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FACTORS THAT INFLUENCE THE DIFFUSION PROCESS OF MOBILE DEVICES IN HIGHER EDUCATION IN BOTSWANA AND NAMIBIA

A Dissertation in

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by

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ABSTRACT

This comparative study uses the Diffusion of Innovation (DoI) theoretical framework to explore factors that influence diffusion of mobile devices in higher education in Botswana and Namibia. The five attributes (Relative Avantage, Compatability, Complexity, Trialability, and Observability) of the persuasion stage, which have been found in previous studies to influence the DoI were used to explore factors that influence the diffusion process of mobile devices at the University of Botswana and University of Namibia.

For the participants in this study, Complexity, Trialability, and Observability appeared to be the three factors that shed light on why mobile devices are popular among students for outside class activities such as texting and accessing social media websites, but their use in higher education has not gained the same degree of popularity as they have in social settings. In other words, data imply that mobile devices are seen by participants in this study as complicated and are limited in their Trialability and Observability.

The main implication here is that if mobile devices are to fully diffuse for participants in this study, complexity issues must be revealed and attempts made to reduce them. Similarly, attempts should be made to promote environments that provide opportunities to try out mobile devices for teaching and learning.

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DEDICATION

Ku Meme ngu avalandje

Ku Meme na Tate mba yaputudhandje

Ku Meme ngu apandje uuyuni

Ondemupandula shinene!

Chapter 1

Introduction

Diffusion of Innovation (DoI) is the process through which new ideas spread over time (Rogers, 1983). DoI theory attempts to explain the process that new ideas go through in order for them to take hold. Many studies have been conducted examining factors that influence diffusion processes, but few have been identified in the study of educational technology in Sub-Saharan Africa where technology is often looked to as a way of expanding education to the masses.

Sub-Saharan countries such as Botswana and Namibia are experiencing a surge in mobile device usage (Aker & Mbiti, 2010; Mbarika & Mbarika, 2006), where everyday use of tablets and mobile phones has spread rapidly at unprecedented rates (ICT Update, 2008; Kalba, 2008). In these countries, mobile devices are used for mobile banking (accessing bank accounts, paying for utilities and credit cards; Brown, Cajee, Davies, & Stroebel, 2003), mobile health (diagnosing disease, patient monitoring, accessing health information, awareness campaign), and mobile life (social communication and entertainment; Donner & Tellez, 2008; Semali & Asino, 2013). However, the diffusion of mobile devices that has occurred for everyday use, health, and business applications has not occurred in higher education environments, particularly public universities. The present study examined the factors that influence the diffusion process of these mobile devices at universities in Botswana and Namibia.

A common belief held in many African countries is that there is value in utilizing technology for educational purposes. Reports from the African Union (2006), which has a

membership of all 54 African countries; the Southern African Universities Association (SARUA, 2010), an association of all public universities of the 15 countries that make up the Southern African Development Community (SADC); and the Association of African Universities (Adubifa, 2000), which consists of 199 African universities, provide evidence of commitments from African nations to make technology in education an integral part of educational systems.

Mobile devices are among the fastest growing technologies in the African continent, yet few institutions use mobile devices for learning, teaching, or administration practices in higher education (Ng'ambi, 2005). A comprehensive review of the literature found four institutions—the University of South Africa (UNISA; Nonyongo, Mabusela, & Monene, 2005), Makerere University in Uganda (Kajumbula, 2006), and University of Ibadan in Nigeria (Nwagwu, 2010)—use mobile devices for administrative purposes, in each case to notify students about the status of their application process through Standard Messaging Service (SMS). Although, reports indicate that desktop computers and laptops are used in classrooms and administrative practices, it is unclear why mobile phones have not penetrated this market (Abeli et al., 2010; Wilson-Strydom & Fongwa, 2012).

DoI scholars have cautioned that at times diffusion may be slow or hardly occur, even when a technological innovation has obvious advantages (Rogers, 1983). Moreover, knowledge of benefits of technology may be insufficient to cause diffusion, because other factors may affect the diffusion process. Rogers (2003) further cautioned that the diffusion process can sometimes be lengthy; often innovations are diffused years after they become available, or they can be diffused in one context but not in others. Similarly, Mbatha, Ocholla, and Le Roux (2011) noted that some innovations are adopted

rapidly, others fail, and some may lie dormant for an extended period of time but eventually diffuse. Although these studies may provide insight into the diffusion process of mobile devices in Botswana and Namibia's higher education, no research could be found that examines the factors that account for the slow pace of the diffusion process in these countries.

The present study examines the apparent paradox whereby mobile devices are used in everyday life, but appear to be absent at universities, which are expected to be the hub of innovation and new discoveries. Uses of mobile phones for texting, playing music, image sharing, and Internet access are spreading rapidly in societies, but at African universities, students leave these devices in their backpacks or outside the classroom when they attend lectures. The present study investigated the question of what accounts for differences in mobile device diffusion, whereby they are used in some contexts but are largely absent in others.

Statement of the Problem and Context

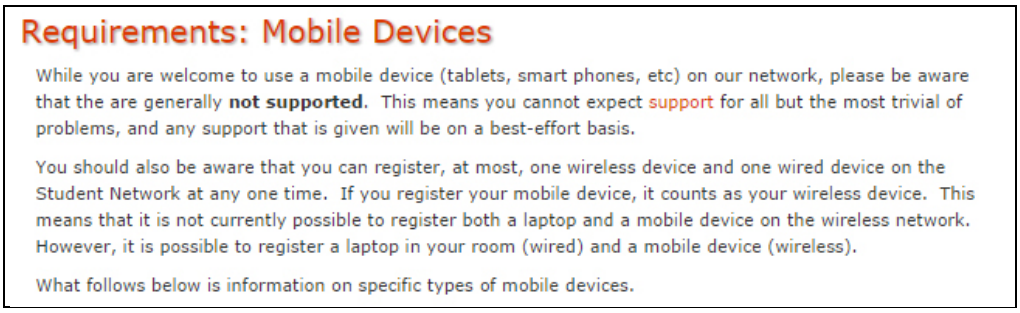
Mobile infrastructures have facilitated the spread of mobile devices to most sectors of society. In 2004, 70% of the world's population had never used a telephone (Paul & Seth, 2012). By 2012, less than 10 years later, the World Bank (2012) reported that close to 75% of the world had access to mobile phones. This rapid growth persists because of widely available mobile networks combined with reduced cost of airtime and data availability (Deloite & GSMA, 2012). Cost reductions made mobile devices affordable, accessible, and integral to the everyday lives of a majority of users in Africa (Mtebe & Raisamo, 2014). In Botswana and Namibia, two countries characterized by

large land mass, poor landline phone networks, poor electricity grids, and impoverished infrastructure to support computer access (Traxler & Leach, 2006), a mobile network that covers 90% of the country enabled the spread of mobile devices to most of the population.

