by Africa University's Research Ethics Committee (Appendix E p.216), and the University of Witwatersrand's Research Ethics Committee (Appendix F p.217). Three additional ethics compliance tools were employed (Appendix G p.218) as follows: (1) Research introductory note to give a brief introduction and justification of the research to the participants, (2) Participant consent form for learners participating in the research, and (3) Africa University staff consent form of members of the administration and academic staff participating in the research. Time and effort were devoted to reflect, evaluate and mitigate ethical concerns (Creswell, 2009). Protecting human subjects was always at the core of the research and research design process. The ethical measures that were taken included maintaining professional relationship and interactions with participants by interacting with them on the CHAT platform of the student learning management system and sending them relevant OER links for their courses. The pre-survey contact sessions were used to educate potential research participants about the OER research and make it clear that the survey was not compulsory and the participants were free to leave before or anytime during the survey. Only those who were willing to take part in the survey were free to accept the questionnaire, after which they were informed that they still had the option not to complete the survey. The protection of the participants' identities involved excluding personal identification information from the survey questionnaire and the data.

4.11 Summary

The research adopted a critical realist perspective using a mixed methods approach. The research population was drawn from registered students, academic and administrative staff of

the July 2017 – July 2018 academic year. Stratified probability sampling was applied to select 370 (85% response rate) participants for the quantitative component of the research.

Confirmatory factor analysis was used as the main quantitative data analysis technique. The data were subjected to tests for conformity for factor analysis procedures and all measures, notably sample size and internal reliability tests, were favourable. The quantitative data were collected using a modified UTAUT2 survey questionnaire. The questionnaire had been used in previous OER research and was reported to explain up to 70% of the total variation in the adoption and use of emerging technologies. In this research, the UTAUT2 questionnaire was able to explain only 25% of the total variation in the adoption and 47% total variation in the actual use behaviour of OER. This was the basis of a major gap identified in this research, leading to the recommendation of the modification of the original research model.

Purposive convenient sampling was used to choose five participants for the qualitative component of the research. The qualitative data were collected mainly using analysis of documents and was complemented and corroborated by the findings from the quantitative component of the research. Theoretical propositions and examining plausible rival explanations were employed as strategies to analyse and interpret data, while analysis techniques included pattern matching logic and explanation building.

Chapter 5: Presentation of Research Data

5.1 Introduction

In this chapter, the data collected from the field are presented and these will be discussed in detail in Chapter 6. The adopted UTAUT2 questionnaire was the main data collection instrument and was complemented by interviews and analysis of relevant documents. First, an analysis of demographic information is presented. This is followed by reliability analysis measures, data analysis method, a presentation of quantitative data collected in order to respond to the research questions and hypotheses, and the presentation of qualitative data from interviews and document analysis. Only SPSS output data tables directly relevant to the research questions and research problem statement under investigation are included in this chapter. The complete extracts are in Appendix H, for more detailed reference.

5.2 Demographic information

The research demographics consist of three variables:

- a) Participant gender, with a response rate of 208 males (56.2%) and 162 females (43.8%) (Table 5.1).
- b) Age group, with 201 respondents (54.3%) aged 16–26 years, 120 respondents (32.4%) aged 27–37 years, and 49 respondents (13.2%) aged 38+ years (Table 5.2).
- c) OER experience variable with 50 respondents (13.5%) confirmed to have no experience of using OER, and 320 respondents (86.5%) confirmed to have experience with OER use (Table 5.3).

These demographic variables were used as moderating variables in the UTAUT2 theoretical framework. Tests were conducted to confirm if hypotheses remain consistently true across all categories of these moderating variables. This helped to direct interventions more precisely to specific categories.

Table 5.1: Participant gender

		Frequency	%	Valid %	Cumulative %
Valid	Male	208	56.2	56.2	56.2
	Female	162	43.8	43.8	100.0
	Total	370	100.0	100.0	

Table 5.2: Age group

		Frequency	%	Valid %	Cumulative %
Valid	16–26	201	54.3	54.3	54.3
	27–37	120	32.4	32.4	86.8
	38+	49	13.2	13.2	100.0
	Total	370	100.0	100.0	

Table 5.3: OER experience

		Frequency	%	Valid %	Cumulative %
Valid	No I have not used OER	50	13.5	13.5	13.5
	Yes I have used OER	320	86.5	86.5	100.0
	Total	370	100.0	100.0	

Tables 21, 22 and 23 show each of the demographic variables by frequency (actual number of respondents), the response rate percentage, the percentage of valid responses and the cumulative percentage. These allows for easy comparison across all three of these important measures.

5.3 Method conformity and reliability measures

As outlined and described in Section 4.5, reliability and validity are essential to guarantee the quality of research. I addressed construct validity concerns by identifying the correct operational measures for the concepts being investigated. Reliability, which validates the data collection procedures to confirm if they can be repeated and still yield the same results, is addressed in Section 4.5.1.

5.4 Quantitative data presentation

This section covers the quantitative data presentation component of the research. Qualitative data are presented in Section 5.5. There are three research questions, which are all associated with a set of hypotheses. The outcome of the hypotheses tests provided a set of confirmed facts that significantly responded to each research question. The hypothesis testing was done using IBM SPSS AMOS graphics software, using the UTAUT2 research model presented in Figure 1. I simulated the research model in AMOS graphics and the outcome is portrayed in Figure 5.1. A set of results in the tables were used to generate test statistics to accept or reject each hypothesis as follows: Table 5.4: Regression weights: UTAUT2–Default model; Table 5.5:

Standardised regression weights: UTAUT2–Default model; Table 5.6: Intercepts: UTAUT2–Default model; and Table 5.7: Squared multiple correlations: UTAUT2–Default model. There are predefined limits for each test statistics that were used to determine whether to accept or reject each hypothesis. The regression weights (Table 5.4) provided probability values (P) that provided the basis for accepting or rejecting the cause and effect relationship (hypothesis) presented in the table. The decision rules were that the hypothesis is accepted if the probability value P is less than 0.05 and rejected if the value is greater than 0.05. Values represented by *** mean they are less than 0.000, and hence, very significant, since 0.000 is significantly less than 0.05.

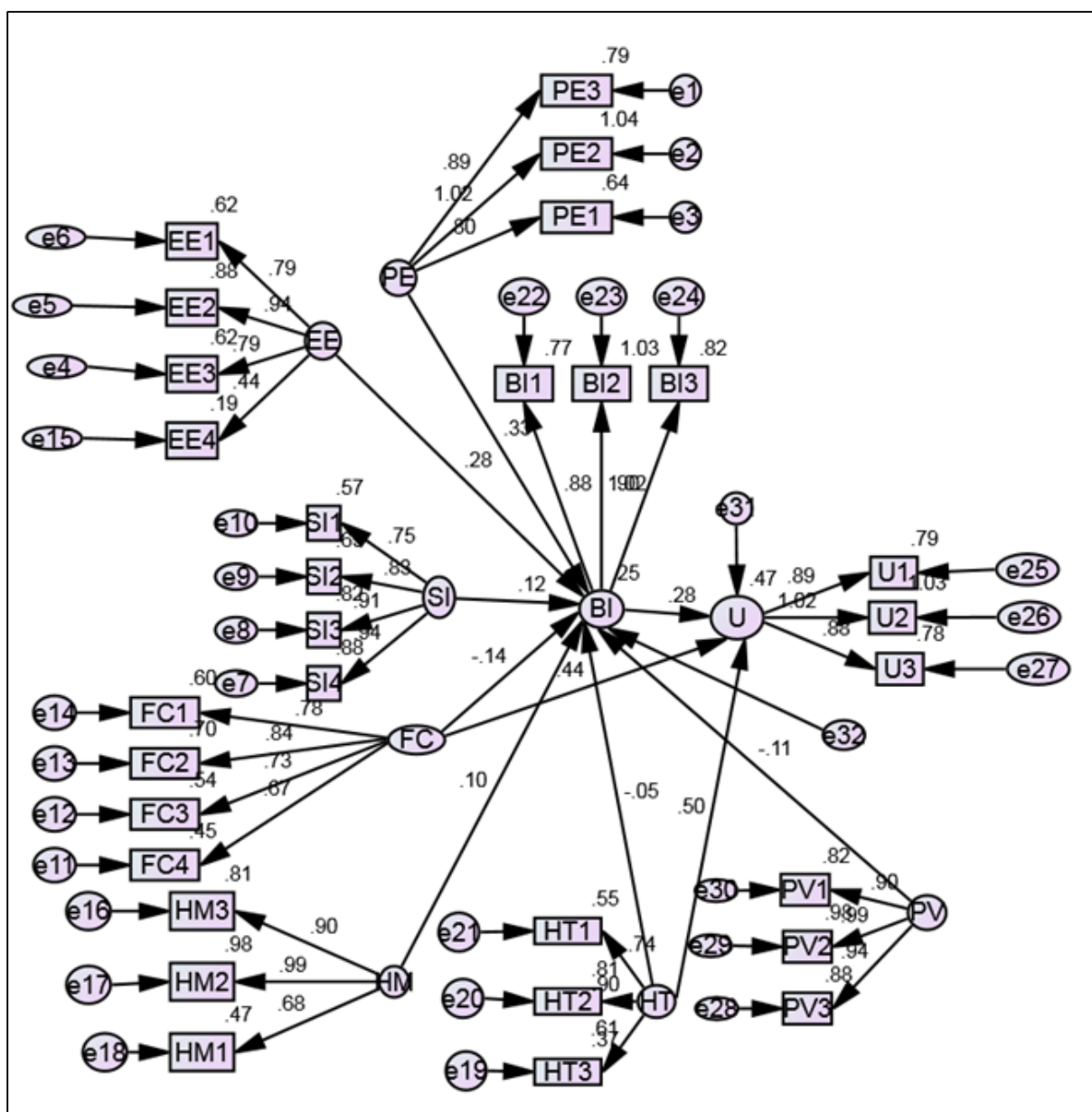


Figure 5.1: UTAUT2 simulation

Table 5.4: Regression weights: UTAUT2–Default model

			Estimate	S.E.	C.R.	P	Label				Estimate	S.E.	C.R.	p	Label
BI	←	PE	0.338	0.046	7.283	***	H1	FC4	←	FC	1.000				
BI	←	SI	0.123	0.046	2.710	.007	H2	FC3	←	FC	0.714	0.060	11.962	***	
BI	←	FC	-0.141	0.049	-2.872	.004	H3	FC2	←	FC	1.061	0.081	13.074	***	
BI	←	HM	0.097	0.042	2.344	.019	H4	FC1	←	FC	1.022	0.082	12.491	***	
BI	←	HT	-0.078	0.070	-1.123	.262	H5	EE4	←	EE	0.606	0.072	8.379	***	
BI	←	PV	-0.071	0.029	-2.428	.015	H6	HM3	←	HM	1.000				
BI	←	EE	0.367	0.063	5.816	***	H7	HM2	←	HM	1.059	0.040	26.209	***	
U	←	BI	0.352	0.052	6.831	***	H8	HM1	←	HM	0.904	0.056	16.174	***	
U	←	FC	0.565	0.067	8.419	***	H9	HT3	←	HT	1.000				
U	←	HT	0.931	0.107	8.692	***	H10	HT2	←	HT	2.109	0.187	11.305	***	
PE3	←	PE	1.000					HT1	←	HT	1.648	0.151	10.946	***	
PE2	←	PE	1.098	0.033	32.974	***		BI1	←	BI	1.000				
PE1	←	PE	0.985	0.046	21.545	***		BI2	←	BI	1.114	0.032	35.016	***	
EE3	←	EE	1.000					BI3	←	BI	0.991	0.036	27.293	***	
EE2	←	EE	1.599	0.087	18.365	***		U1	←	U	1.000				
EE1	←	EE	1.323	0.081	16.331	***		U2	←	U	1.030	0.028	36.442	***	
SI4	←	SI	1.000					U3	←	U	0.897	0.034	26.506	***	
SI3	←	SI	0.957	0.033	28.675	***		PV3	←	PV	1.000				
SI2	←	SI	0.964	0.041	23.499	***		PV2	←	PV	0.992	0.023	43.606	***	
SI1	←	SI	0.884	0.046	19.219	***		PV1	←	PV	0.846	0.027	31.484	***	

Table 5.5 has all the mathematically possible hypotheses, including some that do not make logical sense in real life. The first seven hypotheses are concerned with the UTAUT2 variables that impact Behavioural Intention, also referred to as adoption or acceptance factors. They are represented by the labels H1, H2, H3, H4, H5, H6 and H7. These evaluate RQ1: How do the UTAUT2 variables significantly influence Africa University students' mainstream adoption of OER in their learning process? Hypotheses H8, H9 and H10 are concerned with variables that impact actual Use behaviour. These evaluate RQ2: How do the UTAUT2 variables significantly influence actual OER use behaviour among Africa University students? The predictive power or regression weight and estimates of each variable are given in Table 5.5. These can be viewed as the prediction factor; for example, the 0.33 for H1 means for every 100 units of Performance Expectancy, Behavioural Intention increases by 33 units.

Table 5.5: Standardised regression estimates: UTAUT2–Default model

			Estimate	Label				Estimate	Label
BI	←	PE	0.330	H1	FC4	←	FC	0.669	
BI	←	SI	0.124	H2	FC3	←	FC	0.734	
BI	←	FC	-0.139	H3	FC2	←	FC	0.836	
BI	←	HM	0.105	H4	FC1	←	FC	0.777	
BI	←	HT	-0.053	H5	EE4	←	EE	0.440	
BI	←	PV	-0.108	H6	HM3	←	HM	0.902	
BI	←	EE	0.281	H7	HM2	←	HM	0.989	
U	←	BI	0.276	H8	HM1	←	HM	0.682	
U	←	FC	0.437	H9	HT3	←	HT	0.605	
U	←	HT	0.499	H10	HT2	←	HT	0.901	
PE3	←	PE	0.889		HT1	←	HT	0.739	
PE2	←	PE	1.019		BI1	←	BI	0.880	
PE1	←	PE	0.801		BI2	←	BI	1.017	
EE3	←	EE	0.789		BI3	←	BI	0.905	
EE2	←	EE	0.938		U1	←	U	0.889	
EE1	←	EE	0.786		U2	←	U	1.015	
SI4	←	SI	0.937		U3	←	U	0.885	
SI3	←	SI	0.907		PV3	←	PV	0.936	
SI2	←	SI	0.833		PV2	←	PV	0.991	
SI1	←	SI	0.755		PV1	←	PV	0.904	

Factor analysis is a form of structural equation modelling and, in this case, a linear equation with a constant (minimum value) were summed up with variables representing other correlated factors. The constant in linear algebra is commonly referred to as the intercept, which is the value when the variation curve crosses the axis, i.e. when the value of all other correlated variables is equal to zero. Table 5.6 is a compilation of intercepts, that is, the minimum value explained by each measurement item in the 'Estimate' column. The probability values in the 'P' column is the test for statistical significance of each minimum value explained (intercept). The value is significant if the P value is less than 0.05. In Table 5.6 all values less than 0.000 are represented by ***. It can be noted that all intercepts are statistically significant. This means that all constructs account for a meaningful variation. The lowest three intercepts are PV1 = 4.468, PV2 = 4.359 and PV 3 = 4.035; these items are measures of the Price Value construct. In Section 4.5.1, Price Value was identified as a weak measure, and it was explained that if it were excluded, the internal consistency reliability measure would increase. This is evidence of the effectiveness of the reliability of SPSS test statistics and analysis techniques applied in this research.

Table 5.6: Intercepts: UTAUT2–Default model

	Estimate	S.E.	C.R.	p	Label
PE3	6.143	0.064	96.318	***	
PE2	6.062	0.061	99.229	***	
PE1	6.070	0.070	87.033	***	
EE3	5.981	0.056	106.469	***	
EE2	5.630	0.076	74.469	***	
EE1	5.608	0.075	75.158	***	
SI4	6.019	0.062	97.261	***	
SI3	5.919	0.061	96.695	***	
SI2	5.797	0.067	86.322	***	
SI1	5.730	0.068	84.284	***	
FC4	5.705	0.085	66.836	***	
FC3	5.884	0.055	106.083	***	
FC2	5.605	0.072	77.383	***	
FC1	5.562	0.075	74.110	***	
EE4	6.032	0.061	98.739	***	
HM3	5.651	0.069	81.903	***	
HM2	5.711	0.067	85.715	***	
HM1	5.273	0.082	63.978	***	
HT3	5.600	0.065	85.712	***	
HT2	4.819	0.093	52.037	***	
HT1	5.027	0.088	57.006	***	
BI1	5.854	0.066	88.927	***	
BI2	5.897	0.063	92.883	***	
BI3	5.908	0.063	93.078	***	
U1	5.265	0.083	63.443	***	
U2	5.311	0.075	70.941	***	
U3	5.516	0.075	73.696	***	
PV3	4.468	0.095	47.220	***	
PV2	4.359	0.089	49.171	***	
PV1	4.035	0.083	48.668	***	

Squared multiple correlations (Table 5.7) are important test statistics that represent the total amount of variation in the model explained by the variable. For example, the estimate of PV1

= 0.817 meant that I was able to explain 81.7% of the variation. In other words, the variable PV1 could not account for only 19.3% of the variation. This value is referred to as the error rate. The 19.3% error rate is the value explained by error variables (e1, e2, e3) associated with the constructs in the simulated UTAUT2 model depicted in Figure 5.1.

Table 5.7: Squared multiple correlations: UTAUT2–Default model

	Estimate		Estimate
BI	0.248	HM1	0.465
U	0.468	HM2	0.978
PV1	0.817	HM3	0.813
PV2	0.983	EE4	<u>0.193</u>
PV3	0.876	FC1	0.604
U3	0.783	FC2	0.699
U2	1.031	FC3	0.539
U1	0.791	FC4	0.447
BI3	0.819	SI1	0.569
BI2	1.034	SI2	0.694
BI1	0.775	SI3	0.823
HT1	0.547	SI4	0.879
HT2	0.812	EE1	0.618
HT3	0.367	EE2	0.880
PE1	.641	EE3	0.623
PE2	1.038	PE3	0.790

5.5 Presentation of qualitative data

This research was a mixed methods research, and the main research component was quantitative and has been presented in the preceding sections. The complementary component consists of qualitative data and qualitative interpretations, confirming the outcomes of the quantitative measures. Documentation and interviews were the main sources of qualitative data. The qualitative data were collected through interviews, documentary and archival records analyses.

5.5.1 Data from documentation

The outcomes of the document analysis were not directly applied in the testing of hypotheses. The outcomes were useful in the formulation of explanations and recommendations. The diagram of integrated research findings (Figure 7.1) shows how the information extracted from document analysis was used. Institutional OER affirmative policies play an instrumental role in the effective adoption and use (Smith, 2013; UNESCO, 2012a & 2016b). Institutions like MIT that have successfully rolled out OER interventions with meaningful adoption and use acknowledge deliberate OER supportive policies as one of the critical success factors (MIT,

2013). Africa University relevant policy documents were therefore reviewed to confirm the presence or absence of OER affirmative policy, implicitly or explicitly expressed.

The qualitative data input documents were institutional ICT Policy, Quality Policy, E-learning Policy, Performance Target Forms, Performance Evaluation Forms, Network Resources Utilisation Reports, and dissertations/theses. A detailed analysis of the input documents is provided in Table 5.8. It should be noted that the Africa University ICT Policy addresses learning management systems, support services, security and privacy, data usage, computer laboratories and smart classrooms but has no specific OER references or attributes. The policy does not explicitly advocate or promote the use of OER. The Africa University Quality Policy regulates teaching, learning, evaluation, and recruitment and assessment standards, among other education quality concerns, but no specific OER references or attributes were identified, and the policy does not have specific provisions to advance the use of OER. The Africa University Distance Learning Policy has been bridging the distance by using e-learning, online classroom presence with instructional technologies, and the development of modules as key objectives; however, it does not outline specific OER adoption or use guidelines. The policy does not explicitly advocate or promote use of OER. The Africa University Educator Performance Target Form is a document designed to gather teaching, research, and outreach load and initiatives at the beginning of each academic year, but it has no specific provision or request for OER activities or initiatives. The document does not also explicitly advocate or promote the use of OER. The Africa University performance evaluation form serves as an input for systematic evaluation of teaching, research, and outreach load and initiatives performed by educators at the end of each academic year and, again, these evaluation parameters have no specific OER references or considerations. There is no mention of any specific OER initiative or OER related recognition and reward. The recognition and reward is subjective and universal, which may not be adequate to promote emerging technologies like OER. The Network Resources Utilisation Reports were also reviewed. These are part of a wider range of network utilisation reports that are used by management and support engineers to trouble shoot and optimise the network. I used these Network Resource Utilisation Reports to check for any traces of OER resources and excessive traffic to OER resources. The outcome of the analysis revealed excessive traffic to YouTube OER resources and no evidence of meaningful traffic to EcoSchool OER portal. Lastly, dissertations/theses reference lists were reviewed (sample size 10) to check for evidence of OER resources referenced during research, and all the dissertations/theses that were reviewed made reference to at least one OER resource and several

free online resources that are not necessarily OER. However, there was no single reference to EcoSchool OER that was identified and no single citation of EcoSchool OER.