However, in Sub-Saharan Africa, the diffusion of mobile devices is a paradox (Karsenti, 2009). In the health sector, various projects illustrate the spread of mobiles including the Wired Mothers project in Zanzibar, Tanzania, which uses mobile phones to address maternal and neonatal morbidity and mortality by distributing information to mothers and health care workers to assist during delivery. In banking, the m-Pesa project in Kenya gained attention as a SMS-based money transfer system that allows individuals to send and withdraw money using their mobile phones. By August 2009, m-Pesa had grown to more than seven million users in a span of two years reflecting an adoption by 38% of the adult population in the country (Jack & Suri, 2010). In agriculture, the Cocoa Link Initiative in Ghana provides farmers with information about new farming practices and crop marketing through their mobile phones (World Cocoa Foundation, 2011). However, when it comes to higher education, an accounting of projects that evidence the benefits can hardly be found (Alrasheedi & Capretz, 2013; Utulu & Alonge, 2012) despite researchers promoting the use of mobile devices to provide both lecturers and students access to quality-on-demand information that can be location and time based (Agbatogun, 2013; Davidrajuh, 2005; Wabwoba, Omieno, Simiyu, & Sisungo, 2011).

Several reasons have been suggested for the absence of projects exemplifying the benefits of mobile devices in African higher education. First, although mobiles devices are present at universities, university IT support staff do not offer similar support for

mobile device users as given to those with laptops or desktop computers (see Figure 1-1). This means that if a university user encounters a technical issue while on campus, little to no support would be given.



Requirements: Mobile Devices

While you are welcome to use a mobile device (tablets, smart phones, etc) on our network, please be aware that the are generally **not supported**. This means you cannot expect support for all but the most trivial of problems, and any support that is given will be on a best-effort basis.

You should also be aware that you can register, at most, one wireless device and one wired device on the Student Network at any one time. If you register your mobile device, it counts as your wireless device. This means that it is not currently possible to register both a laptop and a mobile device on the wireless network. However, it is possible to register a laptop in your room (wired) and a mobile device (wireless).

What follows below is information on specific types of mobile devices.

Figure 1-1. Rhodes University mobile devices requirements.
Retrieved from http://www.ru.ac.za/studentnetworking/requirements/mobiledevices/

Second, higher education institutions seem to not be regarded as an important space for using mobiles in education. A report by UNESCO (Isaacs, 2012) reviewing projects on mobile devices reveals that the majority of projects in educational settings focus on primary through secondary schools and are concentrated in South Africa, Kenya, and Uganda. Moreover, these projects predominantly end after the pilot stage, in large part because they tend to be sponsored by donor agencies and cease to exist once funding is removed (Isaacs, 2012). Third, in African universities, mobile devices are not considered educational computing hardware. Such hardware consists mainly of desktop computers, which are limited in flexibility and mobility (Jairak, Praneetpolgrang, & Mekhabunchakij, 2009) and are costly because they require extensive infrastructure, such as construction of computer labs (Kukulska-Hulme & Traxler, 2005). Fourth, access to academic materials remains "PC-centric" (Chipangura, 2013), in large part because

academics and institutional policy makers depend on PCs while students primarily use mobile devices (Donner & Gitau, 2009).

Mobile devices are the most widely available technology at African universities. They are present at universities, where students, teachers, and administrators have access to them while on campus. The wide availability is perhaps because when compared to desktop computers, mobile devices are relatively cheap, portable, and viewed as personal devices (Kukulska-Hulme & Traxler 2005; Vosloo, 2012). They are extremely popular among students (Ng'ambi, 2005) for outside-of-class activities such as texting and accessing social media sites, but their use in higher education in Africa has not gained momentum to the same degree as they have in social settings. To maximize and benefit from the promises of mobile devices, a high adoption rate is needed (Arpaci, 2014).

Theoretical Framework

The current study uses the DoI theoretical framework to explain the factors that influence diffusion of mobile devices in higher education in Botswana and Namibia. Rogers' (1995, 2003) DoI theory is often used to explain whether and why technology is or is not adopted in education (Holloway, 1996). Surry and Farquhar (1997) argued that DoI theory makes valuable contributions to studying educational technology in three ways:

1. it helps explain why technologies are, or are not, adopted;
2. it aids in the development of systematic models that could guide the instructional innovation process;

3. it enables practitioners to work with potential adopters by providing for a way to understand the innovation process and theories of innovation.

The following sections, describe the diffusion of innovation process, present the five stages of DoI, with particular attention to the persuasion stage on which the present study is focused. The section will conclude with an explanation of how DoI will be used in the present study.

The Diffusion of Innovation Process

All innovations go through a process in which they move from the inventor(s) to being taken up by the masses. DoI describes the process by which (1) an innovation (2) is communicated through certain channels (3) over time (4) among the members of a group or social system (Rogers, 2003).

Innovation. An innovation is an idea, a practice, or an object viewed as new by an individual or unit of adoption. Newness does not imply having never existed before; an innovation need only be regarded as new or used in a new way, even if someone else was already aware of it. An example of newness could be the use of PowerPoint presentation software to design games for class. Most users of PowerPoint rely on it for making presentations. As such, using the software for games would constitute a new use for those who were not aware that the product could be used in such a manner. This dissertation examines the innovation of mobile devices, limited to mobile phones and tablets.

Communication channels. Communication channels are means by which messages get from one individual to another. Communication can involve mass media

channels such as television or interpersonal channels such as face-to-face exchange between individuals. Communication has been shown to be important, because individuals often base their evaluation of innovations on information from others who are familiar with them and have already adopted the innovations.

Time. Time is a critical component of the process because diffusion is assessed over time. The time dimension includes (1) the innovation-decision process, through which an individual arrives at the decision either to adopt and make full use of an innovation as the best course of action available or to reject and not adopt the innovation. (2) The second dimension of time is innovativeness, which refers to how early or late the individual or group adopts an innovation.. (3) The third dimension is the rate of adoption, which measures the number of those who adopt the innovation over time.

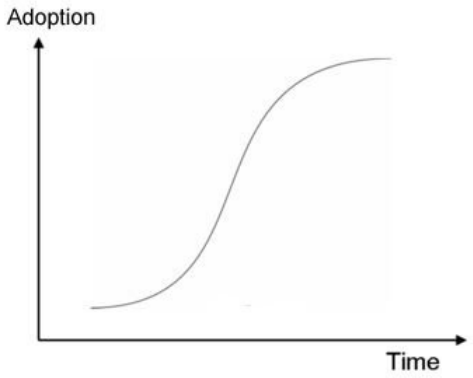


Figure 1-2. S-Curve of innovation

When the numbers of adopters are plotted on a cumulative frequency over time, the result is an S-shaped curve, which reveals that adoption begins with a few adopters, and then climbs as the number of adopters increases until the number levels off when many have adopted.

Social System. Social system refers to interrelated units connected in a common goal. The diffusion process takes place within a social system and can be affected by cultural boundaries, social structures, and opinion leaders. As such, there is a relationship between the social system and the diffusion process, which takes place within it.

DoI Stages

DoI consists of five stages, which form the innovation decision process in which an individual (or decision-making unit or a cultural system) evaluates and decides whether to incorporate an innovation into ongoing practices.

The diffusion of innovation process illustrated in Figure 1-3 begins with the *Knowledge Stage*, when an individual or a group becomes aware of the innovation and begins to understand how it functions. At the *Persuasion Stage*, a favorable or unfavorable opinion is formed based on the perceived characteristics of the innovation. At the *Decision Stage*, an individual (or decision-making unit) engages in activities that lead to a choice of whether to adopt or reject the innovation. In other words, adoption means that an individual (or decision-making unit) does something differently from what was being done previously. During the *Implementation Stage*, the innovation is put to use, and lastly in the *Confirmation Stage*, the individual or decision-making unit seeks confirmation of the chosen decision to adopt or reject the innovation.

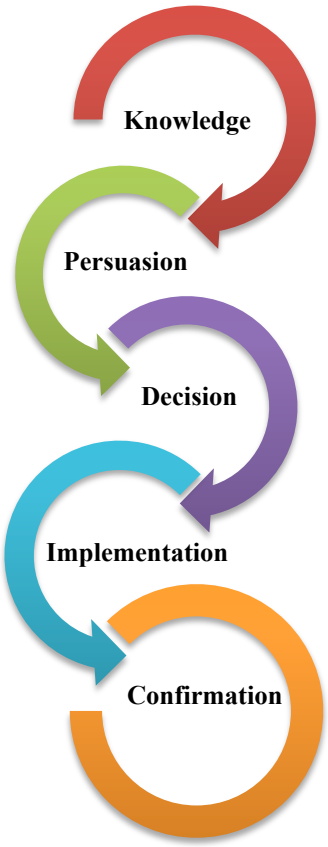


Figure 1-3. Five Stages in the Diffusion Process

Persuasion Stage. Among the stages of the DoI model, the persuasion stage is regarded as the most important. Up to 87% of adoption of an innovation is influenced by perceptions that potential adopters form toward an innovation (Rogers, 2003). Perceptions are formed based on five attributes listed in Table 1-1 and explained in further details in following paragraphs.

Table 1-1

Perceived attributes of an innovation

Attribute	Explanation
Relative Advantage	Refers to the extent that an innovation is perceived to be better than what an individual has or had before. If an innovation is seen to offer a greater relative advantage, then the rate of adoption increases.
Compatibility	Addresses whether or not an innovation is consistent with existing value structures and past experiences of a potential adopter. If an innovation does not conflict with existing value structures, then the possibility of adoption increases.
Complexity	Concerns perceptions that an innovation is difficult to understand and use. If an innovation is easy to use, then the possibility of adoption increases
Trial-ability	Focuses on whether potential adopters can try out an innovation before fully committing to it. If an innovation can be tried out or experimented with on a limited basis, then there is a greater chance for adoption.
Observability	Refers to the degree that results of an innovation are visible to others. If results are observable and potential adopters can ask question about it from friends or neighbors, adoption is easier.

Source: Rogers, 2003

Relative Advantage

Relative Advantage (RA) is the extent to which an innovation is perceived to be better than what the individual has or had. In terms of mobile devices, one immediate RA is that of instant communication compared to writing letters or sending a person to deliver a message. RA can also be expressed in various ways, including economic or social status gained. Semali and Asino (2011) found that mobile devices provide economic RA as exemplified by women in Tanzania who used mobile phones to call different markets to check prices and move their goods to where they could receive better deals.

Perception of RA varies depending on whether the innovation is seen as preventive (benefits are not readily apparent) or incremental (demonstrating immediate

benefits). Preventive innovations have a low RA whereas incremental innovations have high RA. For example the idea of not eating too much red meat to prevent heart disease (an unwanted future event) is harder to adopt than the incremental innovation of using a bandage to cover up a cut on an individual's finger where the benefit can be readily seen (immediate benefits). High RA helps speed up the diffusion process. The delayed gratification from a preventive idea, however, leads to difficulty in perceiving an RA and may explain why certain innovations are or are not or taking longer to diffuse.

Although Rogers does not rank the five perceived attributes in order of importance, researchers such as Greenhalgh, Robert, MacFarlane, Bate, and Kyriakidou (2004) have argued that RA is a *sine qua non*, an absolute necessity, because if potential adopters do not perceive a relative advantage, they are less likely to evaluate the other four attributes (Nutley, Davies, & Walter, 2002).

In the context of the present study, a review of the literature revealed no studies that consider the perceived relative advantage of mobile devices in Botswana and Namibia higher education. As such, this study seeks to discover whether there are relative advantages perceived by potential adopters at the Universities of Botswana and Namibia.