Table 5.8: Analysis of documentation

Document Reference	Content	Issues Identified
<i>Africa University ICT Policy (June 2016)</i>	Learning management system, support services, security and privacy, data usage, computer laboratories, smart classrooms	No specific OER reference or attributes
<i>Africa University Quality Policy (December 2015)</i>	Teaching, learning, evaluation and assessment standards	No specific OER reference or attributes
<i>Africa University Distance Learning Policy (December 2016)</i>	Bridging the learning distance using e-learning, online classroom presence	No specific OER reference or attributes
<i>Africa University Educator Performance Target Forms (January 2017)</i>	Teaching, research, teaching load, outreach and personal initiatives	No specific OER reference or attributes
<i>Africa University Performance Evaluation Forms (January 2017)</i>	Teaching, research, teaching load, outreach and personal initiatives	No specific OER reference or attributes
<i>Network Resources Utilisation Reports (April 2017)</i>	Network resource utilisation data, and statistics of OER resources	Excessive traffic to OER resources, mainly YouTube
<i>Dissertations/Theses (July 2017)</i>	Complete reference list and citations of educational resources used in the research	The dissertations made reference to at least one OER resource and several free online resources that are not necessary OER. There was no single reference to EcoSchool OER

Analysis statistics and interpretations of the qualitative data are presented in Section 6.4.

5.8.2 Interviews

During the interviews, I took notes using the interview record sheet (Figure 5.2), and after every telephone interview, each participant also completed the interview record sheet and emailed it to me. I used the two interview record sheets for the data analysis. The details of the analysis and interpretation of interview data are presented in Section 6.4.2.

Please note: (1) The question **‘Comment on the importance of Open Educational Resources in accomplishing learning activities?’** serves to qualitatively confirm the hypothesis H1: PE→BI Performance Expectancy significantly influences Behavioural Intention. (2) The question **‘Do you consider Open Educational Resources navigation to be clear and understandable?’** serves to qualitatively affirm hypothesis H2: EE→BI Effort Expectancy significantly influences Behavioural Intention. This hypothesis was accepted by test statistics derived from quantitative data. (3) The question **‘Do you believe social peers influence students to use Open Educational Resources?’** serves to qualitatively confirm the hypothesis H3: SI→BI Social Influence significantly influences Behavioural Intention. (4) The question **‘Would you say having the necessary prior knowledge influences students to use Open Educational Resources?’** serves to qualitatively ascertain the hypothesis H4: FC→BI Facilitating Conditions significantly influence Behavioural Intention and H8: FC→U Facilitating Conditions significantly influence actual Use. (5) The question **‘Can it be said that students enjoy using Open Educational Resources? Please comment’** serves to qualitatively validate the hypothesis H5: HM→BI Hedonic Motivation significantly influences Behavioural Intention. The hypothesis was accepted by test statistics derived from quantitative data. (6) The question **‘Some say students are driven to use Open Educational Resources by a common habit. Can we say students are significantly driven by habit to use OER?’** serves to qualitatively validate the hypothesis H6: HT→BI Habit significantly influences Behavioural Intention and H9: HT→U Habit significantly influences actual Use. (7) The question **‘Marketing and advertising campaigns project Econet Wireless Zimbabwe EcoSchool Open Educational Resources initiative as good value for money to learners and educators. Please comment’** serves to qualitatively validate the hypothesis H7: PV→BI Price Value significantly influences Behavioural Intention and H11: There is no significant adoption and use of EcoSchool OER resources among Africa University students. (8) The question **‘Is it correct to assume that in general students plan to use Open Educational Resources e.g. YouTube videos frequently?’** serves to qualitatively validate the hypothesis

H10: BI→U Behavioural Intention significantly influences actual Use. (9) **The question ‘Students use Open Educational Resources Frequently. What is your opinion on that?’** serves to qualitatively validate if the students use Open Educational Resources Frequently as projected in Hypothesis H12: There is significant adoption and use of other forms of OER among Africa University students.

Open Educational Resources (OER) are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge. OER are offered for free through a public domain or under a license that permits their free use and customization by others.

Research Construct	Question
Performance Expectancy	Comment on the help of Open Educational Resources in accomplishing learning activities?
Effort Expectancy	Do you consider Open Educational Resources navigation to be clear and understandable?
Social Influence	Do you believe social peers influence students to use Open Educational Resources?
Facilitating Conditions	Would you say having the necessary prior knowledge influences students to use Open Educational Resources?
Hedonic Motivation	Can it be said that students enjoy using Open Educational Resources; please comment?
Price Value	Marketing and advertising campaigns project Econet Wireless Zimbabwe EcoSchool Open Education Resources initiative as good value for money to learners and educators. Please comment?
Habit	Some say students are driven to use Open Educational Resources by a common habit. Can we say students are significantly driven by habit to use OER?
Behavioural Intention	Is it correct to assume in general that students plan to use Open Educational Resources e.g. YouTube videos frequently?
Use	'Students use Open Educational Resources Frequently' what is your opinion on that?

Excellent and efficiency
 Very understandable and user friendly and easy to manage.
 YES
 YES
 Depends with one's passion but mostly they do because of social media everyone has access to a gadget like tablets, smart phones
 Yes because it is efficient and communication reaches to most people.
 Not really it is because the world is no a global village therefore anyone who is studying is bound to use technology
 IF resources permits YES
 It is a good move in terms of Technological advancement in this decade we are now living!

@Phaema 11/6/18

Figure 5.2: Interview response record sheet

Note: The interview response record sheet did not include a space for collecting personal identifiable information, however the respondents instinctively signed the documents on submission via email. From the signatures it is not possible for readers to positively identify the interview respondent. On the basis of the interpretation the researcher considered the incident sufficiently mitigated and took no further action.

5.6 Summary

This chapter gave a systematic presentation of data collected from the field and a description of data collection processes. Some preliminary data analyses were also performed at this initial stage. The outcomes of the hypotheses tests from quantitative data analysis differed from those obtained from the qualitative data and the mixed methods approach. The differences and explanations are detailed in Chapter 6, which deals with data analysis. It forms the basis of the answers to the research questions.

Chapter 6: Data Analysis

6.1 Introduction

After a systematic presentation of the research findings in Chapter 5, this chapter presents the systematic synthesis and analysis of these research findings. In addition, it interprets and conveys the research findings to give real life meaning to the research results. The relevant research findings identified during the literature review are invoked as the basis for real life comparison or corroboration of the analysis of outcomes. The chapter begins with an analysis and discussion of the quantitative data, followed by a discussion of the qualitative data and concludes with the mixed data analysis. This three-phased approach provided a systematic and effective explanation to the research questions and hypotheses. Although some practical recommendations become apparent in this chapter, they are not explored in detail, but they are presented and elaborated on in Chapter 7.

6.2 Analysis of the quantitative data

This section consists of detailed analyses of the quantitative data related to the research questions and hypotheses presented in Section 5.5. The outcome of the UTAUT2 confirmatory factor analysis is depicted in Figure 6.1. The confirmatory factor analysis could be described as a statistical technique used to verify the structure of a set of observed factors or variables (independent variables). It provided a set of functions to test hypotheses on the relationship between the following observed variables: Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Habit, Price Value, and two unobserved variables, Behavioural Intention and Use. Knowledge of the existing diffusion of the innovation theory UTAUT2 was used to postulate the relationship pattern of the research constructs and to derive correlations corresponding to the problem statement. The correlations between the research variables were then tested for statistical significance.

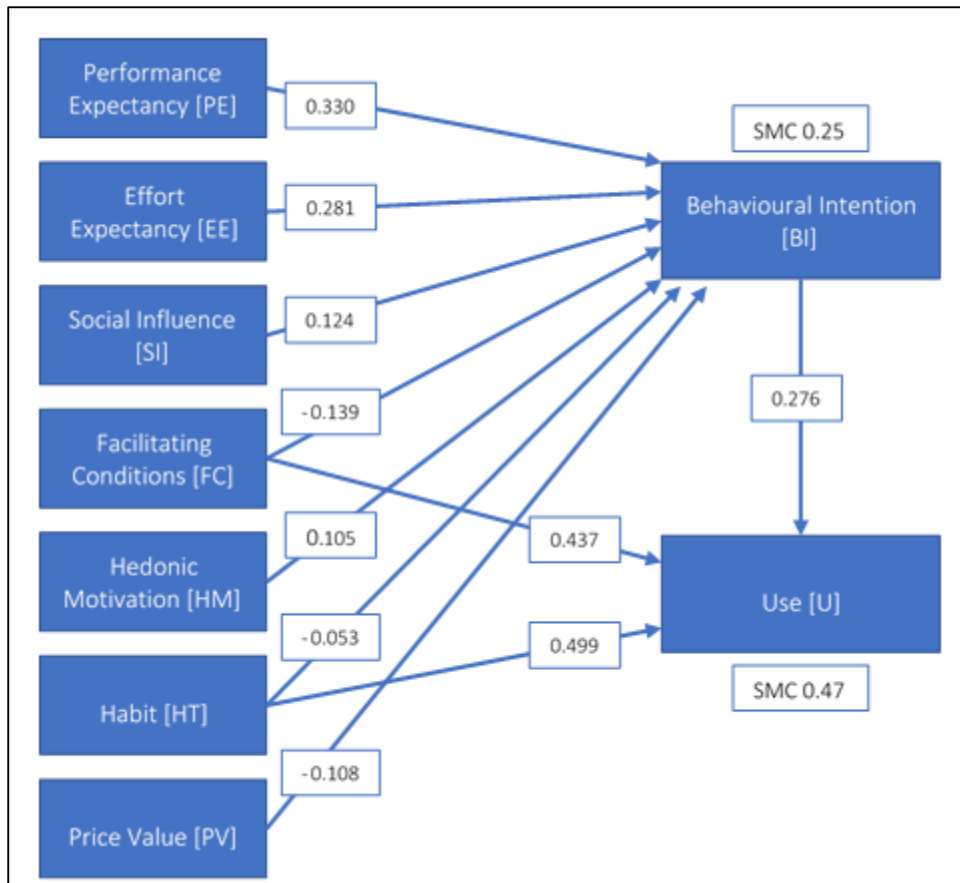


Figure 6.1: UTAUT2 confirmatory factor analysis

In Figure 6.1, the regression weights estimate for the Performance Expectancy construct is 0.330, meaning that for every 100 units of Performance Expectancy, Behavioural Intention increases by 33 units, i.e. a 33% positive impact. The same logic and interpretation is applicable to all regression weights estimates in this model. The impacts of different constructs on Behavioural Intention are as follows: Effort Expectancy 0.281 (28.1%); Social Influence 0.124 (12.4%); Hedonic Motivation 0.105 (10.5%); Facilitating Conditions -0.139 (-13.9%); Habit -0.053 (-5.3%); and Price Value -0.108 (-10.8%). On actual Use behaviour, Facilitating Conditions have an impact of 0.437 (43.7%) and Habit has an impact of 0.499 (4.99%). The negative values of Facilitating Conditions (-0.139; -13.9%), Habit (-0.053; 5.3%) and Price Value (-0.108; -10.8%) suggest that there are current issues with the Facilitating Conditions, Habit, and Price Value at Africa University that have a negative bearing on Behavioural Intention and Use of OER. Possible recommendations to address the problem will be detailed in Section 7.3. The total variation explained by Behavioural Intention (0.25; 25%) and Use (0.470; 47%) indicate that there is room for improvement of the UTAUT2 model variables to

increase the average variance explained. It was noted from the literature review that the average variance explained can be as high as 69%.

A summary of the analysis of the 12 hypotheses is presented in Table 6.1 and an analysis commentary for each hypothesis extracted from this bird's eye view perspective is discussed in the following sections.

6.2.1 H1: PE significantly influences BI (RQ1)

Performance Expectancy is the anticipated set of advantages that will accrue to task performance as a result of adopting technology. The hypothesis *PE→BI Performance Expectancy significantly influences Behavioural Intention* was accepted by the default unmoderated model and by all other categories of moderating variables, except the 38+ year age group. The senior learners at Africa University did not consider Performance Expectancy to be a significant influence on their Behavioural Intention to use OER. A possible explanation could be that senior students know what works and do not make judgements based on expected outcomes.

6.2.2 H2: EE significantly influences BI (RQ1)

Effort Expectancy is defined as the perceived amount of effort required to learn and be proficient in using a new technology. The hypothesis *EE→BI Effort Expectancy significantly influences Behavioural Intention* was rejected by the male age group aged 27–37 years and was accepted by all other categories and the unmodified default model. This group might have rejected it because at their age they may have gained enough university experience for self-teaching and learning.

H3: SI significantly influences BI (RQ1)

Social Influence is the perceived influence of the opinion of important peers for choosing to use or not to use the emerging technology. The hypothesis *SI→BI Social Influence significantly influences Behavioural Intention* was rejected by the 16–26-year and the 38+-year age groups and by the inexperienced group. It can be noted that age has a strong bearing on the perception of Social Influence at Africa University.

Table 6.1: Summary of hypothesis testing

	Default Model		Moderate by Age						Moderated by Gender				Moderated by Experience			
	Unmoderated		16–26 years		27–37 years		38+years		Male		Female		Experienced		Inexperienced	
	P	Decision	P	Decision	P	Decision	P	Decision	P	Decision	P	Decision	P	Decision	P	Decision
H1: PE→BI Performance Expectancy significantly influences Behavioural Intention (RQ1)	***	Supported	***	Supported	***	Supported	.247	Not Supported	***	Supported	***	Supported	***	Supported	***	Supported
H2: EE→BI Effort Expectancy significantly influences Behavioural Intention. (RQ1)	***	Supported	***	Supported	0.805	Not Supported	***	Supported	0.581	Not Supported	***	Supported	***	Supported	0.011	Supported
H3: SI→BI Social Influence significantly influences Behavioural Intention (RQ1)	0.007	Supported	0.071	Not Supported	0.003	Supported	0.871	Not Supported	0.003	Supported	0.007	Supported	0.036	Supported	0.159	Not Supported
H4: FC→BI Facilitating Conditions significantly influence Behavioural Intention (RQ1)	0.004	Supported	0.257	Not Supported	***	Supported	***	Supported	0.148	Not Supported	0.004	Supported	0.007	Supported	0.401	Not Supported
H5: HM→BI Hedonic Motivation significantly influences Behavioural Intention (RQ1)	0.019	Supported	0.004	Supported	0.077	Not Supported	0.081	Not Supported	0.010	Supported	0.019	Supported	0.059	Not Supported	0.591	Not Supported
H6: HT→BI Habit significantly influences Behavioural Intention (RQ1)	0.262	Not Supported	0.002	Supported	0.593	Not Supported	0.003	Supported	0.489	Not Supported	0.262	Not Supported	0.790	Not Supported	0.011	Supported

Table 6.1 Continued																
	P	Decision	P	Decision	P	Decision	P	Decision	P	Decision	P	Decision	P	Decision	P	Decision
H7: PV→BI Price Value significantly influences Behavioural Intention (RQ1)	0.015	Supported	0.022	Supported	0.940	Not Supported	***	Supported	0.027	Supported	0.015	Supported	0.111	Not Supported	0.093	Not Supported
H8: FC→U Facilitating Conditions significantly influence actual Use (RQ2)	***	Supported	***	Supported	***	Supported	0.358	Not Supported	***	Supported	***	Supported	***	Supported	***	Supported
H9: HT→U Hedonic Motivation significantly influences actual Use (RQ2)	***	Supported	***	Supported	***	Supported	0.008	Supported	***	Supported	***	Supported	***	Supported	0.011	Supported
H10: BI→U Behavioural Intention significantly influences actual Use (RQ2)	***	Supported	***	Supported	***	Supported	0.056	Not Supported	***	Supported	***	Supported	***	Supported	0.002	Supported
H11: There is no significant adoption and use of EcoSchool OER resources among Africa University students (RQ3)	***	Supported	***	Supported	***	Supported	***	Supported	***	Supported	***	Supported	***	Supported	***	Supported
H12: There is significant adoption and use of other forms of OER among Africa University students (RQ3)	***	Supported	***	Supported	***	Supported	***	Supported	***	Supported	***	Supported	***	Supported	***	Supported

6.2.3 H4: FC significantly influence BI (RQ1)

Facilitating Conditions allow for the extent of satisfaction with the conditions, support structures and facilities required to scaffold the adoption of the innovation. The hypothesis *FC→BI Facilitating Conditions significantly influence Behavioural Intention* was rejected by the inexperienced group and by both males and females aged 16–26 years. This profile suits most first year students, who have probably not experienced the available Facilitating Conditions. The final year students at Africa University are always complaining about how inadequate the data allocation is to download all the online resources they need. They have also complained to and petitioned the university administration to have the laboratory hours extended. All these are Facilitating Conditions issues that can influence the adoption and use of OER.

6.2.4 H5: HM significantly influences BI (RQ1)

Hedonic Motivation is the measure of satisfaction, joy and pleasure derived from using a particular set of technology or innovation. *HM→BI Hedonic Motivation significantly influences Behavioural Intention* was rejected by the 27–37 years and the 38+ years age group and also by both the experienced and inexperienced groups. This might be because they are experienced and feel that they do not use an educational resource because of the joy or pleasure derived from it (affect value), but as a result of the gap it closes in their requirements, i.e. the actual utility value.

6.2.5 H6: HT significantly influences BI (RQ1)

Habit is a measure of previous use or experience of the technology or innovation. This hypothesis has the highest number of rejections. *HT→BI Habit significantly influences Behavioural Intention* is the only hypothesis that was rejected by both males and females. Therefore, in the context of Africa University, Habit is not a significant determinant of Behavioural Intention. This measure may be applicable in other contexts, but in the context of this research it is not a well appreciated construct or variable. One can argue that it is not habit that drives the students to accept OER, but it is the actual benefit value of the OER.

6.2.6 H7: PV significantly influences BI (RQ1)

Price Value is a measure of the actual cost of using technology or innovations, and it is also a measure of what the user perceives to be the actual cost. The hypothesis $PV \rightarrow BI$ *Price Value significantly influences Behavioural Intention* was rejected by the 27–37-year age group and the experienced and inexperienced groups of respondents. This profile includes final year students and all early takers of post graduate studies. For this profile of respondents, I presumed that it was inconceivable that Price Value could stand in their way to acquire the needed resources. Most of them were working class postgraduate students on paid attachment, or just returning from paid attachment to conclude the final year of undergraduate study.

6.2.7 H8: BI significantly influences actual U (RQ2)

Behavioural Intention is defined as the acceptance that a set of technology is useful and looking forward to adopting and using it. It is, however, different from actual Use. The hypothesis $BI \rightarrow U$ *Behavioural Intention significantly influences actual Use* was rejected only by the 38+-year age group, and accepted by the default unmoderated model and all other categories of moderating variables. The 38+-year age group was the only one that rejected this hypothesis on the use of OER. This could be because the senior learners make instant decisions because of their experience and no longer consider cycles of evaluations as determinants of the utility of an educational resource.

6.2.8 H9: FC significantly influence actual U (RQ2)

Use refers to the actual practical utilisation of the technology set to achieve the expected or desired outcome. This research was concerned with both the act and pattern of utilisation. The hypothesis $FC \rightarrow U$ *Facilitating Conditions significantly influence actual Use* was rejected by the 38+-year age group only, but it was accepted by all the other age categories. This could be due to the assumption that the senior students only care for proven immediate benefits.

6.2.9 H10: HM significantly influences actual U (RQ2)

This hypothesis was universally accepted by all the categories and models tested in this study. It means the measure of previous use or experience with the technology or innovation can significantly influence adoption and use. This correlation must be used to increase the use of OER at Africa University.