Compatibility

Compatibility refers to the extent that an innovation conforms to individuals' values, beliefs, and circumstances. An example of diffusion failure due to incompatibility with values and beliefs involves a two-year health campaign with 200 families in a Peruvian village. The campaign was aimed at persuading the community to boil drinking water, but it was unsuccessful in large part because it conflicted with values and beliefs

of the community. Local customs linked hot food with illness, and hence boiling water was deemed as only appropriate for the sick. Healthy persons were prohibited by community norms from drinking boiled water (Rogers, 2003). The new idea of boiling water—*the innovation that was being promoted*—was not compatible with the values of the community and as such failed to diffuse as part of the health campaign.

If the innovation is consistent with existing values, past experiences, and needs of potential adopters, this would lower uncertainty and ease the diffusion process. The present study considers whether the use of mobiles in teaching and learning is compatible with the values and beliefs at the University of Botswana (UB) and the University of Namibia (UNAM). Are there beliefs that potential adopters hold at the two institutions that are influencing the diffusion process? Are mobile devices compatible with the previously introduced ideas at UB and UNAM?

Complexity

Complexity is concerned with whether potential adopters perceive an innovation as difficult or complicated to use. If an innovation is seen as intuitive to potential users, then it will diffuse easily. Conversely, an innovation perceived as too complex will negatively impact the diffusion process. A mobile phone, for example, operates the same way as a telephone. A user dials numbers and after a few rings, a voice emanates from the receiver. Adopters did not have to learn new skills for making phone calls that differed from landlines; consequently, mobile phoned were easily diffused as a communication tool.

In the context of this study, a question of concern is whether mobile devices are seen as too complicated to use or integrate in the teaching and learning practices at UB and UNAM and hence slowing down the diffusion process.

Trialability

Trying out is one way in which potential adopters ascertain whether an innovation fits their needs or will work in their conditions and circumstances. In the case of mobile phones in Africa, the pay-as-you go model was a trialability aspect that helped with diffusion in social circles, where signing up for a contract is not necessary but customers can pay as they use mobile service. SIM cards can be purchased at stores in Botswana and Namibia, even by those without a physical mobile device of their own. Individuals purchase credit as needed and that minimizes the need to commit to a long-term contract or equipment. Rogers (2003) argued that the perception of being able to try out an innovation, by members of a social group, is positively related to its rate of adoption. In other words if one is able to try something out first before committing—similar to taking a car for a test drive before buying—there is a better chance for adoption to occur.

In the current study, it is important to examine whether trialability (i.e., being able to try out a mobile device for learning and teaching on a small scale) can be used to explain mobile device diffusion at UB and UNAM.

Observability

Observability refers to the degree that the innovation or its results are visible to others. Rogers (2003) suggested that observability of an innovation is positively related

to its rate of adoption. Kabla (2008) argued that early instances of observability of car phones helped mobile phones diffuse through society faster than landline phones, which took one hundred years to reach one billion subscribers.

Mobile phones were easily observed in cars. Drivers on the road were alerted to the presence of a car phone by the special antenna on a vehicle. The antenna for a car phone was different in both size and placement from a radio antenna. The observability continued with hand-held phones, which could be seen in the hands of users in shopping malls, airports, restaurants, and so on. Observability is an important attribute, because it acts as a further stimulus to adoption, especially for those who are late to the diffusion process. If an innovation can be seen, potential adopters can ask questions, lower their own uncertainty, and increase diffusion.

DoI in the Current Study

At its core, diffusion research is concerned with the process that increases or decreases the adoption of new idea, product, or practice by members of a group. DoI theory posits that, in general, innovations will be more readily adopted if they are perceived by the potential adopter to have or provide greater relative advantage than what is already being used; if they are compatible with the individual's values; if they can be tried out by the user before fully committing; if their usage can be observed; and if they are perceived as uncomplicated or less complicated then what is already in use (Rogers, 1983). Put differently, if the relative advantages of an innovation are known, then they could be promoted; if comparability issues are known, they can be addressed; if complexity issues can be revealed, attempts can be made to reduce them; if there is lack

of trialabilty, attempts can be made to provide opportunities to try; and if there are more opportunities to try, the chances for observability increase.

Given the importance of the persuasion stage in the DoI model, the current dissertation focuses on the persuasion stage as a way to understand the factors that influence the diffusion process at the UB and UNAM. Examining factors that affect diffusion of mobile devices in higher education is an important step into understanding what enables the decision to adopt or reject the innovation.

Why Compare Botswana and Namibia?

The application of the comparative method in education is based on a premise that engaging in research cross-culturally and cross-nationally provides an opportunity for deeper understanding of a phenomenon (Crosselly & Broadfoot, 1992; Nieben, 1982; Rosselló, 1963). Although the comparative method will be explained further in Chapter 3, this comparative case study was conducted because the phenomenon being examined occurs in the same context in the selected countries, and the goal is to understand how different or similar the causes are. This study took place at two national universities in two countries where data were collected from students and lecturers (faculty). UB and UNAM are the largest institutions in Botswana and Namibia, located in the capital city of their respective countries, where students come to study from all regions. Moreover, Information Communication Technologies (ICT) in education for both countries has been tied to national economic competitiveness. In other words, both Botswana and Namibia declared in their national plans that technology in education is crucial to development.

Conducting comparative study in educational technology is important for addressing unrealistic expectations about the benefits of educational technology. The lack of comparative scrutiny and indirect study of ICT comparatively has led to an acceptance of questionable assumptions about what technology can do in relation to education and society. An example would be claims such as those made by Mugimu (2006) that "higher education of quality could be brought to many more people if only universities in the developing world could get on the bandwagon of advancing ICTs and creatively tap into the current E-learning possibilities and innovations" (p. 69). Moreover, there is an assumption that virtual learning environments and online learning can provide education to marginalized populations; it is important to recognize that while certain learning environments are open for anyone to access, many individuals still do not have monetary or physical resources to enable them to participate in such learning.

As technology continues to be more present in education globally and as more people wrestle with arguments of positive transformations garnered from technology in education (Oliver & Goerke, 2008), the need for studies in ICT utilizing the comparative method will undoubtedly grow. The use of the comparative method in this study is to contribute a case study of examining an educational technology phenomenon cross nationally. As the indicators in Table 1-2 show, a comparison of Botswana and Namibia in this dissertation can be justified for several reasons.

Table 1-2

Botswana and Namibia Comparative Indicators

	Botswana	Namibia
Capital	Gaborone	Windhoek
Official Languages	English	English
Other major spoken languages	Setswana, Kalanga, Sekgalagadi	Afrikaans, Damara/Nama, Herero, German, Oshiwambo, Rukwangali, Silozi, Setswana
Total population (millions)	2,007	2,283
GDP per capita (PPP) US$	13,832	6,515
Adult literacy rate (% ages 15 and older)	84%	89%
Gross primary, secondary, tertiary school enrollment	72%	70%
Public expenditure on education as % of GDP	7.8%	8.3%
Population covered by a mobile-cellular network	99%	88%

Sources: 2012 The Little Data Book on Information and Communication Technology (ITU & World Bank - http://www.itu.int/ITU-D/ict/publications/material/LDB_ICT_2012.pdf)

The two countries are sparsely populated with populations of slightly over two million spread across the country. Both countries have national plans that are designed to transform them into developed countries and that focus on reaping the benefits of ICT in education. In both countries, there is a very high adoption of mobile devices, as evidenced by ITU subscription data, but no strategy as of yet for incorporating mobile devices into education. Moreover, the institutions where the study takes place are similar in size and also use English as the mode of instruction, which enabled the administering of the same instrument without translating it into different languages.

The Case of Botswana

Botswana aspires to become a Southern African regional leader in utilization of ICT in all sectors (Isaacs, 2007); an aspiration that is evidence by the government's investments in infrastructure (Jain & Mutula, 2001). Researchers have argued that it The country is ranked 89th among 142 countries compared on the 2012 World Economic Forum's ICT network readiness index (Dutta, Bilbao-Osorio, & Geiger, 2012) and, as indicated in Table 1-3, ranks seventh in the same index of African countries. The country went from zero mobile subscription in 2000 to having a subscription rate in 2010 that exceeded the country's population (Briceño-Garmendia & Pushak, 2011).

Table 1-3

2012 World Economic Forum's Africa Network Readiness Index

Rank	Country	Rank	Country	Rank	Country
1	Tunisia	**13**	**Namibia**	24	Cameroon
2	Mauritius	14	Zambia	25	Mali
3	South Africa	15	Uganda	26	Ethiopia
4	Egypt	16	Nigeria	27	Lesotho
5	Cape Verde	17	Malawi	28	Madagascar
6	Rwanda	18	Benin	29	Burkina Faso
7	**Botswana**	19	Algeria	30	Swaziland
8	Morocco	20	Mozambique	31	Burundi
9	Kenya	21	Côte d'Ivoire	32	Chad
10	Ghana	22	Tanzania	33	Mauritania
11	Senegal	23	Zimbabwe	34	Angola
12	The Gambia				

Source: World Economic Forum IT Global Competitiveness Index 2012-2013 (http://reports.weforum.org/global-competitiveness-report-2012-2013/)

The Government of Botswana has committed itself to promoting the educational use of technology and has produced numerous policy documents (Table 1-4) that specifically emphasize the role of technology in the country's educational system.

Table 1-4

Botswana ICT Policy Documents

Policy	Stated Purpose
Vision 2016 (1997)	• Government's strategic plan designed to turn country into a developed and competitive nation. • Consists of seven key goals, one of which is to produce an educated and informed nation and a regional leader in the production and dissemination of information. • Emphasizes ICT in education that allows students and teachers access to information through the improvement of ICT infrastructure.
Revised National Policy on Education (1994)	• Recognizes value of ICT in the early stages of learning. • Recommends inclusion of computers at all levels of schooling because introducing children to technology at an early age will ease transition into using technology at tertiary education level and thereby contribute toward building an information society.
Tertiary Education Policy (2008)	• Established framework for post-secondary education in Botswana. • Describes approach to developing tertiary education and how it will contribute to the realization of the national development goals. • Calls on tertiary institutions to play a leading role in exploiting the benefits of technology to transform Botswana into a knowledge-driven innovative society.
Maitlamo: National Policy for ICT Development (2005)	• Serves as the government's ICT road map in providing communication networks to drive social economic, political and cultural transformation toward national development through effective use of Information and Communication Technology (ICT). • Objectives include: improving access to computers in schools including vocational and tertiary level, improving internet connection, and capacity building on ICT skills for teachers.

Source: Radijeng (2010)

Historical context of education. Bordered by Namibia, South Africa, Zambia, and Zimbabwe, Botswana is a sparsely populated nation with a 2.1 million population in an area the twice the size of the United Kingdom (UK). The British colonial government that occupied the country took a "benign neglect" approach to developing the country (DuToit, 1995, p. 119), which, at independence in 1966, left the incoming domestic government with an estimated 90% population in poverty, a literacy rate of around 25%, a per-capita income of approximately US$60, and little infrastructure (Sebudubudu &

Botlhomilwe, 2012). However, for nearly five decades since independence, the country's growth rate, measured by gross domestic product (GDP), rose to over US$3,500 and has been recognized as one of the world's fastest growing economies (Mogae, 2005). Botswana is categorized as a middle-income country, a category that includes countries such as Colombia, China, Malaysia, Mauritius, Mexico, Namibia, Panama, Romania, and South Africa (World Bank, 2012).

Education system. The educational system in Botswana consists of a free, but non-compulsory, 12 years of primary, junior secondary, and secondary education, after which students may proceed to tertiary institutions (Farrell, Isaacs, & Trucano, 2007). The government of Botswana views ICT as a key component to realizing its goal of developing a quality educational system that adapts to a changing world and empowers graduates to become entrepreneurs and producers of goods and services (ITU, 2010).

University of Botswana

The University of Botswana (UB), located in Gaborone, the capital and largest city, serves as one of the locations where the present study was conducted (see Figure 1-4). UB has two branch campuses in Francistown, the second largest city, and Maun, a city in the north of the country.

Figure 1-4. Map of Botswana

UB is the main and largest tertiary institution in the country with an enrollment of 18,717 students. Currently, UB consists of seven faculties, the graduate school and the center for continuing education (listed in Table 1-1).