6.2.10 Related research results

This section compares the findings from this research with findings from related studies. Percy and Belle (2012) conducted research on OER adoption by educators in Africa (Figure 6.2) and their study investigated the barriers and motivators to adopting and using OER among educators in selected universities in Africa using a customised UTAUT model. The sample consisted of academics from East, West and Southern Africa. The distribution of the sample was; West Africa (27%), East Africa (28%) and Southern Africa (41%). Data were collected using a survey questionnaire. The key findings indicated that Performance Expectancy and Effort Expectancy positively influenced educators' Behavioural Intention to use OER, and that the latter has a strong influence on the actual Use of OER. Facilitating Conditions had no significant positive impact on the adoption and use of OER among educators.

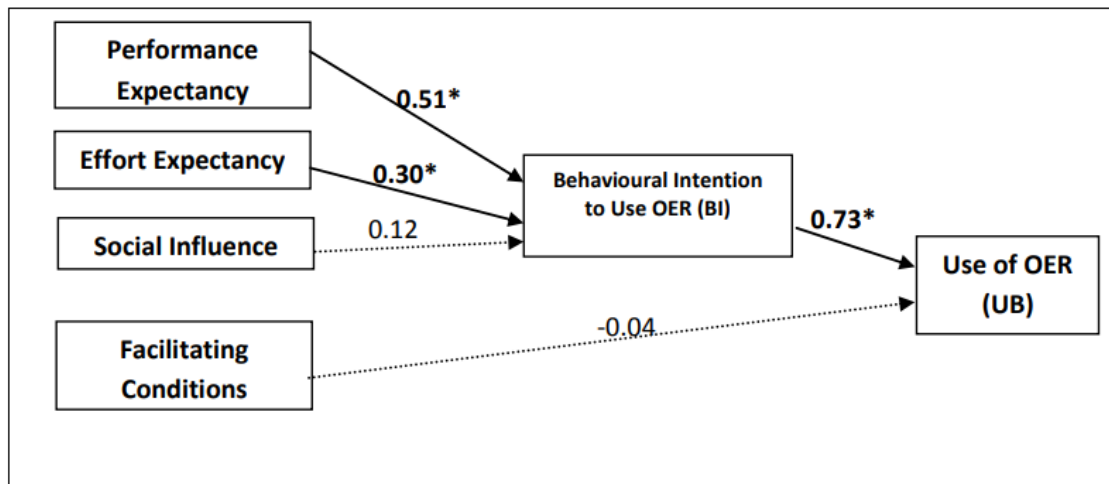


Figure 6.2 OER adoption by educators using UTAUT

Correlations between model constructs (* = significant at $p < 0.05$)

Source: Percy & Belle, 2012, p. 124

Mtebe and Raisamo (2014) conducted an OER study involving five universities in Tanzania (Table 6.2). The research used the UTAUT as the theoretical framework. The objectives of the study were to investigate the educators' intentions to adopt and use OER. A sample of 104 educators was selected from five higher education institutions in Tanzania using stratified random probability sampling. The findings revealed that Effort Expectancy had a significant positive influence on educators' intentions to use OER, while Performance Expectancy, Facilitating Conditions and Social Influence did not have a significant positive influence.

Table 6.2: OER adoption by educators using the UTAUT

Hypothesis	Results	Conclusion
Hypothesis 1: Performance expectancy has a positive effect on behavioural intention to adopt and use OER	Not significant (Beta = -0.187, $p < 0.069$)	Not supported
Hypothesis 2: Effort expectancy has a positive effect on behavioural intention to adopt and use OER	Yes significant (Beta = 0.250, $p < 0.005$)	Supported
Hypothesis 3: Social influence has a positive effect on behavioural intention to adopt and use OER	Not significant (Beta = -0.094, $p < 0.366$)	Not supported
Hypothesis 4: Facilitating conditions have a positive effect on behavioural intention to adopt and use OER	Not significant (Beta = -0.170, $p < 0.083$)	Not supported

Source: Mtebe & Raisamo, 2014, p. 259

A more recent study in India by Padhi (2018) focuses on educators' perceptions of OER adoption and the challenges associated with mainstream OER adoption (Table 6.3). The UTAUT was used as the theoretical model. A survey was used, and survey data were collected from 22 universities across India. The outcomes of this empirical research are as follows:

- a) Hypothesis 1, *Performance Expectancy has a positive impact on the intention to use OER*, was supported. The interpretation was that educators were convinced that using OER would improve their teaching and results.
- b) Hypothesis 2, *Effort Expectancy has a positive impact on the intention to use OER*, was supported. This confirms that the educators believed that OER were easy to learn, i.e. interactions with OER were not complicated and OER were easy to use and integrate into the teaching process.
- c) Hypothesis 3, *Social Influence has a positive impact on the intention to use OER*, was not supported.
- d) Hypothesis 4, *Facilitating Conditions have a positive impact on the intention to use OER*, was not supported. This means that the educators in India felt that their conditions to use OER were sufficient and did not hinder the intention to adopt and use OER.

Table 6.3: OER adoption by educators using the UTAUT

Hypothesis	Regression result	Confirmation
H1: Performance Expectancy significantly influences OER adoption	Highly significant (Beta = 0.342, $p < 0.001$)	Yes
H2: Effort Expectancy significantly influences OER adoption	Highly significant (Beta = 0.434, $p < 0.001$)	Yes
H3: Social Influence significantly influences OER adoption	Not significant (Beta = 0.042, $p < 0.423$)	No
H4: Facilitating Conditions significantly influence OER adoption	Not significant (Beta = -0.047, $p < 0.521$)	No

Source: Padhi, 2018, p. 63

Table 6.4 is a comparison of the analysis of the current research and the research by Percy and Belle (2012), Mtebe and Raisamo (2014) and Padhi (2018). Hypotheses H1: *Performance Expectancy significantly influences Behavioural Intention* and H2: *Effort Expectancy significantly influences Behavioural Intention* are supported by the current research and by Percy and Belle (2014) and Padhi's (2018) researches as well. Only Mtebe and Raisamo's (2014) research does not support the H1 hypothesis. There could be special circumstances in Tanzania that can explain this deviation. Hypotheses H3: *Social Influence significantly influences Behavioural Intention* and H4: *Facilitating Conditions significantly influence Behavioural Intention* are only support by the current research and not supported by Percy Belle (2012), Mtebe and Raisamo (2014) and Padhi's (2018) studies. At this stage in the current research, the analysis has only involved quantitative data, and the impact of moderating variables such as age, gender and experience have not been considered. Further analysis in the coming sections will include the influence of the moderating results and the accuracy of the results from the current research should improve.

From the foregoing comparison, the conclusion arrived at is that Performance Expectancy and Effort Expectancy are confirmed to have a significant positive influence on the adoption and use of OER. Social Influence and Facilitating Conditions have no significant influence on the adoption and use of OER. The real life meaning is that educators/learners are convinced they

can get improved teaching/learning outcomes if they accept and use OER in their teaching/learning process (H1 interpretation). They are also convinced that OER are not complex and they can easily navigate through them and learn with minimum effort (H2 interpretation). The opinion of peers or knowledgeable others is not an important consideration when an educator/learner makes a decision to accept and use OER (H3 interpretation). The prevailing enabling environment (facilities, policies etc.) is not a significant deterrent in the decision of educators/learners to accept and use OER (H4 Interpretation).

Table 6.4: Comparison of OER adoption research

OER Adoption Hypotheses	Current Study		Percy & Belle (2012)		Mtebe & Raisamo (2014)		Padhi (2018)	
	P	Decision	P	Decision	P	Decision	P	Decision
H1: PE→BI Performance Expectancy significantly influences Behavioural Intention (RQ1)	***	Supported	***	Supported	0.187	Not Supported	***	Supported
H2: EE→BI Effort Expectancy significantly influences Behavioural Intention (RQ1)	***	Supported	***	Supported	***	Supported	***	Supported
H3: SI→BI Social Influence significantly influences Behavioural Intention (RQ1)	0.007	Supported	0.120	Not Supported	0.094	Not Supported	0.042	Not Supported
H4: FC→BI Facilitating Conditions significantly influence Behavioural Intention (RQ1)	0.004	Supported	0.040	Supported	0.170	Not Supported	0.047	Not Supported
H5: HM→BI Hedonic Motivation significantly influences Behavioural Intention (RQ1)	0.019	Supported	Gap	Gap	Gap	Gap	Gap	Gap
H6: HT→BI Habit significantly influences Behavioural Intention. (RQ1)	0.262	Not Supported	Gap	Gap	Gap	Gap	Gap	Gap
H7:PV→BI Price Value significantly influences Behavioural Intention (RQ1)	0.015	Supported	Gap	Gap	Gap	Gap	Gap	Gap
H8: FC→U Facilitating Conditions significantly influence actual Use (RQ2)	***	Supported	Gap	Gap	Gap	Gap	Gap	Gap
H9: HT→U Hedonic Motivation significantly influences actual Use (RQ2)	***	Supported	Gap	Gap	Gap	Gap	Gap	Gap
H10: BI→U Behavioural Intention significantly influences actual Use (RQ2)	***	Supported	Gap	Gap	Gap	Gap	Gap	Gap
H11: There is no significant adoption and use of EcoSchool OER resources among Africa University students (RQ3)	***	Supported	Gap	Gap	Gap	Gap	Gap	Gap
H12: There is significant adoption and use of other forms of OER among Africa University students (RQ3)	***	Supported	Gap	Gap	Gap	Gap	Gap	Gap

Correlations between model constructs (* = significant at $p < 0.05$)

As highlighted in Section 2.2, there is a lack of literature on the application of the UTAUT2 on the adoption and use of OER by students in higher education contexts. Consequently, there was no comparable data for Hypotheses: H5: *Hedonic Motivation significantly influences Behavioural Intention*, H6: *Habit significantly influences Behavioural Intention*, H7: *Price Value significantly influences Behavioural Intention*, H8: *Facilitating Conditions significantly influence actual Use*, H9: *Hedonic Motivation significantly influences actual Use*, H10: *Behavioural Intention significantly influences actual Use*, H11: *There is no significant adoption and use of EcoSchool OER resources among Africa University students*, and H12: *There is significant adoption and use of other forms of OER among Africa University students*.

6.2.11 H11: There is no significant use of EcoSchool OER resources (RQ3)

The chi-square test was used to validate if the null hypothesis H11 was supported or not supported at 95% significance level. The chi-square test statistic was computed using Excel by specifying the range of expected frequency and observed frequency to Excel's built-in chi-square test function. The critical value was 3.841, and H11 is supported if the test statistic 0.000(***) is less than 3.841. The result obtained using the chi-square test (Table 6.5) is that H11 is supported.

Table 6.5: Chi-square test for usage of EcoSchool OER

		Observed Frequency	Expected Frequency	Chi-Square Critical Value (df = 1)	Chi-Square Test Statistic
Valid	I don't use EcoSchool OER	321	276	CV = 3.841	4.91844E-11 = 0.000(***) = Very significant H11 is supported
	I sometimes use EcoSchool OER	49	6	If value of the test statistic is greater than 3.0, H11 is supported; if not, H11 is not supported	
	Total	370	382		

6.2.12 H12: There is significant use of other forms of OER (RQ3)

The chi-square test was used to validate if the null hypothesis H12 was supported or not supported at 95% significance level. The chi-square test statistic was computed using Excel by specifying the range of expected frequency and observed frequency to Excel's built-in chi-square test function. The critical value was 3.841, and H12 is supported if the test statistic 0.000(***) is less than 3.841. The result obtained using the chi-square test (Table 6.6) is that H12 is supported.

Table 6.6: Chi-square test for usage of the forms of OER

		Observed Frequency	Expected Frequency	Chi-Square Critical Value (df = 1)	Chi-Square Test Statistic
Valid	I sometimes use OER	49	6	CV = 3.841	2.29771E-70 = 0.000(***) = Very significant H12 is supported
	I use OER frequently	321	279	If value of the test statistic is greater than 3.0, H12 is supported; if not, H12 is not supported	
	Total	370	385		

6.2.13 RQ1: How UTAUT2 variables influence adoption of OER?

In response to this research question, it was established that Performance Expectancy significantly influences Behavioural Intention; Effort Expectancy significantly influences Behavioural Intention; Social Influence significantly influences Behavioural Intention; Facilitating Conditions significantly influence Behavioural Intention; Hedonic Motivation significantly influences Behavioural Intention; Habit does not significantly influence Behavioural Intention; and Price Value significantly influences Behavioural Intention. The proposition that Performance Expectancy significantly influences Behavioural Intention was accepted by the default unmoderated model and all other categories of moderating variables except the 38+ year age group. The senior learners at Africa University did not consider Performance Expectancy to be a significant influence on their Behavioural Intention to use OER. The postulation that Expectancy significantly influences Behavioural Intention was rejected by the male group aged 27–37 and was accepted by all other categories and the unmodified default model. It might be that at that stage they had had enough university experience of self-teaching and learning. The hypothesis that Social Influence significantly influences Behavioural Intention was rejected by the 16–26 year and the 38+ year age groups and the inexperienced group. The 16-2 age group constitutes the majority of Africa University student population hence; it has as a strong bearing on the perception of Social Influence at Africa University. The hypothesis that Facilitating Conditions significantly influence Behavioural Intention was rejected by the inexperienced group and both males and females aged 16–26. The correlation that Hedonic Motivation significantly influences Behavioural Intention was rejected by the 27–37 year and the 38+ year age groups, and the experienced and inexperienced groups. The deduction that Habit significantly influences Behavioural Intention was rejected by the default unmoderated model, the 27–37 year age group, the male and female group, and the experienced group. Lastly, the inference that Price Value significantly

influences Behavioural Intention was not accepted by the 27–37 year age group and the experienced and inexperienced groups of respondents.

6.2.14 RQ2: How UTAUT2 influence OER use behaviour?

This research question was concerned with the determinants of actual use behaviour and it was established with 95% confidence that Facilitating Conditions significantly influence actual Use; Hedonic Motivation significantly influences actual Use; and Behavioural Intention significantly influences actual Use. The supposition that Behavioural Intention significantly influences actual Use was repudiated only by the 38+ year age group and accepted by the default unmoderated model and all other categories of moderating variables. The supposition that Facilitating Conditions significantly influence actual Use was rejected by the 38+ year age group only, but confirmed by all the other categories. Lastly, the hypothesis that Hedonic Motivation significantly influences actual Use was universally accepted across all the categories and models.

6.2.15 RQ3: What is the prevailing OER usage pattern?

The research finding concluded with 95% confidence that there was no significant adoption and use of EcoSchool OER resources among Africa University students and that there was significant adoption and use of other forms of OER among Africa University students. The hypothesis that there is no significant adoption and use of Econet Wireless Zimbabwe's EcoSchool OER resources among Africa University students was universally accepted across all the categories and models tested for significance in this research. The hypothesis that there is significant adoption and use of other forms of OER among Africa University students was universally accepted across all the categories and models.

6.3 Analysis of qualitative data

This section presents the analysis of data collected from documentation and interviews. The process of data collection was presented in Sections 4.8.3 and 4.8.4. In this section, I linked the metrics derived from the qualitative data with the research questions and hypotheses. This validated the outcomes of the statistical analysis of the quantitative data and projected real life meaning onto the test statistics. This second phase of validating the hypotheses provided additional explanatory power and helped to inform recommendations in the next chapter.

6.3.1 Analysis of documentation and archival records

The results in this section were used to identify and aid expiation of the outcomes from the hypotheses tests. Important issues from the analysis are presented in Table 6.7.

Table 6.7: Issues identified

Document Reference	Research Construct Affected and Issues	Comment
<i>Africa University ICT Policy</i>	Facilitating Conditions (Limited laboratory access times, no explicit OER initiatives) Price Value (Data cap per student per month, Time restrictions)	Facilitating Conditions and Price Value require attention
<i>Africa University Quality Policy</i>	Facilitating Conditions (No explicit OER support)	Facilitating Conditions require attention
<i>Africa University Distance Learning Policy</i>	Facilitating Conditions (No explicit OER support)	Facilitating Conditions require attention
<i>Africa University Educator Performance Target Forms</i>	Facilitating Conditions (No explicit OER recognitions) Hedonic Motivation (No explicit OER recognitions) Habit (No explicit OER recognitions)	Facilitating Conditions, Hedonic Motivation and Habit require attention
<i>Africa University Performance Evaluation Forms</i>	Facilitating Conditions (No explicit OER recognitions, No OER training for educators) Hedonic Motivation (No explicit OER recognitions, No OER training for educators) Habit (No explicit OER recognitions, No OER training for educators)	Facilitating Conditions, Hedonic Motivation and Habit require attention
<i>Network Resources Utilisation Reports</i>	Use (No OER training for learners, Data cap limits, Time restrictions)	Use require attention
<i>Dissertations/Theses</i>	Use (No EcoSchool OER referenced)	Use require attention

The data obtained from the network utilisation reports is summarised as follows:

- Figure 6.3 shows the level of network utilisation per user category. The users are categorised into five groups namely: CyberStudents (all Africa University students), CyberStaff (all Africa University non-academic staff), CyberExecutive (the Vice Chancellor and members of the executive cabinet), CyberICT (all employees of the ICT department), and CyberAcademic (all academic staff members). The CyberStudents group is the largest consumer of network resources in terms of uploaded and downloaded data, and usage time.
- Figure 6.4 shows restricted applications and the levels of access. According to the explanation given by the network administrator, network resources that achieve a high level of utilisation are placed in the blocked or restricted list. The administrator then controls access of the resources by limiting access times and periods to limit

network congestion. It can be noted that the largest traffic comes from streaming of data on the YouTube website. According to the network administrator, EcoSchool OER resources site is a trusted site and enjoys unrestricted access. However, access to the EcoSchool OER website had not reached significant levels.