Table 1-5

University of Botswana enrollment

Botswana faculty	Student Enrollment
School of Graduate Studies	1692
Faculty of Health Sciences	663
Faculty of Humanities	3001
Faculty of Education	3813
Faculty of Business	3776
Faculty of Social Science	2613
Faculty of Engineering & Technology	1456
Faculty of Science	1703

Source: University of Botswana Annual Report 2012 - 2013

Botswana is rich in minerals such as diamonds and uses the revenues to support students attending UB as well as those students studying abroad when the field of study is not available at the institutions (Teferra & Altbach, 2003). UB has set itself the lofty goal of being a center of academic excellence in Africa and the world by advancing intellectual and human resource capability of the country and international community. Although the government funds the institution, the funding often does not match the rapid growth of the university, which results in the increased needed resources outstripping the level of funding.

ICT Infrastructure at University of Botswana

UB faces various infrastructure-related challenges. The institution is characterized by a high students-to-computers ratio as well as consistent power outages that disrupt workflow. Moreover, ICT use continues to be hampered by poor Internet connectivity and slow speed, which creates crowding, delays, and frustration for students; it also affects UB faculty and administration (Gerhan & Mutula, 2005; 2007). Such conditions have led researchers (Ashurst, 2001; Chang et al., 2012; Lekaukau, 2001) to suggest that mobile devices such as mobile phones, which far exceed the number of fixed-line telephones in Botswana, should be explored as a way of implementing technology in education. The argument advanced is that by circumventing low bandwidth and substandard computer resources, UB can leverage an already existing, robust network of mobile connectivity.

The Case of Namibia

Namibia's national plan, known as Vision 2030 (Government of the Republic of Namibia, 2004), commits the government to improving the quality of life of its citizens to the level of their counterparts in the developed world by 2030. Similar to Botswana, the role of ICT for educating and training a skilled labor force needed for Namibia's development is featured prominently.

Although the country is in the 105th position on the 2012 World Economic Forum's network readiness index and ranks 13th on the same index of African countries (see Table 1-3), Namibia has received commendation for committing financial resources to ICT and developing processes for implementing initiatives (Farrell et al., 2007). The documents listed in Table 1-6 guide the government's ICT initiatives. The Namibian government's ICT Policy in Education exemplifies the value Namibia places on ICT as a tool for development, as well as its importance in education as a subject and as a tool to assist in educational delivery and management.

Table 1-6

Namibia ICT-related Policy Documents

Policy Document	Stated Purpose
Vision 2030	to improve the quality of life of the people of Namibia to the level of their counterparts in the developed world by 2030
ICT Policy for Education	to prepare all Namibia's learners, students, teachers, and communities of today for the world economy of tomorrow
Education and Training Sector Improvement Plan (ETSIP)	to embed ICT at all levels of the education system and to integrate the use of ICT as a tool in the delivery of curriculum and learning across all levels for ICT skills and specializations required if Namibia is to make the transition to a Knowledge Based Economy (KBE) and the ICT skilled workforce it demands
TECH/NA!	to leverage ICTs to assist and facilitate learning for the benefit of all learners and teachers across the curriculum to improve the efficiency of educational administration and management across all levels

to broaden access to quality educational services for learners at all levels of the education system

Historical context of education. Namibia has a population of 2.2 million people in an area equivalent to that of France and Germany combined. It is bordered by the Atlantic Ocean on the west, Angola to the north, Zambia and Zimbabwe to the northeast, Botswana to the east, and South Africa to the south (Figure 1-4).

In 1990, the country achieved independence from the apartheid government of South Africa, which was preceded by a colonial period under Germany. Colonialism and apartheid laws ensured that Namibia remained divided for the purpose of controlling the population. This control involved a system of categorization based on a hierarchical racial paradigm in the country whereby the White population was at the top as superiors, individuals of mixed-race in the middle (referred to as Coloreds), and Black people at the bottom as third-class citizens. Moreover, development of Namibia's infrastructure was for the benefit of the elite White population and not the majority of the country. This was exemplified by roads to carry White minorities to White enclaves and the linking of mining facilities that exploited the vast mineral wealth of the country (Mbuende, 1986). Consequently, an uneven distribution of infrastructure developed, disadvantaging the majority of Namibians who had little access to the national communication grid. Mass adoption of mobile devices in the country, therefore, was enabled by the need for communication and provided a relative advantage because there were few other means of communication access (Asino, Wilder, & Ferris, 2011).

Namibia's educational system. Namibia's Ministry of Education (MoE) is tasked with overseeing the country's education system. Learners proceed through seven years of primary school, three years of junior secondary school, and two years of senior

secondary, for a total of 12 years of basic education. After completing secondary school, students can choose from tertiary institutions that include vocational training, polytechnic or universities (Farrell et al., 2007).

University of Namibia

Tertiary education is relatively new in Namibia, having been started around 1980. Prior to this, students sought permission to travel abroad for further education and most went mainly to South Africa (Teferra & Altbach, 2003). In 1992, two years after independence, the new government created the University of Namibia (UNAM) as the main public university, headquartered in Windhoek, the capital of the country. UNAM consists of 11 campuses spread throughout the country as marked on the map in Figure 1-5.