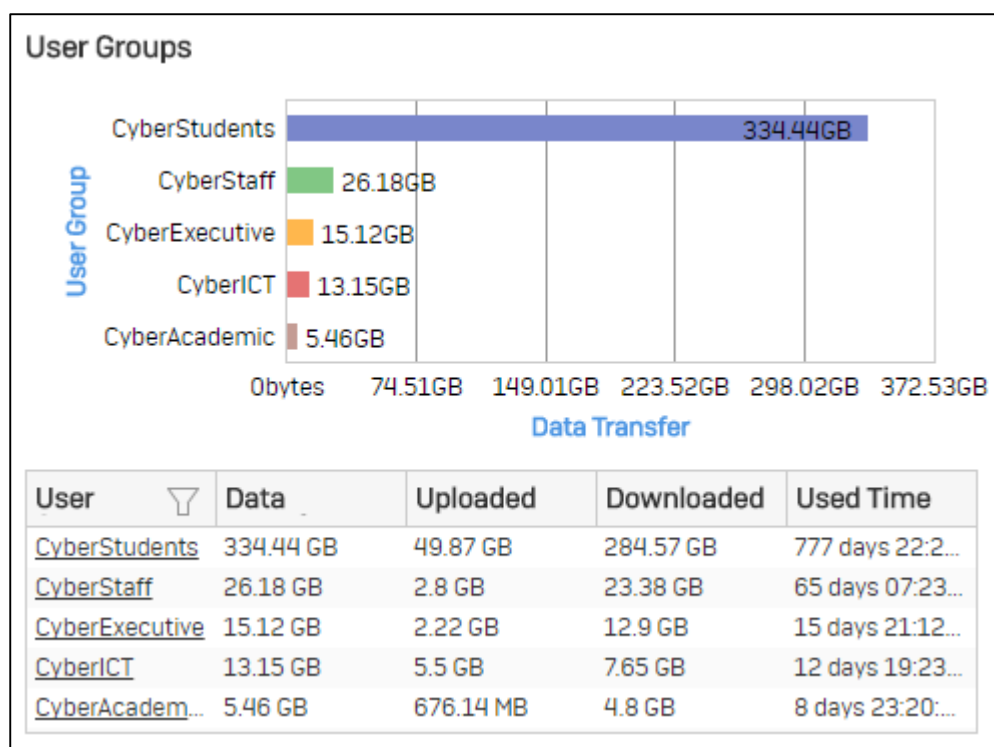


Figure 6.3: Network utilisation per user group

Source: Africa university network utilization report (April, 2017, p.4)

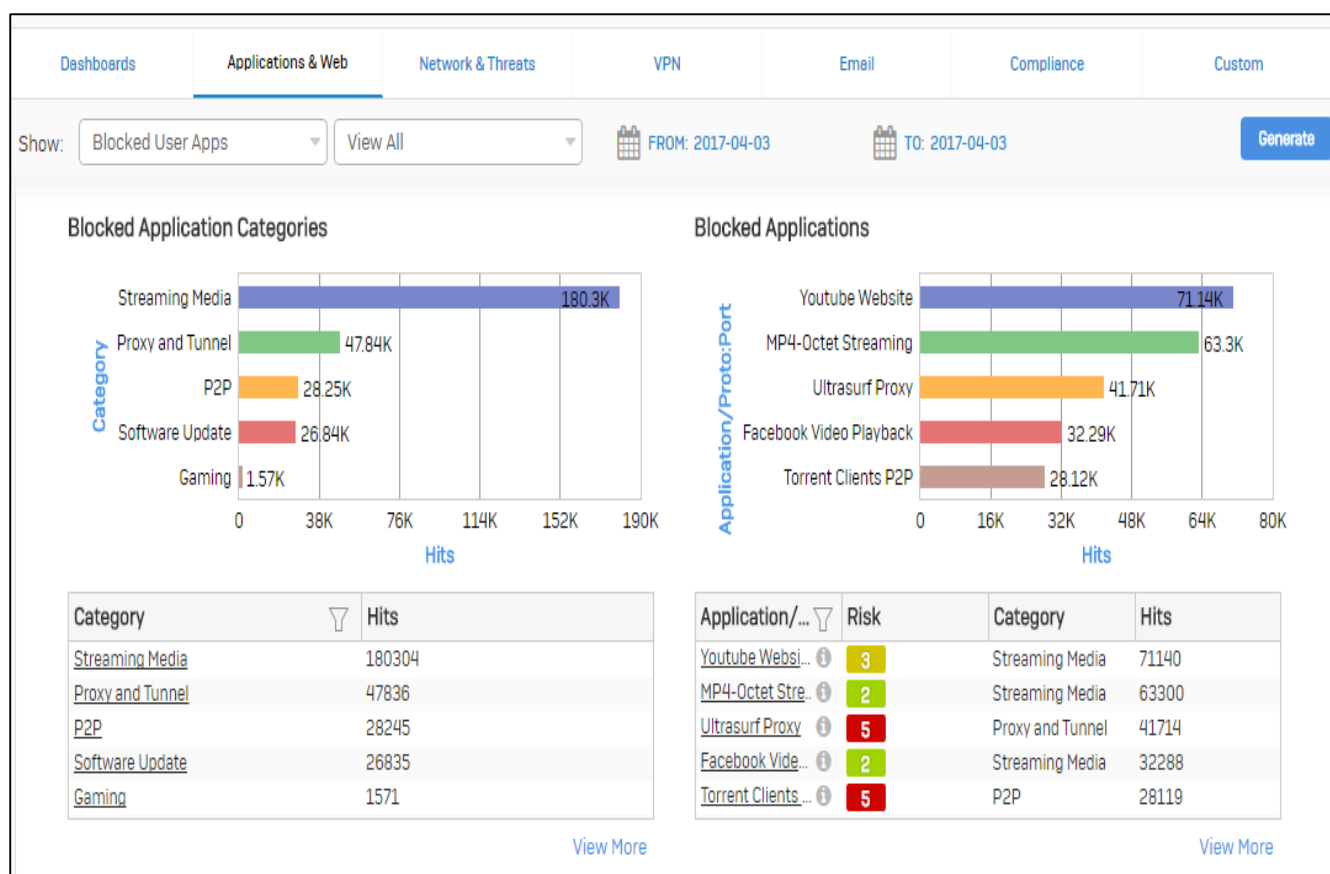


Figure 6.4: Restricted application report

Source: Africa university network utilization report (April, 2017, p.5)

6.3.2 Analysis of interview data

Table 6.8 summarises all the responses in the interviews. The interview questions relate to the hypotheses in the following ways:

- 1) The question *Comment on the importance of Open Educational Resources in accomplishing learning activities* serves to qualitatively confirm the hypothesis H1: PE→BI *Performance Expectancy significantly influences Behavioural Intention*. This hypothesis was accepted by test statistics derived from quantitative data.
- 2) The question *Do you consider Open Educational Resources navigation to be clear and understandable?* serves to qualitatively affirm the hypothesis H2: EE→BI *Effort Expectancy significantly influences Behavioural Intention*. This hypothesis was accepted by test statistics derived from quantitative data.
- 3) The question *Do you believe social peers influence students to use Open Educational Resources?* serves to qualitatively confirm the hypothesis H3: SI→BI *Social Influence significantly influences Behavioural Intention*. This hypothesis was accepted by test statistics derived from quantitative data.
- 4) The question *Would you say having the necessary prior knowledge influences students to use Open Educational Resources?* serves to qualitatively ascertain the hypothesis H4: FC→BI *Facilitating Conditions significantly influence Behavioural Intention* and H8: FC→U *Facilitating Conditions significantly influence actual Use*. The hypotheses were accepted by test statistics derived from quantitative data.
- 5) The question *Can it be said that students enjoy using Open Educational Resources? Please comment* serves to qualitatively validate the hypothesis H5: HM→BI *Hedonic Motivation significantly influences Behavioural Intention*. This hypothesis was accepted by test statistics derived from quantitative data.
- 6) The question *Some say students are driven to use Open Educational Resources by a common habit. Can we say students are significantly driven by habit to use OER?* serves to qualitatively validate the hypotheses H6: HT→BI *Habit significantly influences Behavioural Intention* and H9: HT→U *Habit significantly influences actual Use*. These hypotheses were rejected by test statistics derived from quantitative data.
- 7) The question *Marketing and advertising campaigns project the Econet Wireless Zimbabwe EcoSchool Open Education Resources initiative as good value for money to*

learners and educators. Please comment serves to qualitatively validate the hypotheses H7: PV→BI *Price Value significantly influences Behavioural Intention* and H11: *There is no significant adoption and use of EcoSchool OER resources among Africa University students*. These hypotheses were accepted by test statistics derived from quantitative data.

- 8) The question *Is it correct to assume in general that students plan to use Open Educational Resources, e.g. YouTube videos, frequently?* serves to qualitatively validate the hypothesis H10: BI→U *Behavioural Intention significantly influences actual Use*. This hypothesis was accepted by test statistics derived from quantitative data.
- 9) The question *Students use Open Educational Resources frequently. What is your opinion on that?* serves to qualitatively validate if the students use OER frequently as projected in Hypothesis H12: *There is significant adoption and use of other forms of OER among Africa University students*. This hypothesis was accepted by test statistics derived from quantitative data.

Note: *The profiles of interview participants were as follows: (1) Participants 1 (1st year student), (2) Participant 2 (2nd year student), (3) Participant 3 (3rd year student), (4) Participant 4 (4th year student), and (5) Participant 5 (Post-graduate student). The critical realist perspective adopted in this research emphasises the deep understanding of particular phenomenon, as such interviews were restricted to students to complement the quantitative student data collected using the survey questionnaire. As detailed in the methodology chapter the interviews were confirmatory and complementary in nature and needed not be necessarily detailed.*

Table 6.8: Summary of interview responses

Research Construct	Interviews Response Analysis	Decision
Comment on the importance of Open Educational Resources in accomplishing learning activities? (H1: PE→BI)	OER are effective in providing supplementary instruction. However, there is a need for a lecturer to review the content before recommending it to students. (Participant 1) (Supported) Excellent and efficiency. (Participant 2) (Supported) Provide most content supplied by students in activities. It also helps in greater detail in feeding or providing more knowledge in the community. (Participant 3) (Supported) OER have helped in streaming learning activities and have also provided flexibility. (Participant 4) (Supported) They have made it easy to streamline and benchmark. (Participant 5) (Supported) Acceptance Rate = 100%; Reject Rate = 0%	H1 Supported
Do you consider Open Educational Resources navigation to be clear and understandable? (H2: EE→BI)	Not all the resources are easy to navigate. Some of the resources have been removed and some are outdated. (Participant 1) (Supported) Very understandable and user friendly and easy to manage. (Participant 2) (Supported) Yes, they are, as most of them allow for search capability and if the resource is not located via menu, the search will help. (Participant 3) (Supported) Not always. (Participant 4) (Supported) Yes, just like in social media. (Participant 5) (Supported) Acceptance Rate = 80%; Rejection Rate = 20%	H2 Supported

Table 6.1 Continued		
Research Construct	Interviews Response Analysis	Decision
Do you believe social peers influence students to use Open Educational Resources? (H3: SI→BI)	In mathematical subjects, lecturers are hesitant in recommending OER, preferring to use tried and tested textbooks. OER have also not gained acceptance with lecturers as many are not aware of the free use. (Participant 1) (Not Supported) Yes, very common. (Participant 2) (Supported) Yes, as they have ability to share findings with each other and, therefore, trigger use by others. (Respondent 3) (Supported) Yes, it's expected. (Participant 4) (Supported) Yes, for every student. (Participant 5) (Supported) Acceptance Rate = 80%; Rejection Rate = 20%	H3 Supported
Would you say having the necessary prior knowledge influences students to use Open Educational Resources? (H4: FC→BI and H8: FC→U)	In most instances, in my experience, students are the ones that inform me of the OER. I believe students discover them as they search the web and then spread them to their peers. (Participant 1) (Not Supported) Yes, it helps for sure. (Participant 2) (Supported) Yes, as knowledge of the of the subject matter guides in what the user is looking for (resources). (Participant 3) (Supported) Yes, I would say having the necessary prior knowledge influences students to use OER. (Participant 4) (Supported) Definitely. Students need information literacy training to be able to know what, where, which and how to access and use OER. (Participant 5) (Supported) Acceptance Rate = 80%; Rejection Rate = 20%	H4 Supported H8 Supported
Can it be said that students enjoy using Open Educational Resources? Please comment. (H5: HM→BI)	I am not sure, but my view is that students use them to learn about concepts that they may not be sure of. (Participant 1) (Not Supported) Depends with one's passion, but mostly they do; because of social media everyone has access to a gadget like tablets, smart phones. (Participant 2) (Not Supported) Yes, as it provides a hub of information in one place. (Participant 3) (Supported) Lack of knowledge discourages use. (Participant 4) (Not Supported) It needs encouragement from faculty of information professionals for them to enjoy using OER. (Participant 5) (Not Supported) Acceptance Rate = 20%; Rejection Rate = 80%	H5 not supported

Table 6.1 Continued		
Research Construct	Interviews Response Analysis	Decision
Marketing and advertising campaigns project the Econet Wireless Zimbabwe's EcoSchool Open Education Resources initiative as good value for money to learners and educators. Please comment. (H7: PV→BI and H11: There is no significant adoption and use of EcoSchool OER resources among Africa University students)	I believe that the campaigns have assisted students, especially in Zimbabwe where access to resources is limited as compared to other countries. (Participant 1) (Not Supported) Yes, because it is efficient and communication reaches to most people. (Participant 2) (Not Supported) Yes, as more people are going on board. (Participant 3) (Not Supported) Yes, reasonable for most Zimbabweans. (Participant 4) (Not Supported) I don't think a lot of people use it, even if it is cheap and marketed extensively. (Participant 5) (Not Supported) H7: Acceptance Rate = 0%; Rejection Rate = 100%	H7 not supported Since H7 is the converse of H11, H11 is supported
Some say students are driven to use Open Educational Resources by a common habit. Can we say students are significantly driven by habit to use Open Educational Resources? (H6: HT→BI and H9: HT→U)	Students are driven by the need to find solutions instead of common habit. Once they begin to see value they then use OER. (Participant 1) (Not Supported) Not exactly, cannot be the driving motivator. (Participant 2) (Not Supported) Yes, it does as norm become habits with time. (Participant 3) (Supported) Yes, reasonable expectation. (Participant 4) (Supported) I think so and also policy which forces teachers to inculcate the use of OER to students. (Participant 5) (Supported) H6 and H10: Acceptance Rate = 60%; Rejection Rate = 40%	H6 Supported H9 Supported
Is it correct to assume in general that students plan to use Open Educational Resources, e.g. YouTube videos, frequently? (H10: BI→U)	YouTube is seen in a positive light by students and thus they tend to use it. We should also remember that students differ in terms of learning styles and when they prefer to learn. (Participant 1) (Supported) If resources permit, yes. (Participant 2) (Supported) Yes, they do; students now learn more with illustrations and videos do this best. (Participant 3) (Supported) Yes, it's the trend (Participant 4) (Supported) Yes, everyone is falling for online (Participant 5) (Supported) Acceptance Rate = 100%; Rejection Rate = 0%	H10 Supported
Students use Open Educational Resources frequently. What is your opinion on that? (H12: There is significant adoption and use of other forms of OER among Africa University students)	Yes, students use OER because of its usefulness, convenience and as they seek to find solutions to problems that they encounter. (Participant 1) (Supported) It is a good move in terms of technological advancement in this decade we are now living. (Participant 2) (Supported) Yes, they do as more information is obtained this way. (Participant 3) (Supported) Yes, it appears so (Participant 4) (Supported) In this current environment where there is accessibility, yes. (Participant 5) (Supported) Acceptance Rate = 100%; Rejection Rate = 0	H12 Supported

Table 6.9: Qualitative and quantitative hypotheses tests outcome

Hypothesis	Quantitative Analysis Decision	Qualitative Analysis Decision
H1: PE→BI Performance Expectancy significantly influences Behavioural Intention	Supported	Supported
H2: EE→BI Effort Expectancy significantly influences Behavioural Intention	Supported	Supported
H3: SI→BI Social Influence significantly influences Behavioural Intention	Supported	Supported
H4: FC→BI Facilitating Conditions significantly influence Behavioural Intention	Supported	Supported
H5: HM→BI Hedonic Motivation significantly influences Behavioural Intention	Supported	Not Supported
H6: HT→BI Habit significantly influences Behavioural Intention	Not Supported	Supported
H7: PV→BI Price Value significantly influences Behavioural Intention	Supported	Not Supported
H8: FC→U Facilitating Conditions significantly influence actual Use	Supported	Supported
H9: HT→U Habit significantly influences actual Use	Supported	Supported
H10: BI→U Behavioural Intention significantly influences actual Use	Supported	Supported
H11: There is no significant adoption and use of EcoSchool OER resources among Africa University students	Supported	Supported
H12: There is significant adoption and use of other forms of OER among Africa University students	Supported	Supported

It should be noted that there was a difference in the outcomes of qualitative and quantitative hypothesis tests, as depicted in Table 6.9: different sets of hypotheses are accepted and rejected altogether. The outcome of quantitative hypothesis analysis rejects the hypothesis H6: HT→BI *Habit significantly influences Behavioural Intention* and accepts all other hypotheses. The outcome of qualitative data analysis rejects H5: HM→BI *Hedonic Motivation significantly influences Behavioural Intention* and H7: PV→BI *Price Value significantly influences Behavioural Intention* and accepts all other hypotheses. Consequently, the question is which outcome should be accepted? The mixed analysis method was used to integrate the outcome from the qualitative analysis and the quantitative analysis to arrive at one outcome.

6.4 Analysis of mixed data

The last step of data analysis in this mixed methods research was data integration, which was done by integrating the standard output from SPSS computer software. Manual tables compiled for the presentation of the research findings in Chapter 5 and some visuals, were created by mapping the various outputs into two-dimensional tables and figures. This allowed for a blending of the key research outcomes with visual images. Integration can be said to occur to the extent that different data elements are combined throughout the study in such a way as to become interdependent and reach a common theoretical or research goal, thereby producing findings that are greater than the sum of the parts.

In this segment of data analysis, I used the experience and knowledge gained from the literature review to produce visuals that portray both the meaning and context required to respond to the composite research questions. Depicted in Table 6.10 is the hypothesis tests decision matrix consisting of an amalgamation of all of the following 10 scenarios or instances tested for each hypothesis: default unmoderated model, 16–26 year age group, 27–37 year age group, 38+ year age group, the male gender age group, the female gender age group, the OER experience group, the group without OER experience, the test of unmoderated hypothesis using the qualitative approach, and the outcome of mixed methods analysis. The frequency rate of rejection and acceptance of each hypothesis was calculated and is the basis on which the outcome of the mixed methods analysis was determined for each hypothesis. The acceptable error rate is a maximum of 30% since the research is modelled on the UTAUT2 framework, which has been able to push up to 70% of the variations in the adoption and use of emerging technologies. The decision rule is the acceptance or rejection percentage rate of each hypothesis and from Table 6.10 the hypotheses are supported or not supported as follows:

- 1) H1: *Performance Expectancy significantly influences Behavioural Intention* is supported with an acceptance rate of 89%.
- 2) H2: *Effort Expectancy significantly influences Behavioural Intention* is supported with an acceptance rate of 78%.
- 3) We don't confirm H3: *Social Influence significantly influences Behavioural Intention* because it has an acceptance rate of 67%, giving it an unacceptable error rate of 33%.
- 4) H4: *Facilitating Conditions significantly influence Behavioural Intention* is not supported as it has an acceptance rate of 56%, corresponding to high acceptance error rate of 44%.
- 5) H5: *Hedonic Motivation significantly influences Behavioural Intention* is supported because of low acceptance rate of 75%, yielding an acceptable error rate of 25%.
- 6) H6: *Habit significantly influences Behavioural Intention* is supported because of a low acceptance rate of 77%, equating to an acceptable error rate of 23%.
- 7) H7: *Price Value significantly influences Behavioural Intention* is supported because of the low acceptance rate of 80%, corresponding to an unacceptable error rate of 20%.
- 8) H11: *There is no significant adoption and use of EcoSchool OER resources among Africa University students* is supported with a confirmation rate of 100%.
- 9) H12: *There is significant adoption and use of other forms of OER among Africa University students* is supported based on its 100% confirmation across all tests.

The main research question in this research is 'How and why did OER adoption and use occur the way they did among students at Africa University?' It is represented in Table 6.10 that hypotheses H1, H2, H3, H4, H5, H6, H7, H8, H9, and H10 provide a set of significant statements or facts tested at 95% significance level to

respond to the ‘why’. Hypotheses H11 and H12 provided a response to the how, also at a 95% significance level.

Table 6.10: Hypothesis test decision matrix

Quantitative Hypothesis Testing									Qualitative tests outcome
	Outcome of hypotheses tests	Age			Gender		Experience		
			16–26 years	27–37 years	38+ years	Male	Female	Experienced	Inexperienced
H1: PE→BI Performance Expectancy significantly influences Behavioural Intention.(RQ1)	Supported	Supported	Supported	Not Supported	Supported	Supported	Supported	Supported	Supported
H2: EE→BI Effort Expectancy significantly influences Behavioural Intention (RQ1)	Supported	Supported	Not Supported	Supported	Not Supported	Supported	Supported	Supported	Supported
H3: SI→BI Social Influence significantly influences Behavioural Intention (RQ1)	Not Supported	Not Supported	Supported	Not Supported	Supported	Supported	Supported	Not Supported	Not Supported
H4: FC→BI Facilitating Conditions significantly influence Behavioural Intention (RQ1)	Supported	Not Supported	Supported	Supported	Not Supported	Supported	Supported	Not Supported	Supported
H5: HM→BI Hedonic Motivation significantly influences Behavioural Intention (RQ1)	Supported	Supported	Not Supported	Not Supported	Supported	Supported	Not Supported	Not Supported	Not Supported
H6: HT→BI Habit significantly influences Behavioural Intention (RQ1)	Supported	Supported	Not Supported	Supported	Not Supported	Not Supported	Not Supported	Supported	Accept
H7:PV→BI Price Value significantly influences Behavioural Intention (RQ1)	Supported	Supported	Not Supported	Supported	Supported	Supported	Not Supported	Not Supported	Not Supported
H8: FC→U Facilitating Conditions significantly influence actual Use (RQ2)	Supported	Supported	Supported	Not Supported	Supported	Supported	Supported	Supported	Supported
H9: HT→U Habit significantly influences actual Use (RQ2)	Supported	Supported	Supported	supported	Supported	Supported	Supported	Supported	Supported

Table 6.10 Continued									
Quantitative Hypothesis Testing									Qualitative tests outcome
	Outcome of hypotheses tests	Age			Gender		Experience		
			16–26 years	27–37 years	38+ years	Male	Female	Experienced	Inexperienced
H10: BI→U Behavioural Intention significantly influences actual Use (RQ2)	Supported	Supported	Supported	Not Supported	Supported	Supported	Supported	Supported	Supported
H11: There is no significant adoption and use of EcoSchool OER resources among Africa University students (RQ3)	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported
H12: There is significant adoption and use of other forms of OER among Africa University students (RQ3)	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported

6.5 Summary

The chapter further analysed the data presented in Chapter 5 by revealing the real life or operational meaning. The findings in this chapter were compared with outcomes from existing related research. There is a deficit in existing research on the application of the UTAUT2 in the adoption and use of OER by learners in higher education contexts and, as a result, the comparison of the current research with existing research was limited to the available literature. The chapter started with the analysis of quantitative data, incorporating the impact of the moderating variables (age, gender and experience). Qualitative data analysis was performed separately, and the outcome was then merged with the quantitative analysis results in the mixed data analysis. This refined the outcome of the findings. The impact of the mixed data analysis can be confirmed by how the results of the current research logically and progressively improved to match some of the findings from existing research. The next chapter will draw conclusions from this chapter and make some recommendations from the conclusions.