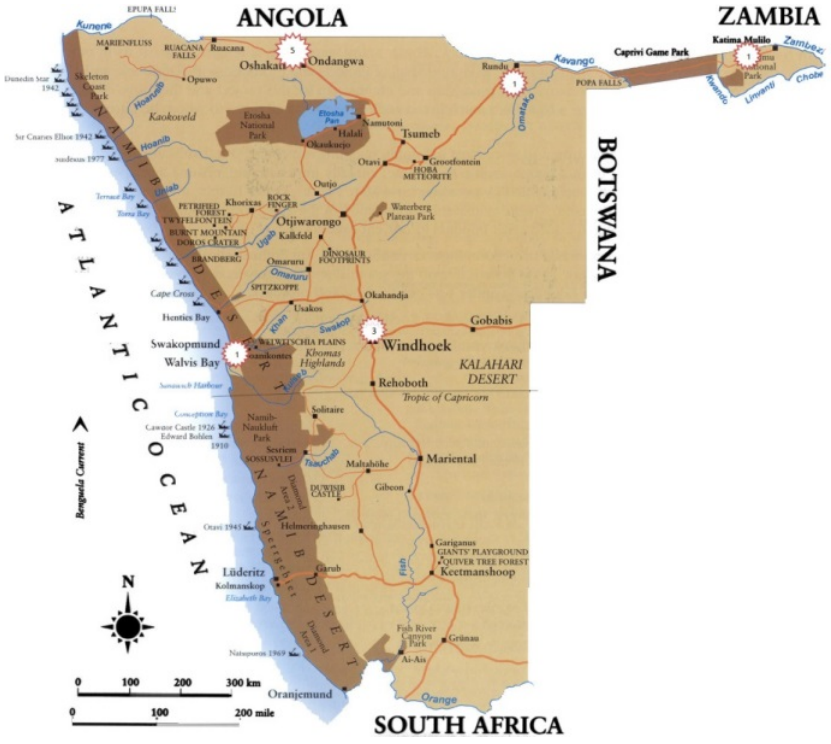


Figure 1-5. Map of Namibia showing UNAM campuses

UNAM currently consists of eight faculties listed in Table 1-7 that produce most of university graduates in the country.

Table 1-7

University of Namibia enrollment

Faculties	Student enrollment
External Studies	3094
Faculty of Agriculture and Natural Resources	642
Faculty of Economics and Management Science	3604
Faculty of Education	3818
Faculty of Humanities and Social Sciences	1942
Faculty of Law	882
Faculty of Health Sciences (School of Nursing & Public Health, School of Pharmacy and School of Medicine)	1402
Faculty of Science	1630
Faculty of Engineering and Information Technology	346
Foundation Programmes	176
Total enrollment	17536

Source: UNAM 2009 Annual report

ICT Infrastructure at University of Namibia

ICT infrastructure at UNAM is still in its infancy. February 2012 saw the establishment of a campus wide wireless network (eLearning Africa, 2012). However, connectivity issues remain, making it difficult to engage in academic activities such as accessing online research journals (Trotter, Kell, Willmers, Gray, Mchombu, & King, 2014).

Purpose of the Study

The purpose of this case study is to explain factors that influence the diffusion of mobile devices in Higher Education in Botswana and Namibia. The "*diffusion of mobile*

devices" in this study will be defined as the spread of mobile devices in higher education for use in formal teaching and learning practices.

Research Questions

The overall question that this dissertation aims to answer is: *What factors influence the use of mobile devices in higher education in Botswana and Namibia?* To obtain data to answer the main research question, this study is guided by the following sub-questions:

RQ1: What types of technologies do participants have and how are they used?

RQ2: Do perceptions toward diffusion attributes differ by institution?

RQ3: Do perceptions toward diffusion attributes differ by university status?

RQ4: Do perceptions toward diffusion attributes differ by gender?

RQ5: Do diffusion patterns in Namibia and Botswana differ from those exemplified by the Rogers DOI model?

RQ6: What do participants believe are the advantages of using mobile devices for learning over other technologies?

RQ7: What do participants perceive as barriers preventing the use of mobile devices in teaching and learning?

Limitations

This study has certain limitations that must be acknowledged. First, the sample consisted of only students who attended class on the days that the researcher was at the universities. Moreover, classes included in the study were chosen based on snowball sampling

(explained further in chapter 3). As such, randomness or equality of participants was not ensured. Second, generalizability is limited in this study because the study takes place at two universities in two countries that are different from other countries globally. The findings from this study may provide lessons learned that are applicable to other contexts, but additional research would need to be conducted that adjusts to new contexts. Third, the study was conducted in the capital cities of Botswana and Namibia because resources limited the inclusion of other campuses in the two countries. Although participants came from all corners of the country, it is foreseeable that inclusion of other campuses and other universities could have provided different results. And finally, the perceptions of university administrators or politicians in the ministries of education have not been included and could have provided different information.

Delimitations

In any research endeavor, decisions are made that define and direct the course of the study. These decisions, referred to as delimitations, include choice of topic to study, research questions, theoretical perspectives, and so on, and are made by the researcher in large part to bound the study in a manner that it is manageable to complete. Delimitations are in the control of the researcher; hence, it is important that the researcher acknowledge them for the purpose of the reader. In the context of this study, the main delimitation that must be acknowledged is the choice of the context of the study. While it is true that there is limited research on diffusion of innovation in Africa, the choice of research location is also influenced by the researcher being African and desiring to contribute to the knowledge base on the continent, specifically on Namibia. As such, it was intentional to

choose understudied countries in Southern Africa instead of comparing African countries to non-African countries. The goal was to compare African countries to learn from their perspectives and about their context. Moreover, the present study is guided by the belief that African countries have as much to learn from each other as from western nations.

Summary

The slow diffusion of mobile devices in higher education institutions in Africa is perplexing given that mobile devices are one of the fastest penetrating technologies on the continent. Although mobile devices present an opportunity to meet the educational technology needs of African countries like Botswana and Namibia, they are seemingly absent in formal education. Broadly, this dissertation is concerned with the diffusion of technology in education. The primary aim is to add to the limited body of knowledge on diffusion of technologies in education in Africa, focusing specifically on Botswana and Namibia, by examining factors that influence the adoption of mobile devices. Understanding the factors that influence the diffusion process is critical if mobile devices are to be successfully implemented into teaching and learning practices. The next chapter presents the literature reviewed for this study.

Chapter 2

Literature Review

This chapter provides a synthesis of literature focused on Diffusion of Innovations (DoI) and the comparative method. The purpose of this study is to explain factors that influence the diffusion of mobile devices in Higher Education in Botswana and Namibia. The goal of the literature review is to provide a justification for the study by explaining how other researchers have examined the topic and how the present study addresses the existing gaps or extend existing knowledge on the topic. To accomplish this goal, the review of literature in this chapter is organized into four sections: mobile devices in education, DoI theory, DoI research in Africa, and the comparative method. First, mobile devices are examined as an innovation in education. The second section summarizes Rogers's (1983, 2003) diffusion of innovation theory and its applications in the field of education. The third focuses on DoI research in Africa, and the last section reviews literature that informs the use of the comparative method in the study.