Chapter 7: Conclusions and Recommendations

7.1 Introduction

This chapter presents two conclusions regarding how OER adoption and use has occurred the way it did among Africa University students and 4 recommendations based to identified reasons as to why the prevalent adoption and use pattern of OER at Africa University emerged the way it did. The conclusions and recommendations address the aim of the research which was to ascertain the pattern of adoption and use of OER among Africa University students and derive significant explanations as to how the prevailing adoption and use pattern of OER came about. The research was a post OER intervention review at Africa University following the official launch of the EcoSchool OER initiative by Econet Wireless Zimbabwe in February 2014. The UTAUT2 was used as the research model or the trigger mechanism for OER adoption and use. The realist perspective used in this study is not limited to what the researcher can observe; it is premised on the existence of a trigger mechanism the UTAUT2 theoretical framework that allows researchers to understand unobservable events in empirical studies involving the adoption and use of innovation. The study identified deviations from the expected outcomes of prior applications of UTAUT2 in OER adoption and use studies, and used qualitative data evidence to explain and make recommendations to address these contradictions. The study culminates with recommendations for the improvement of the UTAUT2 model, as the contribution to the body of knowledge. Areas for future research are also suggested.

7.2 Conclusions

The conclusions of the study are the derived responses to the research questions based on mixed/integrated data analysis. The integration of the research findings marks the end of the prolonged and iterative data synthesis and analysis process. Figure 7.1 depicts the integration of the research findings and shows the cycle of data elements and components derived from the data sets and how they relate and interrelate to achieve the common theroretical research goal to establish the following: how OER adoption and use occurred among Africa University students?; and why OER adoption and use manifested themselves the way they did among Africa University students. The diagram further shows how the findings from the ‘how’ and ‘why’ data sets were converted into recommendations, with input from the issues identified during the qualitative research. Higher level of synthesis and analysis extracted what can be

deemed significant contribution to the body of knowledge. From the same diagram of integrated research outcomes in Figure 7.1, two conclusive statements are noted in response to how OER adoption has occurred at Africa University:

1. **There is no significant adoption and use of EcoSchool OER resources among Africa University students (Conclusion 1).** Hypothesis H11, which stated: *There is no significant adoption and use of EcoSchool OER resources among Africa University students*, was confirmed on the basis of the mixed methods statistical analysis used. The conclusion was that Africa University students did not significantly adopt EcoSchool OER. This was corroborated by the lack of evidence of EcoSchool use in the Network Utilisation Reports (Section 6.4). In addition, the dissertation and theses references did not feature the EcoSchool OER repository, and the community of EcoSchool users did not emerge as expected from the CoP theories reviewed in literature;
2. **There is significant adoption and use of other forms of OER among Africa University students (Conclusion 2).** Hypothesis H12 sought to establish whether Africa University students made meaningful use of OER other than the EcoSchool OER. The hypothesis stated: *There is significant adoption and use of other forms of OER among Africa University students*. On the basis of the results of the statistical tests, this hypothesis was confirmed. The conclusion was that Africa University students used other OER in their studies. The review of Network Resources Utilisation Reports showed that students accessed YouTube OER quite extensively, suggesting the use of these resources. This was corroborated by references in students' dissertations and assignments, which mentioned other forms of OER. Africa University students have significantly adopted other forms of OER in their mainstream learning process.

The responses to the 'why outcomes' of hypotheses tests H1 to H7 provided the basis of the explanation as to why OER adoption and use occurred the way it did at Africa University as follows:

- i) **Performance Expectancy significantly influences Behavioural Intention (H1).** Hypothesis H1 sought to establish whether perceived ease of use of OER had a meaningful influence on the consideration to use OER. The hypothesis stated that *Performance Expectancy significantly influences Behavioural Intention*. This hypothesis was confirmed on the basis of the results of the statistical tests. The conclusion was that Africa University students consider OER to be meaningful

contributors to their learning efforts. This was corroborated by the findings of the analysis of the network reports. The high Performance Expectancy among students motivated them to search for free educational resources without necessarily limiting themselves to the officially launched EcoSchool OER;

ii) **Effort Expectancy significantly influences Behavioural Intention (H2).** Hypothesis H2 sought to establish the extent to which perceived ease of use of OER by Africa University students influenced their intention to use them. The hypothesis stated that *Effort Expectancy significantly influences Behavioural Intention*. This hypothesis was accepted on the basis of the results of the statistical tests. The conclusion was that Africa University students consider OER easy to use. The high Effort Expectancy urged the students to search for free online learning resources that are not necessarily EcoSchool OER;

iii) **Social Influence does not significantly influence Behavioural Intention (H3).** Hypothesis H3 sought to ascertain if Africa University students considered the opinions of peers important in their consideration to use OER. The hypothesis stated that *Social Influence significantly influences Behavioural Intention*. On the basis of the results of the statistical tests, this hypothesis was not confirmed. The conclusion was that Africa University students did not consider the influence or perception of peers or models as significant in their adoption of OER. This was corroborated by the fact that the EcoSchool OER team tried to appeal to the Social Influence variable by identifying OER champions among the students. These individuals, picked from the student body, played an active role during OER presentations and soon after. Despite that, there was no significant uptake of EcoSchool OER among Africa University students;

iv) **Facilitating Conditions significantly influence Behavioural Intention (H4).** Hypothesis H4 sought to establish whether supporting OER infrastructure and policy influence the intention to adopt OER. The hypothesis stated that *Facilitating Conditions significantly influence Behavioural Intention*. On the basis of the results of the statistical tests, this hypothesis was confirmed. The conclusion was that Africa University students did not consider Facilitating Conditions to be a significant determinant in their search efforts for learning resources. Facilitating Conditions were identified as an issue during the qualitative analysis of documents. This was corroborated by the negative regression weights coefficient of -0.139 (-13.9%), reflecting a negative impact of Facilitating Conditions on Behavioural Intention or acceptance of OER among Africa University students. The analysis of qualitative data identified the specific issues

relating to Facilitating Conditions (Limited laboratory access times, No explicit OER initiatives, No explicit OER support, No explicit OER recognitions, No OER training for educators).

v) **Hedonic Motivation significantly influences Behavioural Intention (H5).**

Hypothesis H5 sought to establish whether the OER affect value influences the decision of Africa University students to adopt OER. The hypothesis stated that *Hedonic Motivation significantly influences Behavioural Intention*. On the basis of the results of the statistical tests, this hypothesis was confirmed. The conclusion was that Africa University students considered the pleasure or enjoyment of using a learning resource to be a significant determinant of what resources they adopt and use in their learning process. The qualitative data analysis also raised concerns regarding Hedonic Motivation (No explicit OER recognitions). It can now be noted that the affect value of OER does not influence Africa University students to adopt OER. But why have the students extensively adopted YouTube OER and not adopted the officially introduced EcoSchool OER? A distinct feature of YouTube OER is its capability to display and track utility value. The EcoSchool OER repository lacks this feature. Utility value or actual performance of OER is an essential determinant of OER adoption and use. Africa University students have widely adopted and are using YouTube videos because of pre-confirmed utility values of the platform. The Network Resource Utilisation Reports confirmed excessive traffic to YouTube videos. This has led to the ICT department passing a policy that restricts maximum bandwidth use. However, the Student Representative Council has lobbied for the lifting of this bandwidth cap, but the technology fee paid by students is not sufficient to cover unlimited bandwidth for each student;

vi) **Habit significantly influences Behavioural Intention (H6).**

Hypothesis H6 sought to establish whether prior practice of using OER had a meaningful influence on the intention to adopt OER. The hypothesis stated that *Habit significantly influences Behavioural Intention*. This hypothesis was confirmed on the basis of the results of the statistical tests. The conclusion was that Africa University students consider prior habitual practice to be a determinant of the learning resources they elect to adopt. The quantitative data analysis revealed that there were issues related to Habit at Africa University, as confirmed by the negative Habit regression weight predictors -0.053 (5.3%) of Behavioural Intention, also called adoption or acceptance. The qualitative

data analysis raised some issues related to Habit (No explicit OER recognitions, No OER training for educators).

- vii) **Price Value significantly influences Behavioural Intention (H7).** Hypothesis H7 sought to establish if monetary value had a meaningful influence on the decision to adopt OER among Africa University students. The hypothesis stated that *Price Value significantly influences Behavioural Intention*. On the basis of the results of the statistical tests, this hypothesis was confirmed. The conclusion was that Africa University students did consider actual and perceived monetary value to be significant determinants when selecting educational resources to use in their learning process. Because of the monthly bandwidth limitations, students use mobile data and other cheaper data products to access learning resources of their choice. The quantitative data analysis revealed that there were issues with Price Value at Africa University, as evidenced by the negative Price Value regression weights coefficients of -0.108 (-10.8%) on Behavioural Intention or acceptance among Africa University students. The qualitative data revealed issues related to Price Value (Data cap per student per month, and Time restrictions to access external internet sites).

The outcomes of the tests for hypotheses H8–H10 identified the UTAUT2 variables that significantly influenced actual OER use behaviour, and the conclusions arrived at were as follows:

- i) **Facilitating Conditions are a significant determinant in the actual Use of OER.** Hypothesis H8 sought to establish whether OER supporting infrastructure and policy had meaningful bearing on the decisions of Africa University students to use OER. The hypothesis stated that *Facilitating Conditions significantly influence actual Use*. Based on the results of the statistical tests, this hypothesis was confirmed. The conclusion arrived at was that Africa University students consider Facilitating Conditions to be a significant determinant in the actual Use of OER. The Facilitating Conditions variable affects both adoption and use and includes both supporting infrastructure and policy framework. Hypothesis H4, which stated that *Facilitating Conditions significantly influence Behavioural Intention*, was concerned with adoption. At adoption level, OER infrastructure support is a pre-requisite. Hypothesis H8 evaluated Facilitating Conditions at Usage level hence; the OER policy framework or OER best practices (section 2.8) play an important role.

- ii) **Habit significantly influences actual Use.** Hypothesis H9 sought to determine whether prior habitual practice or custom was a significant determinant of the actual use behaviour of OER. The hypothesis stated that *Habit significantly influences actual Use*. On the basis of the results of the statistical tests, this hypothesis was confirmed. The conclusion was that prior OER Habit was a significant determinant of the actual OER Use. Therefore, OER use habits must be cultivated among Africa University students. Promoting OER usage Habit among Africa University students could lead to increased adoption. The literature review consistently identified CoP as the best way to promote a habit or practice. It can be noted that the YouTube OER that have been extensively adopted by Africa University students are distributed from a platform that is equivalent to an online CoP.
- iii) **Behavioural Intention significantly influences actual Use.** Hypothesis H10 sought to ascertain whether increasing the acceptance rate, also known as the adoption rate, would correspondingly increase the actual Use behaviour. The hypothesis stated that *Behavioural Intention significantly influences actual Use*. Because of the results of the statistical tests, this hypothesis was accepted. The conclusion was that increasing the Behavioural Intention to adopt OER among Africa University students also increased the actual usage.

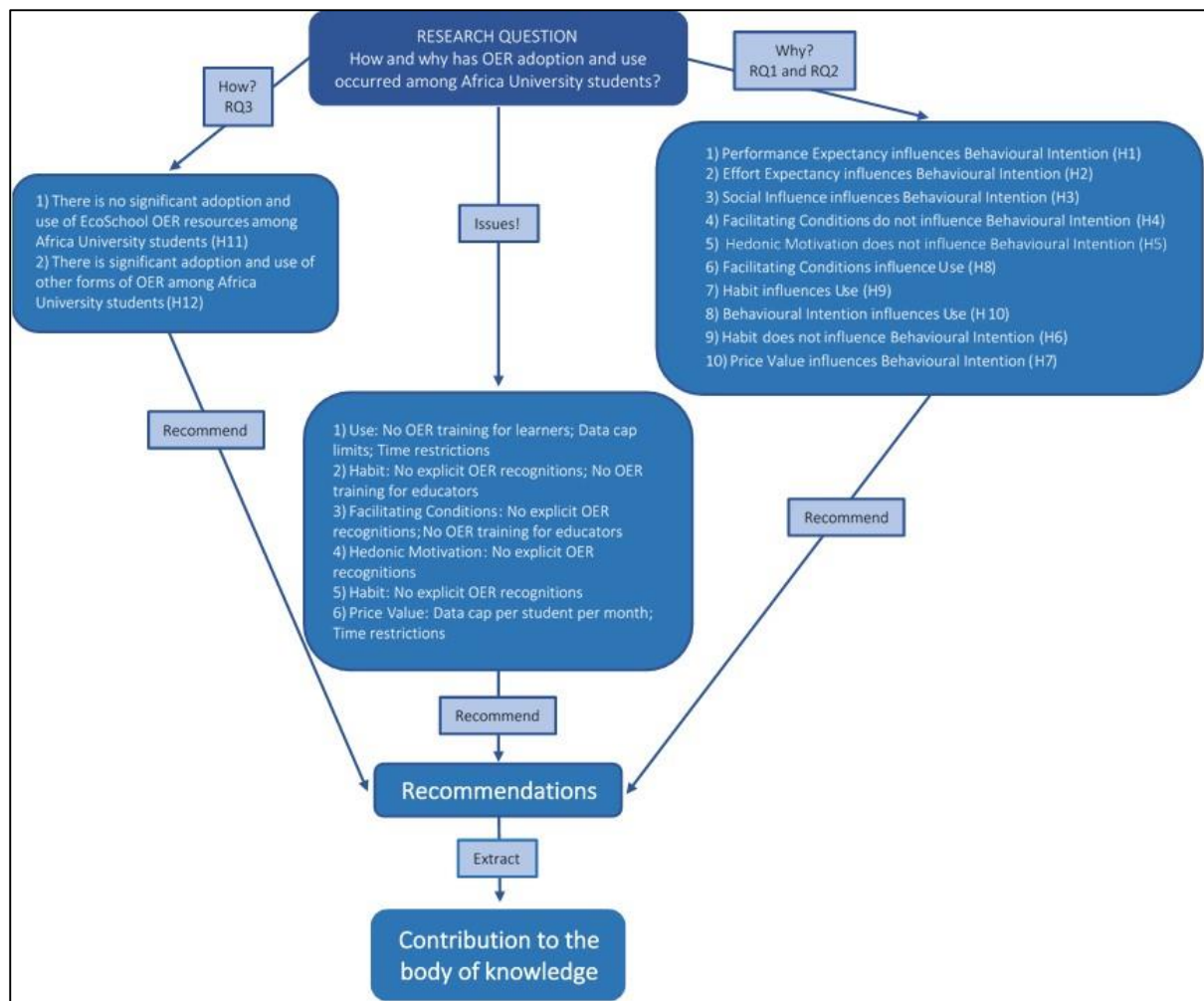


Figure 7.1: Integrated research findings

7.3 Recommendations

The research applied the UTAUT2 model to explain adoption and use of OER among Africa University students. UTAUT2 has been used in prior OER adoption studies and was able to explain up to 70% of the variations. In all reviewed instances [Mtebe & Raisamo, 2014; Percy & Belle, 2012; Padhi, 2018; Tamilmani, Rana, Prakasam & Dwivedi, 2019; Verkijika, 2018; Tamilmani, Rana, Dwivedi, Sahu & Roderick, 2018; Tamilmani, Rana & Dwivedi, June, 2018, Gupta, Dogra & George, 2018; Alalwan, Dwivedi, Rana & Algharabat, 2018; Singh & Matsui, 2018] of prior application of UTAUT and UTAUT2 no negative parameters were reported. The observed parameters on prior application of UTAUT2 on adoption and use studies are considered as the baseline, and the significant deviations arising from the findings of this study are highlighted in this section as deviations or contradictions. Recommendations are identified in this section based on each deviation from the baseline identified. The following section

elaborates each recommendation in detail and applies some of the relevant findings and best practices identified in the literature review chapter to fortify the recommendations.

Using the outcomes of the application of UTAUT2 in this study (Figure 7.2), the major contradictions arising from negative correlation values (highlighted) are as follows:

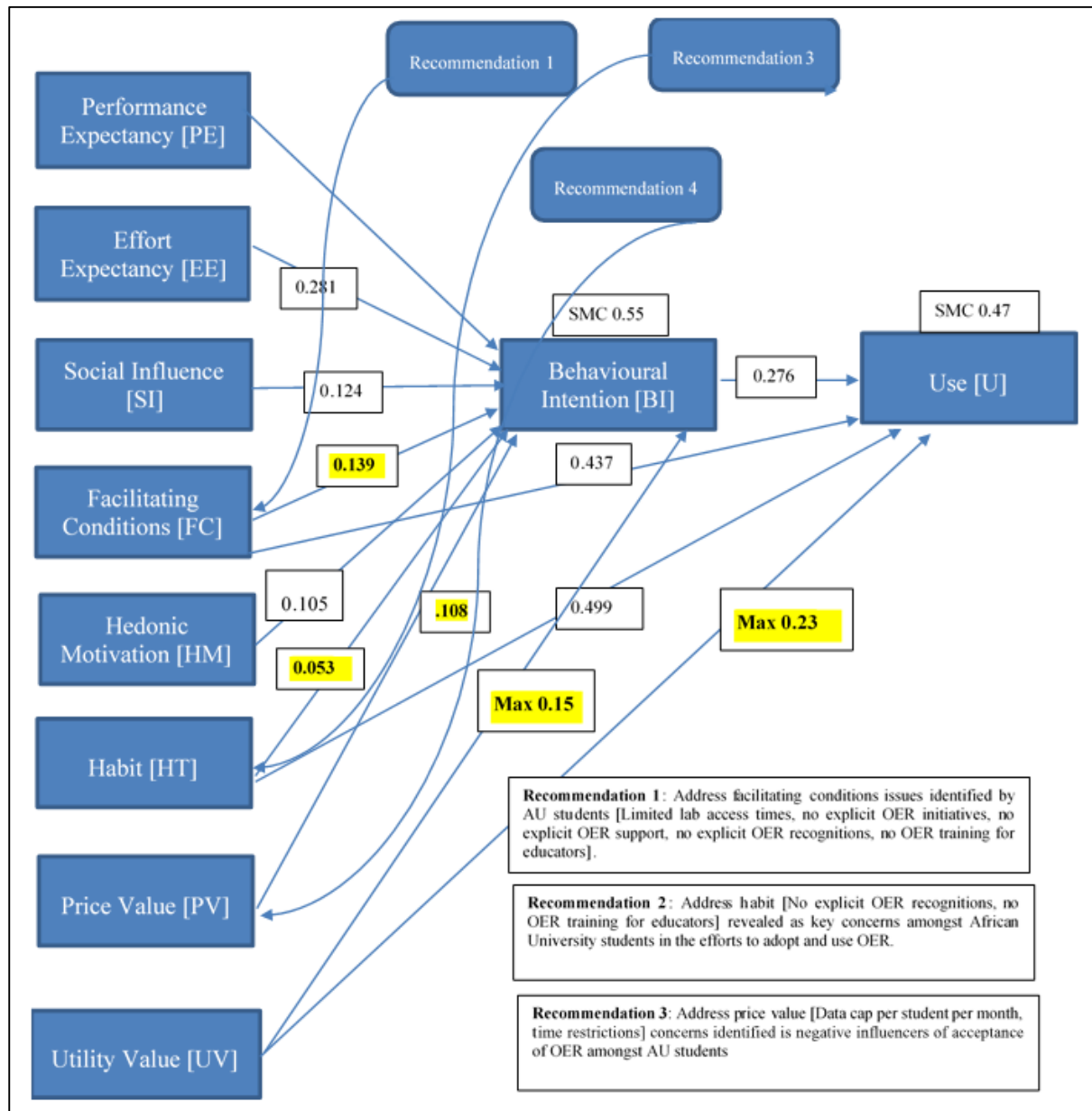


Figure 7.2: Derived OER intervention model for Africa University

7.3.1 Recommendation 1: Address OER Facilitating Conditions issues at Africa University

Facilitating Conditions at **-0.139** equals a -13.9% negative impact on Behavioural Intention and at 0.437 equals a 43.7% positive impact on actual Use behaviour. Africa University must address the identified Facilitating Conditions issues. These include limited computer laboratory access times, absence of explicit OER initiatives, no explicit OER support, no explicit OER recognitions, and no OER training for educators. Addressing these Facilitating Conditions will increase the Behavioural Intention total variation explained, by 13.9%. **This contradiction is the basis for Recommendation 1**, which contends that addressing OER facilitating conditions issues identified in this research at Africa University will increase adoption and use of open educational resources. The ICT department is responsible for provision of ICT infrastructure and services including the updating and stewardship of the institutional ICT policy. This recommendation would therefore the joint responsibility of the ICT department and the ICT steering committee. The implementation could be completed during the course of one academic year, using the allocated annual business. Additional funding could be raised using grant proposal writing to support training and exchange programs of staff.

7.3.2 Recommendation 2: OER Habit issues at Africa University

Habit at **-0.053** equals a -5.3% negative impact on Behavioural Intention and at 0.499 equals a 4.99% positive impact on actual Use behaviour. The identified OER Habit scaffolding challenges were; no explicit OER recognitions, and no OER training for educators. From the statistical analysis of the Habit variable, addressing these challenges will bring the total variation explained to a positive impact of at least 5.3% from the current negative impact of -5.3%. **This deviation is the basis for Recommendation 2**, which contending that Africa University must introduce an OER policy that cultivates OER usage habit through a recognition and reward scheme. The recognition and reward scheme must feed into the performance appraisal scheme. The Department of Online Learning could team up with the Human Resources department to address the identified OER Habit issues identified in this research. The task is easily achievable during the course of one academic year and additional budget implications are envisaged.

7.3.3 Recommendation 3: Price Value issues at Africa University

Price Value at -0.108 equals a -10.8% negative impact on Behavioural Intention. Price Value is left out in many OER researches because OER, by nature, are presumed to be free. I included Price Value because at Africa University, OER are not entirely free. The monthly data limit of 800 Mb per student and extranet access time restrictions are identified Price Value issues at Africa University. Students have to pay to access OER beyond their monthly data cap of 800 Mb. Access to all external internet sites (extranet) is open at prescribed times, and students have to pay for an independent internet connection if they want unrestricted access. Addressing the identified Price Value challenges will introduce a positive 10.8% impact on the total Behavioural Intention variation explained. **This contrast of correlation values is the basis for Recommendation 3.** The recommended solution is that Africa University should have its own OER domain that is hosted internally and is accessible through the LAN and WAN infrastructure. This solution will not lead to additional data access costs to either the students or the institution. This must be the responsibility of the ICT department and the ICT steering committee. There is need to raise additional funding to support the increase of bandwidth. The dedicated OER domain also require additional financial resources that may extend beyond the currently stipulated annual budget, and hence the need for additional financial resources mobilization.

7.3.4 Recommendation 4: Incorporate the utility value construct in the UTAUT2 model

The major differences in the numerical values of the correlations were also considered to be contradictions. In this study the total variation explained by Behavioural Intention 0.25 (25%) and Use 0.470 (47%) reflect a major numerical value in comparison to 0.7 (70%) confirmed by prior studies (Venkatesh et al., 2003, 2007). This big difference in total variation, suggested that UTAUT2 lacked capacity to capture all possible causes of variations at Africa University. The same research instrument was used with due care of reliability and validity measures and procedures. The analysis of network utilisation reports (Section 6.4), provided a useful lead in the form of higher access of YouTube OER resources by Africa University students. The usage was higher than social media (Facebook), movie downloads, and MP4 audio streaming. In the continued iterative logical analysis, I noted that the YouTube videos provided some form of utility value, which comes in the form of the numbers of likes, dislikes, and referrals. It is also

easy to compare and rate YouTube OER resources. The access and use metrics associated with YouTube OER resources provided the utility information that indicated high adoption and use among Africa University students. There is room for improvement of the UTAUT2 model variables to increase the average variance explained from the 45% that was realised in this study. It was noted from the literature review that the average variance explained could be as high as 70%.

The OER resources on the EcoSchool repository lack the features to support Utility Value. The capabilities for OER users to like or dislike with a display of frequencies allow users to see how useful a resource is. Similarly, features like the number of citations and references are tracked for some resources. The conclusion regarding Utility Value at Africa University is that it is a determinant of OER adoption among Africa University students. From the statistical analysis performed, it is clear that introducing Utility Value features to OER can introduce an improvement of up to 15% in the variation explained for Behavioural Intention and a 23% increase in variation explained for the actual OER Use among Africa University students. **This major discrepancy in the total value explained is the basis for Recommendation 4.**

Based on research findings relating to Africa University students adopting YouTube OER with Utility Value rating features instead of EcoSchool OER that was officially introduced at the institution, I proposed the modification of UTAUT2 by adding the Utility Value variable to the UTAUT2 research model. This led to a new research model, which is referred to in this thesis as the Modified UTAUT2 model. The Modified UTAUT2 model is depicted in Figure 7.3. The justification of the utility value construct is provided in Section 7.4 above. I further proposed the following five measurements or evaluation items for Utility Value: Item 1 (UV1.): Number of views of the OER; Item 2 (UV2.): Number of likes; Item 3 (UV3.): Number of dislikes; Item 4 (UV4.): Number of citations of the OER; and Item 5 (UV5.): Number of references of the OER. The influence of Utility Value is also moderated by age, gender and experience. This study's contribution to knowledge is the Modified UTAUT2 model, as depicted in Figure 7.3.

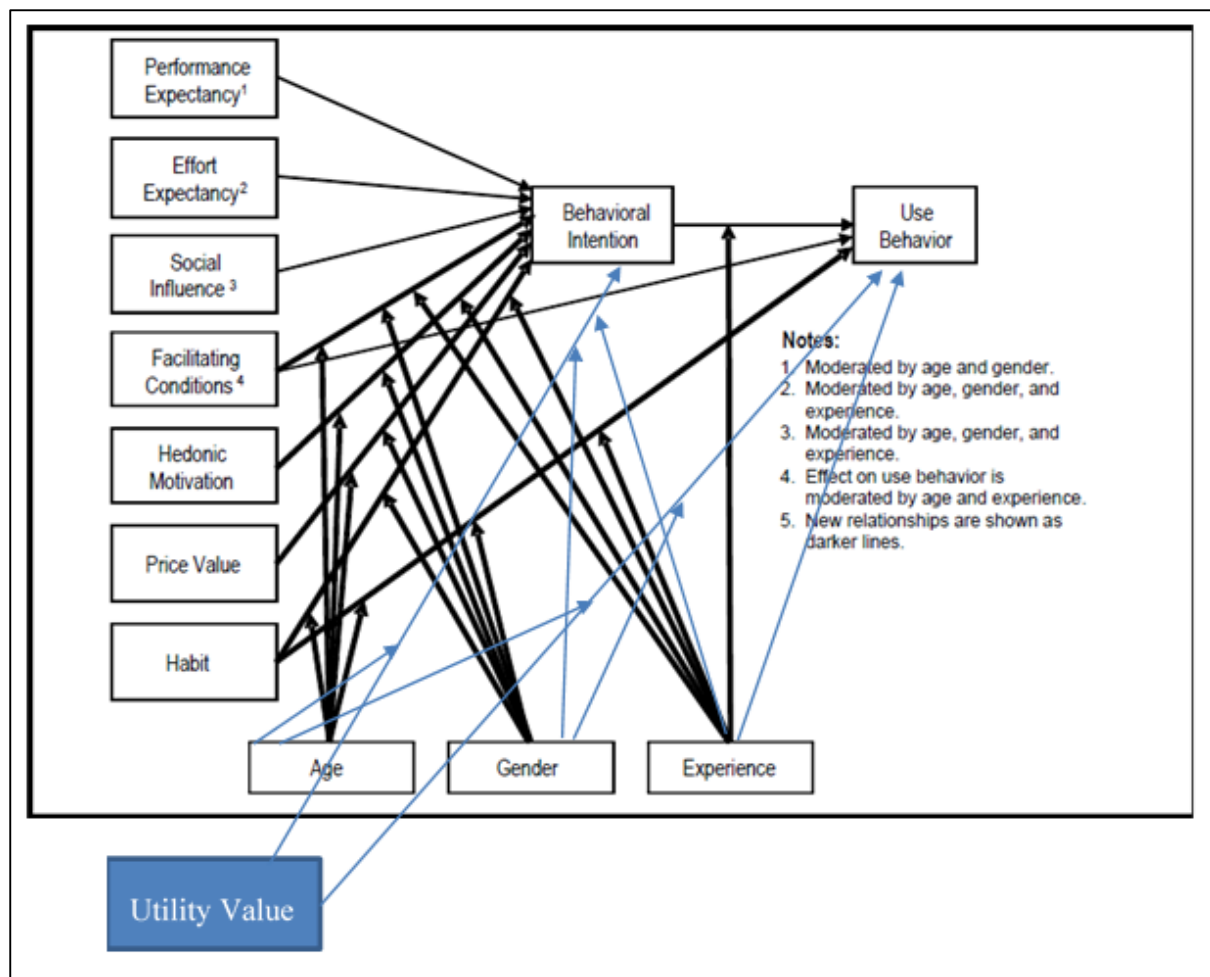


Figure 7.3: Modified UTAUT2

The recommendation for the Utility Value research construct was corroborated by the literature review. A brief review of technology acceptance models that were progressively integrated to derive UTAUT2 was presented in Chapter 3 and revealed that at no point in the genesis of UTAUT2 was the Utility Value construct considered or integrated. The genesis of the UTAUT2 model lies in the field of Psychology in 1980 when Ajzen and Fishbein (1980) originated the Theory of Reasoned Action. Ajzen (1985) improved the Theory of Reasoned Action to the Theory of Planned Behaviour, which was, in turn, used as the basis of Decomposed Theory of Planned Behaviour by Taylor and Todd (1995). In 1986, a researcher in the field of information systems developed TAM as another independent improvement of the Theory of Reasoned Action. In 2000, information systems researchers, Venkatesh and Davis, developed a second generation TAM named TAM2, which was transformed to UTAUT (Venkatesh et al., 2003) and UTAUT2 (Venkatesh et al., 2012). The development of UTAUT included the fusion of the Diffusion of Innovation theory proposed by Rogers (1983). The Diffusion of Innovation has its origins in three other theories: the Social Cognitive Theory

(Rogers, 1983), the Motivational Model (Deci & Ryan, 1985) and the Model of PC Utilisation (Triadis, 1979). The progression outlined above clearly shows that there has been no prior consideration of the Utility Value construct. This makes my recommendation solid, valid and potentially very useful in explaining the acceptance and use of emerging technologies.

7.4 Areas for future research

Following the successful identification of the Utility Value construct and justification for the modification of the original UTAUT2 model to derive a Modified UTAUT2 model (Figure 7.3), the immediate recommendation for future research is to test the Modified UTAUT2 model using a bigger sample of university students in Zimbabwe. The modified research instruments are provided in Appendix B; these altered research instruments reflect the recommendations arising from the findings of this research.

7.5 Synopsis

The research is a post-intervention review of the EcoSchool OER project that was officially launched at Africa University in Zimbabwe on the 28th of February, 2014. The goal of the research was to establish how and why adoption and use of OER had occurred among Africa University students. The UTAUT2 was used as the research model or theoretical framework. The selection of the UTAUT2 was based on its conceptual superiority as a fusion of earlier technology acceptance models and context relevance arising from the recent use of UTAUT in OER research in sub-Saharan Africa (Mtebe & Raisamo, 2014, Percy & Belle, 2012).

The research adopted a critical realist perspective in order to establish the actual reality of how and why OER adoption and use occurred the way they did. A mixed methods design was used with the main component of the research being quantitative, and was complemented by the qualitative component. The quantitative data were collected using an adaptation of the tried and validated UTAUT psychometric questionnaire. The instrument was used in previous OER research and was reported to explain up to 70% of the variation in the adoption and use of emerging technologies. The qualitative data were mainly collected using document analysis and were able to complement and corroborate the findings from the quantitative component of the research. Confirmatory factor analysis was used as the main data analysis technique. The data were subjected to tests for conformity for factor analysis procedures and all measures, notably sample size and internal reliability tests, were favourable. A set of 12 hypotheses were

used to derive a set of significant statements to respond to the main research question, and sub-research questions.

The research derived two major conclusions: **(1) There is no significant adoption and use of EcoSchool OER resources among Africa University students and (2) There is significant adoption and use of other forms of OER among Africa University students.** In this study the adopted research model the second generation Unified Theory for Acceptance and Use of Technology (UTAUT2) was only able to explain only 25% of the total variation in the adoption and 47% of the total variation in the actual Use behaviour of OER. This was the basis of a major gap identified in this research, leading to the modification of the original research model. The findings showed that Africa University students preferred YouTube OER resources with Utility Value tracking features instead of EcoSchool OER resources, formally introduced at the institution. The EcoSchool OER lack Utility Value support features. As a contribution to knowledge, I proposed the modification of the UTAUT2 by adding Utility Value to the original UTUAT2 research model. Consequently, I presented a new research model referred to in this thesis as the Modified UTAUT2 model.

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Appendix A: Research Instruments

Students Survey Questionnaire

Open educational resources (OER) are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property licence that permits their free use and repurposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge. OER are offered for free through a public domain or under a licence that permits their free use and customisation by others.

Please circle the appropriate number to indicate the level of your agreement or disagreement with the following statements on a scale of 1 to 7, where 1 = Strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neutral (neither disagree nor agree), 5 = somewhat agree, 6 = agree, and 7 = Strongly agree.

Strongly disagree	Disagree	Somewhat disagree	neutral	somewhat agree	Agree	Strongly agree
1	2	3	4	5	6	7

Performance Expectancy

PE1. I find OER useful in my studies.

PE2. Using OER helps me accomplish learning activities.

PE3. Using OER increases my academic productivity.

Strongly disagree	Disagree	Somewhat disagree	neutral	somewhat agree	Agree	Strongly agree
1	2	3	4	5	6	7

Effort Expectancy

EE1. Learning how to use OER is easy for me.

EE2. OER navigation is clear and understandable.

EE3. I find OER easy to use.

EE4. It is easy for me to become skilful at using OER.

Strongly disagree	Disagree	Somewhat disagree	neutral	somewhat agree	Agree	Strongly agree
1	2	3	4	5	6	7

Social Influence

SI1. People who are important to me think that I should use OER.

SI2. People who influence my behaviour think that I should use OER.

SI3. People whose opinions that I value prefer that I use OER.

SI4. Use of OER by lecturers influences me to use OER

Strongly disagree	Disagree	Somewhat disagree	neutral	somewhat agree	Agree	Strongly agree
1	2	3	4	5	6	7

Facilitating Conditions

FC1. I have the resources necessary to use OER.

FC2. I have the necessary knowledge to use OER.

FC3. OER are compatible with other learning materials I use.

FC4. There are knowledgeable people to assist with OER

Strongly disagree	Disagree	Somewhat disagree	neutral	somewhat agree	Agree	Strongly agree
1	2	3	4	5	6	7

Hedonic Motivation

HM1. Using OER is fun.

HM2. Using OER is enjoyable.

HM3. Using OER is very entertaining.

	Strongly disagree	Disagree	Somewhat disagree	neutral	somewhat agree	Agree	Strongly agree
	1	2	3	4	5	6	7

Price Value

PV1. EcoSchool OER is reasonably priced.

PV2. EcoSchool OER is a good value for money.

PV3. At the current price, EcoSchool provides a good value.

	Strongly disagree	Disagree	Somewhat disagree	neutral	somewhat agree	Agree	Strongly agree
	1	2	3	4	5	6	7

Habit

HT1. The use of OER has become a habit for me.

HT2. I am addicted to using OER.

HT3. I must use OER.

	Strongly disagree	Disagree	Somewhat disagree	neutral	somewhat agree	Agree	Strongly agree
	1	2	3	4	5	6	7

Behavioural Intention

BI1. I intend to continue using OER in the future.

BI2. I will always try to use OER in my learning activities.

BI3. I plan to continue to use OER frequently.

<i>Use</i>	Strongly disagree	Disagree	Somewhat disagree	neutral	somewhat agree	Agree	Strongly agree
	1	2	3	4	5	6	7
U1. I have been using OER							
U2. I use OER frequency							
U3. I use a variety of OER							

Participant Information

The intent of this section is to obtain some information about individuals who respond to this survey. Information gathered about participants will be treated confidentially, and only group data will be reported as an outcome of this research.

1. Gender: ☐Female ☐Male

2. Age: ☐16–26 ☐27–37 ☐38+ years

3. I have some experience of using Open Educational Resources in my learning process?

☐Yes ☐No

4. I use Econet’s EcoSchool Open Education Resources frequently in my learning process?

☐No ☐Sometimes ☐Yes

5. I use other forms of Open Educational Resources frequently in my learning process?

☐No ☐Sometimes ☐Yes

Appendix B: Recommended Research Instruments

Recommended Students Survey Questionnaire

OER are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property licence that permits their free use and repurposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge. OER are offered for free through a public domain or under a licence that permits their free use and customisation by others.

Please circle the appropriate number to indicate the level of your agreement or disagreement with the following statements on a scale of 1 to 7, where 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neutral (neither disagree nor agree), 5 = somewhat agree, 6 = agree, and 7 = strongly agree.

	Strongly disagree	Disagree	Somewhat disagree	neutral	somewhat agree	Agree	Strongly agree
	1	2	3	4	5	6	7
Utility Value [UV]							
UV1. Number of times an OER has been viewed as important							
UV2. I value the of people who have liked the OER							
UV3. I consider the number of dislike ratings on the OER							
UV4. The number of citations of the OER is important to me							

UV5 I consider the reference frequency of the OER

Performance Expectancy

1 2 3 4 5 6 7

PE1. I find OER useful in my studies.

PE2. Using OER helps me accomplish learning activities.

PE3. Using OER increases my academic productivity.

Strongly disagree Disagree Somewhat disagree neutral somewhat agree Agree Strongly agree

Effort Expectancy

1 2 3 4 5 6 7

EE1. Learning how to use OER is easy for me.

EE2. OER navigation is clear and understandable.

EE3. I find OER easy to use.

EE4. It is easy for me to become skilful at using OER.

Strongly disagree Disagree Somewhat disagree neutral somewhat agree Agree Strongly agree

Social Influence

1 2 3 4 5 6 7

SI1. People who are important to me think that I should use OER.

SI2. People who influence my behaviour think that I should use OER.

SI3. People whose opinions that I value prefer that I use OER.

SI4. Use of OER by lecturers influences me to use OER

Strongly disagree	Disagree	Somewhat disagree	neutral	somewhat agree	Agree	Strongly agree
1	2	3	4	5	6	7

Facilitating Conditions

FC1. I have the resources necessary to use OER.

FC2. I have the necessary knowledge to use OER.

FC3. OER are compatible with other learning materials I use.

FC4. There are knowledgeable people to assist with OER

Strongly disagree	Disagree	Somewhat disagree	neutral	somewhat agree	Agree	Strongly agree
1	2	3	4	5	6	7

Hedonic Motivation

HM1. Using OER is fun.

HM2. Using OER is enjoyable.

HM3. Using OER is very entertaining.

Strongly disagree	Disagree	Somewhat disagree	neutral	somewhat agree	Agree	Strongly agree
1	2	3	4	5	6	7

Price Value

PV1. EcoSchool OER is reasonably priced.

PV2. EcoSchool OER is good value for money.

PV3. At the current price, EcoSchool provides a good value.

	Strongly disagree	Disagree	Somewhat disagree	neutral	somewhat agree	Agree	Strongly agree
	1	2	3	4	5	6	7

Habit

HT1. The use of OER has become a habit for me.

HT2. I am addicted to using OER.

HT3. I must use OER.

	Strongly disagree	Disagree	Somewhat disagree	neutral	somewhat agree	Agree	Strongly agree
	1	2	3	4	5	6	7

Behavioural Intention

BI1. I intend to continue using OER in the future.

BI2. I will always try to use OER in my learning activities.

BI3. I plan to continue to use OER frequently.

	Strongly disagree	Disagree	Somewhat disagree	neutral	somewhat agree	Agree	Strongly agree
	1	2	3	4	5	6	7

Use

U1. I have been using OER

U2. I use OER frequency

U3. I use a variety of OER

Participant Information

The intent of this section is to obtain some information about individuals who respond to this survey. Information gathered about participants will be treated confidentially, and only group data will be reported as an outcome of this research.

1. Gender: ☐Female ☐Male
2. Age: ☐16–26 ☐27–37 ☐38+ years
3. I have some experience of using Open Educational Resources in my learning process?
☐Yes ☐No
4. I use Econet's EcoSchool Open Education Resources frequently in my learning process?
☐No ☐Sometimes ☐Yes
5. I use other forms of Open Educational Resources frequently in my learning process?
☐No ☐Sometimes ☐Yes

Recommended Interview Questions

<i>Research Construct</i>	<i>Question</i>
Utility Value (UV)	How important is the Number of times an OER has been viewed in your decision to adopt and use the OER? How important is the frequency of likes associated with an OER in your decision to adopt and use it? Do you consider the number of dislike ratings on the OER to be important for you to accept to use the OER? How important is the number of citations of the OER in your decision to accept and use the OER in your mainstream learning? Do you consider the reference frequency of the OER is a determinant of your acceptance and use of the OER?
Performance Expectancy (EP)	Comment on the help of Open Educational Resources in accomplishing learning activities?
Effort Expectancy (EE)	Do you consider Open Educational Resources navigation to be clear and understandable?
Social Influence (SI)	Do you believe social peers influence students to use Open Educational Resources?
Facilitating Conditions (FC)	Would you say having the necessary prior knowledge influences students to use Open Educational Resources?
Hedonic Motivation (HM)	Can it be said that students enjoy using Open Educational Resources, please comment?
Price Value (PV)	Marketing and advertising campaigns project Econet Wireless Zimbabwe EcoSchool Open Education Resources initiative as good value for money to learners and educators. Please comment?
Habit (HT)	Some say students are driven to use Open Educational Resources by a common habit. Can we say students are significantly driven by habit to use OER?
Behavioural Intention (BI)	Is it correct to assume in general that students plan to use Open Educational Resources e.g. YouTube videos frequently.
Use (U)	‘Students use Open Educational Resources frequently’ what is your opinion on that?

Appendix C: Adopted OER Knowledge, Competences and Skills

“Below is a ‘shopping list’ of the knowledge, competences and skills that higher education institutions may wish to develop in order to use OER effectively. This list highlights areas where openness adds value and/or where particular attention is needed. These areas are:

1. Expertise in advocacy and promotion of OER as a vehicle for improving the quality of learning and teaching in education (having a good grasp of both conceptual and practical issues, policy implications, etc.). This requires:

- (a) Commitment to the concept of openness, without which any attempts at advocacy are unlikely to succeed;
- (b) Understanding of the pros and cons of different Open Licensing arrangements, combined with insight into how most current policy environments constrain the use of OER and Open Licensing of intellectual capital (with a particular focus on the challenges of persuading educational decision makers in environments where intellectual property policies make no provision for Open Licensing);
- (c) Clarity about the difficult issues associated with using proprietary content in diverse online environments, new media and technology and therefore awareness of the benefits of OER as open resources that are usable, reusable and adaptable with no restrictions;
- (d) Clarity about the economic benefits of OER, in terms of marketing institutions and programmes, the cost-effectiveness of materials production, and policies, contracts and grants;
- (e) Sound knowledge of practical examples of the use of OER to illustrate key points; and
- (f) Up-to-date knowledge of the arguments for and against use of OER.

2. Legal expertise to be able to:

- (a) Understand and advise people on how copyright works generally, the nature of copyright licensing and different approaches to the licensing of materials;
- (b) Review copyright policies, contracts and grant conditions currently in place at the institution, including policies establishing who owns copyrightable content developed by administrators, academic staff and others;
- (c) Develop and adapt privacy, copyright and IPR policies that facilitate and achieve goals related to publishing OER;

(d) Determine requirements for copyright clearance and privacy to release materials under open licences; and

(e) Reflect copyright and disclaimer statements accurately in materials of different kinds and multiple media.

3. Expertise in developing and explaining business models that justify and illustrate the use and benefits of Open Licensing to institutions, academic staff, and other creators of educational content (including publishers).

4. Programme, course and materials design and development expertise, with a particular focus on helping academic staff harness the full potential of resource-based learning and student-centred pedagogies in their programmes and courses. An understanding of educational approaches is important (e.g., being able to differentiate among open, distance, electronic and blended learning, and their respective merits), as is an understanding of the context of education in the specific sector in which work is taking place. In addition, it requires skills in:

(a) Conducting educational needs assessments;

(b) Managing curriculum development processes;

(c) Effectively identifying target audiences; (d) Defining effective and relevant learning outcomes;

(e) Identifying relevant content areas for programmes, courses and modules; (f) Selecting appropriate combinations of teaching and learning strategies to achieve identified learning outcomes;

(g) Carrying out financial planning to ensure affordability and long-term sustainability of teaching and learning strategies selected;

(h) Developing effective and engaging teaching and learning materials;

(i) Integrating meaningful student support into materials during design;

(j) Designing appropriate effective assessment strategies;

(k) Applying the most appropriate media and technologies to support learning outcomes;

(l) Using media and technologies to support educational delivery, interaction and student support;

(m) Sourcing OER, based on knowledge of the strengths and features of the main repositories, specialised repositories and OER search engines;

- (n) Adapting and integrating OER coherently into contextualised programme and course curricula;
- (o) Negotiating with external individuals and/or organisations to issue or re-issue resources under open licences;
- (p) Re-versioning existing resources using optical character recognition where they do not exist in digital form;
- (q) Understanding: • whether it is permissible to modify the content when customising material and, if so, to what extent it can be done and how it should be handled; and • if work has been adapted for a specific purpose, how this should be indicated in the customised content;
- (r) Reinforcing the need to credit the original author/source of the content that is being accessed for use through Open Licensing; and
- (s) Implementing the necessary processes for producing print-on-demand texts.

5. Technical expertise. This set of skills is tightly connected to the skills of materials design and development. Increasingly, resource-based learning and student-centred strategies are harnessing a wide range of media and are deployed in e-learning environments, facilitated by the ready availability of digitised, openly licensed educational content. This requires skills in:

- (a) Advising institutions on the pros and cons of establishing their own repositories, as well as providing advice on other possible ways of sharing their OER;
- (b) Creating stable, operational virtual learning environments (VLE) and content repositories;
- (c) Supporting academic staff in developing courses within already operational or newly deployed VLE; and
- (d) Developing computer-based multimedia materials (including video and audio materials).

6. Expertise in managing networks/consortia of people and institutions to work cooperatively on various teaching and learning improvement projects including an ability to adapt to challenging environments (for example, power outages, physical discomfort, difficult personalities, institutional politics) and remain focused on the task at hand.

7. Monitoring and evaluation expertise to design and conduct formative evaluation processes, as well as longer-term summative evaluation and/ or impact assessment activities that determine the extent to which the use of Open Licensing has led to

improvements in the quality of teaching and learning, greater productivity, enhanced cost-effectiveness, and so on.

8. Expertise in curating and sharing OER effectively. This includes:

- (a) Technical skills to develop and maintain web platforms to host OER online, as well as to share the content and metadata with other web platforms;
- (b) Ability to generate relevant and meaningful metadata for OER; (c) Knowledge of, and skills to deploy, standardised global taxonomies for describing resources in different disciplines and domains; and
- (d) Website design and management skills to create online environments in which content can be easily discovered and downloaded.

9. Communication and research skills to be able to share information about OER, in the form of web updates, newsletters, brochures, case studies, research reports and so on. This includes the full spectrum of skills required for such communication activities, from researching and documenting best practices and core concepts to graphic design and layout.” (UNESCO, 2015, p. 17–20)

Appendix D: Promoting More Effective and Inclusive Education by Designing OER

“Students learn differently. Learning experiences that match a student’s individual learning needs result in the best learning outcomes. OER should be open and accessible to students with a diversity of learning needs. Learning needs are affected by: • Sensory, motor, cognitive, emotional and social constraints; • Learning styles or approaches; • Linguistic and cultural backgrounds; and • technical, financial and environmental constraints. Accessible learning is achieved by matching the individual learning needs of each student with a learning experience that addresses those needs. This can be accomplished through the resource delivery system by reconfiguring the resource, where possible, augmenting the resource or replacing the resource or parts of it with another resource that addresses the same learning goals. To support this, learning materials or educational resources should:

1. Include labelling to indicate what learning needs the resource addresses;
2. Allow the creation of variations and enhancements through open licences;
3. Support flexible styling (e.g., enlarging the font, enhancing the colour contrast and adjusting the layout for students with vision impairments or mobile devices);
4. Support keyboard control of functions and navigation (for students who cannot use or do not have access to a mouse or pointing device);
5. Provide audio or text descriptions of non-text information presented in videos, graphics or images (for students who have visual constraints or who have limited displays);
6. Provide text captions of information presented in audio format (for students who have hearing constraints or lack audio interfaces);
7. Cleanly separate text that can be read in the interface from underlying code or scripting (to enable translation);
8. Use open formats wherever possible to make it easier for alternative access systems and devices to display and control the resource; and
9. Adhere to international standards of interoperability so that OER can be used on a wide variety of devices and applications.

The resource delivery system should also enable each student, or her/his support team, to identify the student’s functional learning needs.” (UNESCO, 2015, p. 21–22)

Appendix E: Africa University Ethics Clearance



(A United Methodist Related Institution)
INVESTING IN AFRICA'S FUTURE

AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE (AUREC)

P.O. BOX 1320, MUTARE, ZIMBABWE • OFF NYANGA ROAD, OLD MUTARE • TEL: (+263-20) 60975/60026/61611 • E-MAIL: aurec@afriau.edu • WEBSITE: www.afriau.edu
Ref: AU202/17 August 30, 2017

Agripah Kandiero
Africa University
Box 1320
Mutare

RE: Adoption and usage characteristics of Open Education Resources (OER) among Higher Education Institution (HEI) learners: A case study of Africa University-Zimbabwe.

Thank you for the above titled proposal that you submitted to the Africa University Research Ethics Committee for review. Please be advised that you should now proceed to get permission from the university, through the registrar before collecting data.

The approval is based on the following.

- a) Research proposal
- b) Questionnaires
- c) Informed consent form

- **APPROVAL NUMBER** AU202/17
This number should be used on all correspondences, consent forms, and appropriate documents.
- **AUREC MEETING DATE** NA
- **APPROVAL DATE** August 30, 2017
- **EXPIRATION DATE** August 29, 2018
- **TYPE OF MEETING** Expedited

After the expiration date this research may only continue upon renewal. For purposes of renewal, a progress report on a standard AUREC form should be submitted a month before expiration date.

- **SERIOUS ADVERSE EVENTS** All serious problems having to do with subject safety must be reported to AUREC within 3 working days on standard AUREC form.
- **MODIFICATIONS** Prior AUREC approval is required before implementing any changes in the proposal (including changes in the consent documents)
- **TERMINATION OF STUDY** Upon termination of the study a report has to be submitted to AUREC using standard form obtained from AUREC.

Yours Faithfully

MITI G.P. AUREC Administrator
FOR CHAIRPERSON, AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE



Appendix F: University of Witwatersrand Ethics Clearance

Wits School of Education



27 St Andrews Road, Parktown, Johannesburg, 2193 Private Bag 3, Wits 2050, South Africa. Tel: +27 11 717-3064 Fax: +27 11 717-3100 E-mail: enquiries@educ.wits.ac.za Website: www.wits.ac.za

26 March 2018

Student Number: 1547028

Protocol Number: 2018ECE004D

Dear Agripah Kandiero

Application for Ethics Clearance: Doctor of Philosophy

Thank you very much for your ethics application. The Ethics Committee in Education of the Faculty of Humanities, acting on behalf of the Senate, has considered your application for ethics clearance for your proposal entitled:

Adoption and usage of emerging technologies by learners in Higher Education Institutions (HEI): A case study of adoption and use of Open Education Resources (OER) at Africa University in Zimbabwe

The committee recently met and I am pleased to inform you that clearance was granted.

Please use the above protocol number in all correspondence to the relevant research parties (schools, parents, learners etc.) and include it in your research report or project on the title page.

The Protocol Number above should be submitted to the Graduate Studies in Education Committee upon submission of your final research report.

All the best with your research project.

Yours sincerely,

A handwritten signature in black ink, appearing to read "M. M. Mhlanga".

Wits School of Education

011 717-3416

cc Supervisor - Dr Ephraim Mhlanga

Appendix G: Ethics Compliance Tools

Information Sheet Learners

DATE: January 2018

Dear Learner

My name is Agripah Kandiero and I'm a PhD student in the School of Education at the University of the Witwatersrand.

I am doing research on **Adoption and usage of emerging technologies by learners in Higher Education Institutions (HEI): A case study of adoption and use of open education resources (OER) at Africa University in Zimbabwe**

My investigation involves identifying and understanding the determining variables and patterns of Open Educational Resources adoption and use among Africa University students after the EcoSchool OER intervention in February 2014. Understanding of factors that facilitate or inhibit adoption of OER provides an opportunity for creating an enabling institutional environment. The distinctive feature of this research is that in addition to measuring variables and patterns of OER adoption and use at Africa University, it seeks to propose an ideal OER intervention model for the institution as the final research outcome. The questionnaire takes approximately 10 minutes to complete. It consists of a demographic section, and sections to get your assessment on Effort Expectancy, Social Influence, Performance Expectancy, Facilitating Conditions, Price Value, Hedonic Motivation, and Experience of Open Educational Resources.

Would you mind if, I invite you to participate in this research. I need your help with the completion of the attached questionnaire.

Remember, this is not a test, it is not for marks and it is voluntary, which means that you don't have to do it. Also, if you decide halfway through that you prefer to stop, this is completely your choice and will not affect you negatively in any way.

I will not be using your own name but I will make one up so no one can identify you. All information about you will be kept confidential in all my writing about the study. Also, all collected information will be stored safely and destroyed between 3–5 years after I have completed my project.

I look forward to working with you!

Please feel free to contact me if you have any questions.

Thank you



Agripah Kandiero

23 Wahlberg Eagle, Amberfield Crest, Centurion, 017

Email: agripah@gmail.com, kandieroa@africau.edu, Cell: +27 764909598, +27 658949175

Learner Consent Form

Please fill in the reply slip below if you agree to participate in my study called: **Adoption and usage of emerging technologies by learners in Higher Education Institutions (HEI): A case study of adoption and use of open education resources (OER) at Africa University in Zimbabwe**

My name is: _____

Permission for questionnaire/test

I agree to fill in a question and answer sheet or write a test for this study. YES/NO

Informed Consent

I understand that:

- my name and information will be kept confidential and safe and that my name and the name of my school will not be revealed.
- I do not have to answer every question and can withdraw from the study at any time.
- I can ask not to be audiotaped, photographed and/or videotape
- all the data collected during this study will be destroyed within 3–5 years after completion of my project.

Sign_____ Date_____

Africa University Staff Consent Form

Please fill in and return the reply slip below indicating your willingness to be a participant in my voluntary research project called: **Adoption and usage of emerging technologies by learners in Higher Education Institutions (HEI): A case study of adoption and use of open education resources (OER) at Africa University in Zimbabwe.**

I, _____ give my consent for the following:

Permission to review/collect documents/artifacts

I agree that (SPECIFY DOCUMENT) can be used for this study only.

Circle one

YES/NO

Permission to be audiotaped

I agree to be audiotaped during the interview or observation lesson

YES/NO

I know that the audiotapes will be used for this project only

YES/NO

Permission to be interviewed

I would like to be interviewed for this study.

YES/NO

I know that I can stop the interview at any time and don't have to answer all the questions asked.

YES/NO

Informed Consent

I understand that:

- my name and information will be kept confidential and safe and that my name and the name of my school will not be revealed.
- I do not have to answer every question and can withdraw from the study at any time.
- I can ask not to be audiotaped, photographed and/or videotape
- all the data collected during this study will be destroyed within 3–5 years after completion of my project.

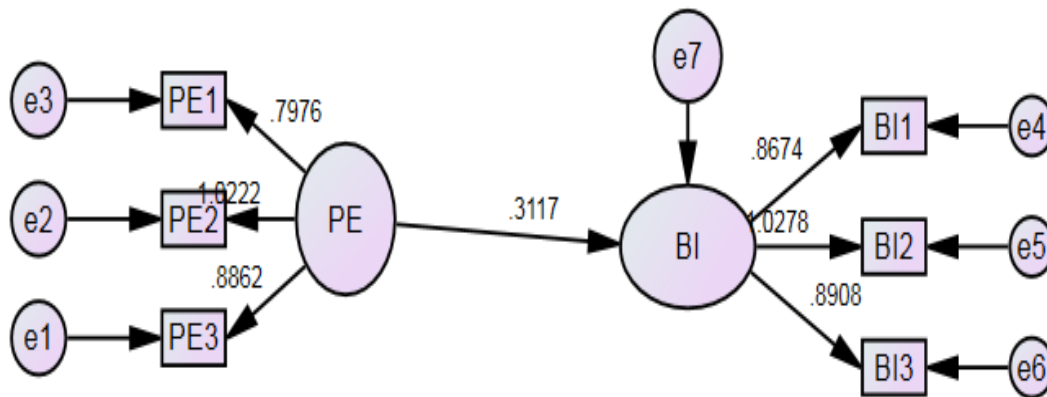
Sign_____ Date_____

Appendix H: Hypothesis Tests SPSS Output

H1: PE→BI Performance Expectancy significantly influences Behavioural Intention.

H1 Regression Weights: (Group number 1–Default model)

	Estimate	S.E.	C.R.	p	Label
BI ← PE	.310	.049	6.256	***	par_5
PE3 ← PE	1.000				
PE2 ← PE	1.105	.034	32.949	***	par_1
PE1 ← PE	.984	.046	21.387	***	par_2
BI1 ← BI	1.000				
BI2 ← BI	1.136	.034	33.061	***	par_3
BI3 ← BI	.989	.038	25.726	***	par_4

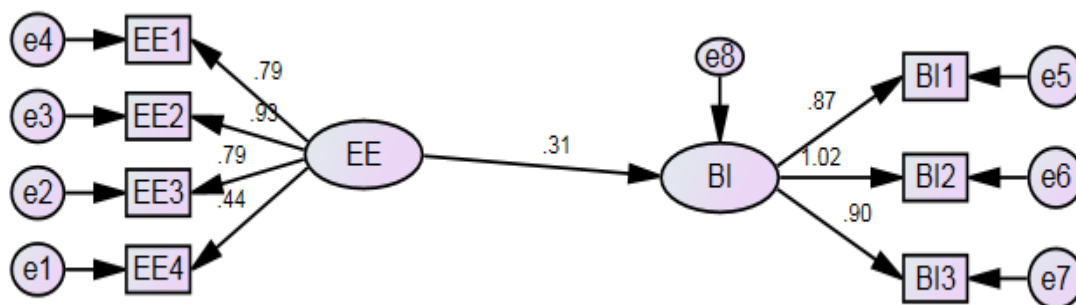


H2: EE→BI Effort Expectancy significantly influences Behavioural Intention.

H2 Regression Weights: (Group number 1–Default model)

	Estimate	S.E.	C.R.	p	Label
BI ← EE	.650	.129	5.054	***	par_6
EE4 ← EE	1.000				
EE3 ← EE	1.637	.193	8.472	***	par_1

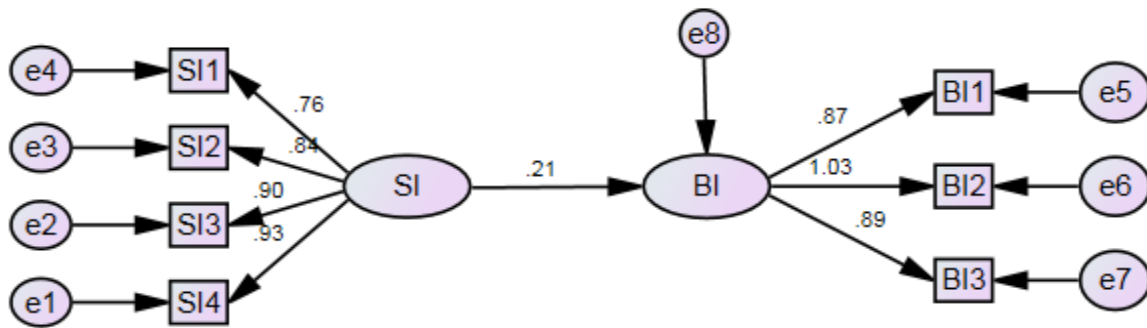
	Estimate	S.E.	C.R.	p	Label
EE2 ← EE	2.600	.297	8.749	***	par_2
EE1 ← EE	2.161	.256	8.454	***	par_3
BI1 ← BI	1.000				
BI2 ← BI	1.121	.033	33.609	***	par_4
BI3 ← BI	.987	.037	26.382	***	par_5



H3: SI→BI Social Influence significantly influences Behavioural Intention.

Regression Weights: (Group number 1–Default model)

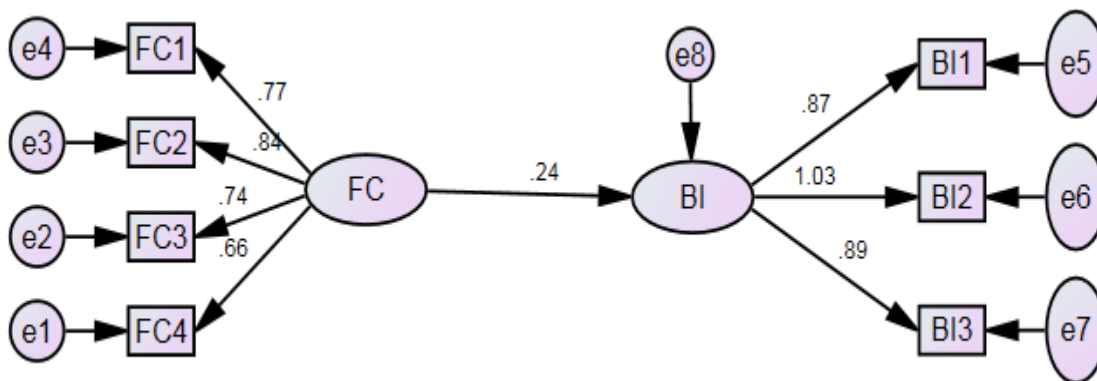
	Estimate	S.E.	C.R.	p	Label
BI ← SI	.208	.051	4.068	***	par_6
SI4 ← SI	1.000				
SI3 ← SI	.958	.032	29.798	***	par_1
SI2 ← SI	.975	.045	21.899	***	par_2
SI1 ← SI	.894	.049	18.060	***	par_3
BI1 ← BI	1.000				
BI2 ← BI	1.140	.035	32.803	***	par_4
BI3 ← BI	.987	.039	25.507	***	par_5



H4: FC→BI Facilitating Conditions significantly influence Behavioural Intention.

Regression Weights: (Group number 1–Default model)

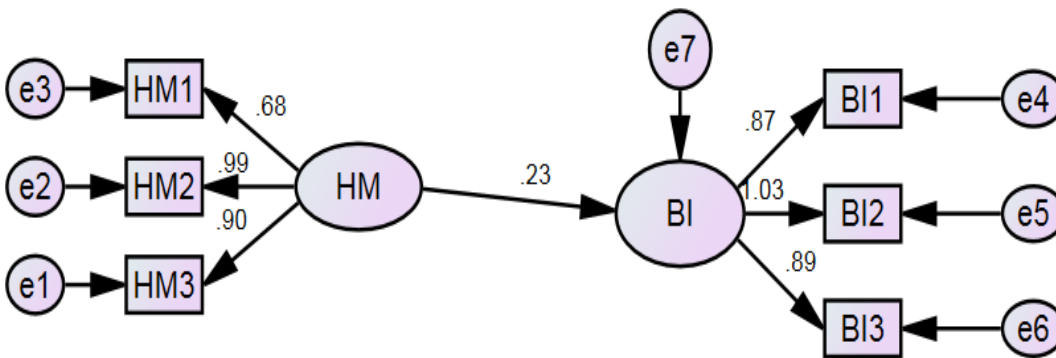
	Estimate	S.E.	C.R.	p	Label
BI ← FC	.245	.058	4.233	***	par_6
FC4 ← FC	1.000				
FC3 ← FC	.734	.060	12.167	***	par_1
FC2 ← FC	1.089	.105	10.400	***	par_2
FC1 ← FC	1.032	.100	10.352	***	par_3
BI1 ← BI	1.000				
BI2 ← BI	1.133	.034	33.390	***	par_4
BI3 ← BI	.986	.038	25.820	***	par_5



H5: HM→BI Hedonic Motivation significantly influences Behavioural Intention.

H5 Regression Weights: (Group number 1–Default model)

	Estimate	S.E.	C.R.	p	Label
BI ← HM	.209	.046	4.528	***	par_5
HM3 ← HM	1.000				
HM2 ← HM	1.056	.038	27.521	***	par_1
HM1 ← HM	.905	.056	16.238	***	par_2
BI1 ← BI	1.000				
BI2 ← BI	1.138	.035	32.864	***	par_3
BI3 ← BI	.989	.039	25.638	***	par_4

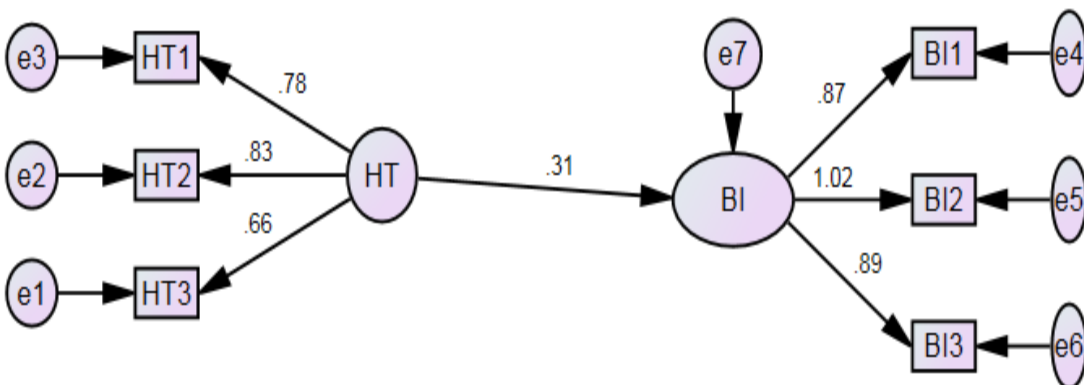


H6: HT→BI Habit significantly influences Behavioural Intention.

Regression Weights: (Group number 1–Default model)

	Estimate	S.E.	C.R.	p	Label
BI ← HT	.407	.076	5.377	***	par_5
HT3 ← HT	1.000				
HT2 ← HT	1.770	.152	11.616	***	par_1
HT1 ← HT	1.598	.138	11.620	***	par_2
BI1 ← BI	1.000				
BI2 ← BI	1.125	.034	33.401	***	par_3

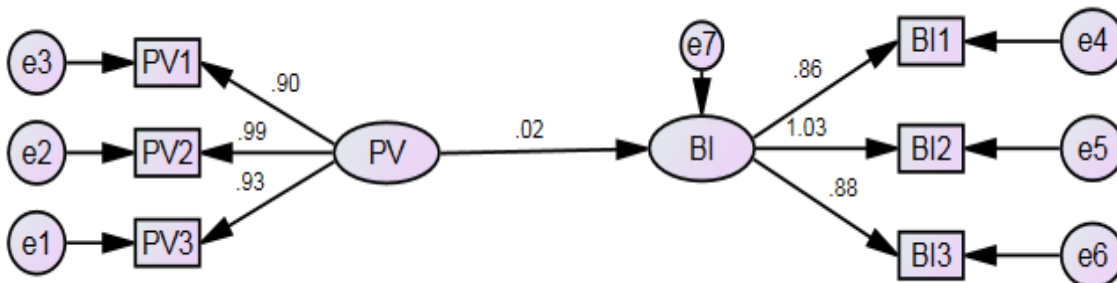
	Estimate	S.E.	C.R.	p	Label
BI3 ← BI	.988	.038	26.196	***	par_4



H7: PV→BI Price Value significantly influences Behavioural Intention.

H7 Regression Weights: (Group number 1–Default model)

	Estimate	S.E.	C.R.	p	Label
BI ← PV	.012	.031	.388	.698	par_5
PV3 ← PV	1.000				
PV2 ← PV	.995	.023	43.425	***	par_1
PV1 ← PV	.846	.027	31.271	***	par_2
BI1 ← BI	1.000				
BI2 ← BI	1.149	.036	32.057	***	par_3
BI3 ← BI	.986	.039	25.098	***	par_4

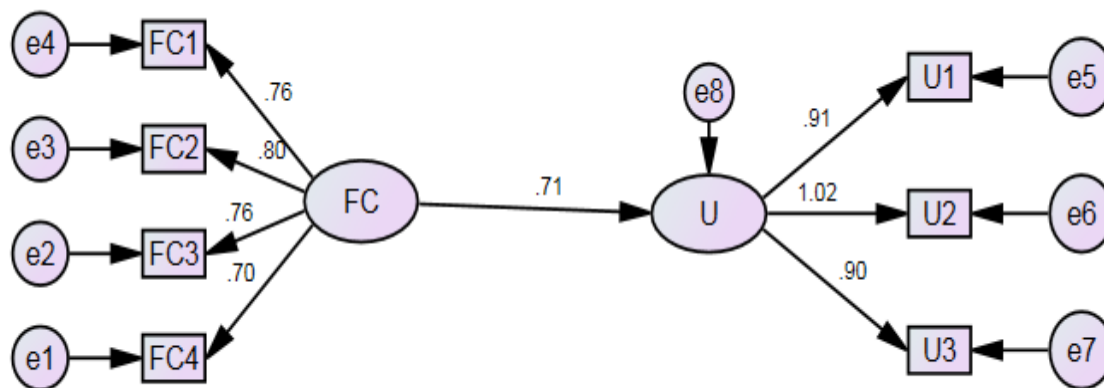


RQ2: How does the UTAUT2 variables significantly influence actual OER use behaviour among Africa University students?

H8: FC→U Facilitating Conditions significantly influence actual Use.

H8 Regression Weights: (Group number 1–Default model)

	Estimate	S.E.	C.R.	p	Label
U ← FC	1.026	.088	11.712	***	par_6
FC4 ← FC	1.000				
FC3 ← FC	.710	.054	13.073	***	par_1
FC2 ← FC	.971	.072	13.569	***	par_2
FC1 ← FC	.955	.073	13.001	***	par_3
U1 ← U	1.000				
U2 ← U	1.043	.024	43.916	***	par_4
U3 ← U	.893	.030	30.024	***	par_5

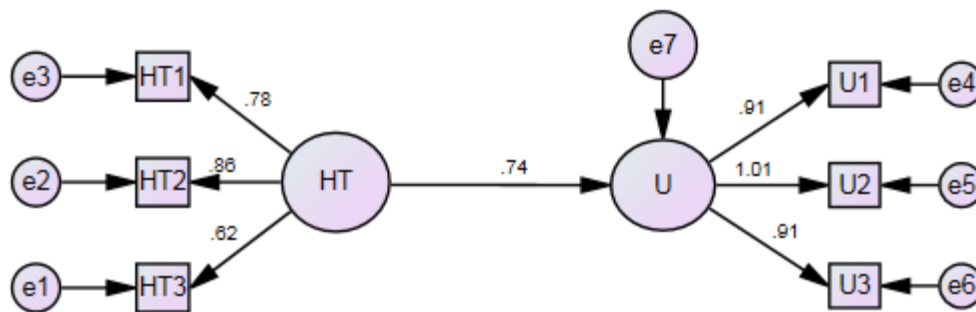


H9: HT→U Hedonic Motivation significantly influences actual Use.

H9 Regression Weights: (Group number 1–Default model)

	Estimate	S.E.	C.R.	p	Label
U ← HT	1.584	.151	10.479	***	par_5
HT3 ← HT	1.000				

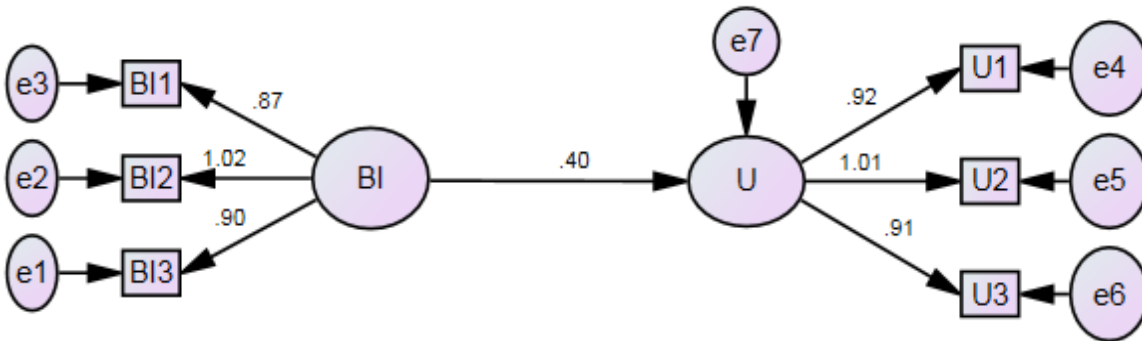
	Estimate	S.E.	C.R.	p	Label
HT2 ← HT	1.961	.163	12.039	***	par_1
HT1 ← HT	1.708	.147	11.578	***	par_2
U1 ← U	1.000				
U2 ← U	1.038	.024	43.907	***	par_3
U3 ← U	.897	.029	30.594	***	par_4



H10: BI→U Behavioural Intention significantly influences actual Use.

Regression Weights: (Group number 1–Default model)

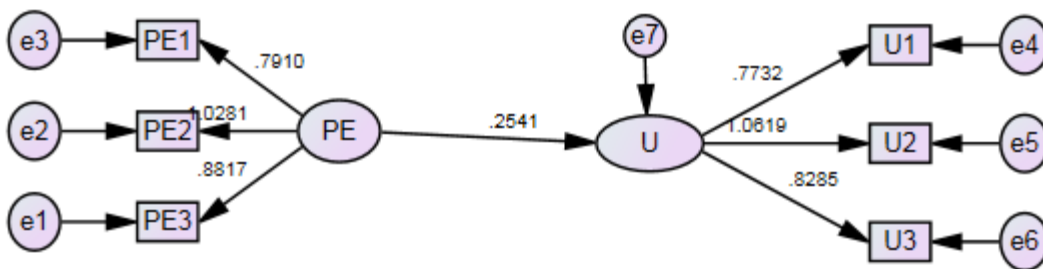
	Estimate	S.E.	C.R.	p	Label
U ← BI	.621	.078	7.944	***	par_5
BI3 ← BI	1.000				
BI2 ← BI	1.136	.029	38.691	***	par_1
BI1 ← BI	1.013	.038	26.355	***	par_2
U1 ← U	1.000				
U2 ← U	1.033	.024	43.286	***	par_3
U3 ← U	.898	.029	31.050	***	par_4



H11: PE→U Performance Expectancy significantly influences Use

H11 Regression Weights: (Group number 1–Default model)

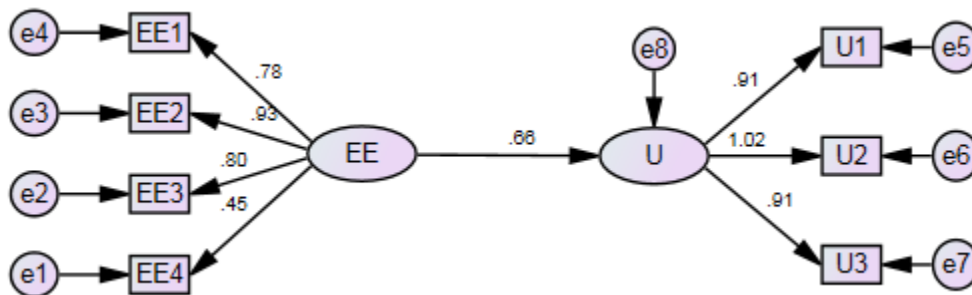
	Estimate	S.E.	C.R.	p	Label
U ← PE	.243	.045	5.370	***	par_5
PE3 ← PE	1.000				
PE2 ← PE	1.117	.034	32.608	***	par_1
PE1 ← PE	.981	.047	20.997	***	par_2
U1 ← U	1.000				
U2 ← U	1.357	.037	36.196	***	par_3
U3 ← U	1.112	.039	28.305	***	par_4



H12: EE→U Effort Expectancy significantly influences Use

Regression Weights: (Group number 1–Default model)

	Estimate	S.E.	C.R.	p	Label
U ← EE	2.071	.265	7.809	***	par_6
EE4 ← EE	1.000				
EE3 ← EE	1.638	.187	8.739	***	par_1
EE2 ← EE	2.554	.297	8.610	***	par_2
EE1 ← EE	2.099	.253	8.314	***	par_3
U1 ← U	1.000				
U2 ← U	1.043	.024	42.743	***	par_4
U3 ← U	.900	.030	30.351	***	par_5

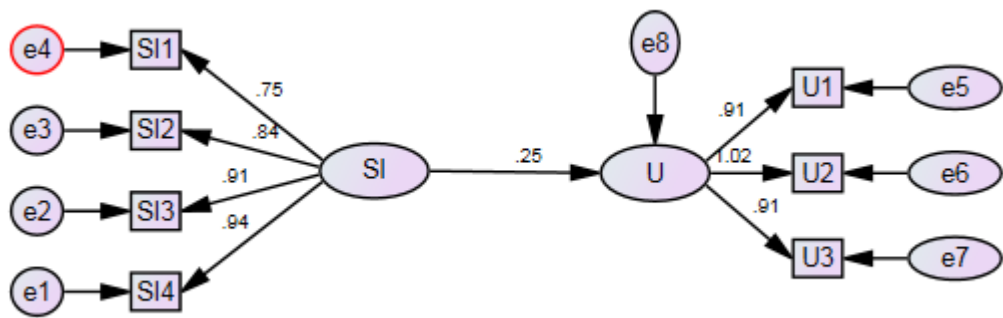


H13: SI→U Social Influence significantly influences Use

Regression Weights: (Group number 1–Default model)

	Estimate	S.E.	C.R.	p	Label
U ← SI	.378	.078	4.865	***	par_6
SI4 ← SI	1.000				
SI3 ← SI	.960	.034	28.640	***	par_1
SI2 ← SI	.969	.041	23.596	***	par_2
SI1 ← SI	.885	.046	19.150	***	par_3
U1 ← U	1.000				

	Estimate	S.E.	C.R.	p	Label
U2 ← U	1.039	.024	42.681	***	par_4
U3 ← U	.896	.029	30.500	***	par_5



Appendix I: Letter from Language Editor



WORDPLAY EDITING
Copy Editor and Proofreader
Email: karien.hurter@gmail.com
Tel: 071 104 9484
Website: <http://wordplayediting.net/>

To Whom It May Concern:

This letter is to confirm that the research proposal *Adoption and Usage of Emerging Technologies by Learners in Higher Education Institutions: The Case of Open Education Resource Currency at Africa University in Zimbabwe* by Agripah Kandiero was edited by a professional language practitioner.

Regards,

Karien Hurter

Name of Client: A Kandiero

This is to certify that language editing has been carried out on the following article/dissertation/thesis:

Title of article/dissertation/thesis:

Adoption and Use of Emerging Technologies by Learners in Higher Education Institutions:
The Case of Open Education Resource Currency at Africa University in Zimbabwe

Language editing was carried out to appropriate academic standards.

Edmore Mutekwe PhD (UJ), M.Ed (UZ), MBA (NUST),
B.Ed (UZ), Cert Ed (UZ), Dip. Pers. Man (IPMZ)

Rodwell Chindomu PGDHE (IIE), B.Ed. (English) (UZ), Dip Ed (UZ), DICJO
(CCOSA), TEFL (Trines Tesol)

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Rd

English Lecturer