Mobiles Devices in Education

This section's focus is on three aspects of mobile devices in education: (a) characteristics of mobile devices, (b) mLearning in universities, and (c) research on use of mobile devices in African higher education. These three subsections constitute a nexus of evidence for why and how mobile devices can be used in education beyond merely the statistics of mass availability. This section describes characteristics of mobile devices that make the innovation appropriate and appealing in education; outlines the

ways educational institutions have explored capitalizing on affordances of mLearning specifically to support students' collaboration and sense-making practices; and concludes with research on mobiles in African Higher Education.

Characteristics of Mobile Devices

In this dissertation, the term "mobile device" is used to refer to mobile phones and tablet devices. The two main characteristics that distinguish mobile devices from other computing devices, such as desktops and laptops, are that they are compact and portable, often enabling users to move around with the technical capability of a powerful computer on their person (Prensky, 2005). Technical capabilities found on many mobile devices include built-in cameras and location-based tools such as GPS, accelerometers, and gyroscopes that measure the physical movements of the device and enable displays to be turned vertically or horizontally depending on how the device is held (Law, Roe, & Zhang, 2013; Searson, 2014). Additional capabilities include the ability to connect to cell-based networks to enable Internet connectivity (Klopfer, Squire, & Jenkins, 2002; Searson, 2014). Many mobile devices also feature programs referred to as applications (apps) that allow users to issue commands through "touch, gesture, and voice input commands" (Searson, 2014, p. xiii).

Features of mobile devices such as portability and constant Internet connection, combined with an interest in how devices can be used for learning and teaching, have brought about a new field referred to as "mobile learning" (mLearning). Sharples and Roschelle (2010) define mLearning as "the study of how to harness personal and portable technologies for effective education" (p. 4) across learning contexts. mLearning is also a

significant development because it integrates and extends mobility into what has been traditionally referred to as electronic learning - eLearning (Ally, 2009). Kusulska-Hulme and Traxler (2007) argue that mLearning is an important development, because the wide availability of portable, lightweight devices that are often small enough to fit in a pocket or in the palm of one's hand present education with an opportunity for "teaching and learning activities that are different from what is possible with other media" (p. 1). It is hypothesized that such learning and teaching practices can make use of the seamless integration of physical and virtual social environments by providing information and learning content that moves across different contexts, locations, and technologies (Dennen & Hao, 2014; Song, 2014; Vavoula & Sharples, 2009). Characteristics of mobile devices make it possible for those taking part in mLearning to choose when they want to learn and where they want to learn it (Alrasheedi, Capretz, & Raza, 2015). The importance of mobile device characteristics that enable mobility and mLearning cannot be understated, especially in the context of universities in Botswana and Namibia where students sometimes have to travel long distances to attend classes.

mLearning in Universities

To promote mLearning in universities, it is important to examine the perspectives that teachers and students hold regarding mobile devices as learning tools because they are ultimately the ones who would need to adopt the technology that enables mLearning. Researchers such as Traxler (2007) have argued that adoption of mLearning is likely to occur faster in higher education than in K-12 environments because most students in university settings already have their own mobile devices. Understanding the views that

student and teachers hold may unearth further possibilities of how to integrate mobile devices in the teaching and learning process (Kafyulilo, 2012). Educational institutions have explored ways of capitalizing on three affordances of mLearning to promote successful learning experiences for students: flexibility, collaboration, and sensemaking.

Using mobile devices for flexibility. mLearning affords flexibility especially for students in higher education. Flexibility occurs when students have choices in their learning experience (Collis & Moonen, 2001) and are not limited by time and space. Flexibility may be impossible or difficult through desktop computers, TV, Radio, or other ICT tools in education because such tools may not allow for interaction or when they do, they are not compact and portable (Brown, 2004; Kafyulilo, 2012; Sharples, 2007; Traxler, 2007; Traxler & Leach, 2006; Valk, Rashid, & Elder, 2010). Providing learning content on mobile devices can allow university learners, especially those who may have other occupations while in school, opportunities to acquire knowledge and skills wherever they are, on devices that are portable, in ways that fit their own particular circumstances.

Using mobile devices for collaboration. Mobile devices have been shown to promote student collaboration on learning tasks. For example, Fails, Druin, and Guha (2010) created a mobile application that allowed participants to write stories collaboratively. Users influenced the direction of stories by adding words, pictures, sounds, and other multimedia components. The core purpose of the system was mobility and collaboration as a way of supporting and encouraging *in situ* usage—on location, such as during a school trip. This means that students can use their devices to move beyond the boundaries of their institutions and engage in learning in authentic contexts.

Mobile devices have also been used to enable collaboration in English Language Learning research. Joseph, Binsted, and Suthers (2005) developed a system called PhotoStudy that enables students to study vocabulary words on both wired and wireless devices. The system was designed to enable and encourage users to collaborate on tasks such as generating images with their camera phones. Once images were generated, students worked together by going through images and testing their language skills. Teachers who participated in the study then used the images to collaborate with their students and jointly create stories.

Another example of a collaborative system was developed by Sun and Shen (2014). Teamwork as a Service (TaaS) was created to support mLearning collaboration through cloud-based online courses. Rather than focusing on collaboration enabled by mobile devices when students are in a synchronous physical environment, TaaS focused on a virtual environment with the goal of exploring ways to collaborate at a distance.

Using mobile devices for sensemaking. In general, sensemaking is about making connections to the environment using the available information. In the context of learning with mobile devices, sensemaking can be described as the conversations and interactions that occur when users move between "observations of the physical world and various digital representations of the underlying phenomena made available via a mobile device" (Rogers, Connelly, Hazlewood, & Tedesco, 2010, p. 12). With mobile devices, users can "collect, evaluate, understand, interpret, and integrate new information" to address a specific problem or accomplish a needed task (Abraham, Petre, & Sharp, 2008, p. 1).

Mobile devices have been used for sensemaking during visits to museums through the use of radio-frequency identification (RFID). Hsi and Fait (2005) used RFID tags to

create learning experiences in the Exploratorium, a hands-on science museum in San Francisco. The RFID application called the eXspot system consisted of an RFID reader that could be mounted on museum exhibits, an RFID card carried by visitors, a wireless network, a registration kiosk, and dynamically generated Web pages. Participants were issued RFID cards at the start of their museum visit. The cards were designed to show Exploratorium-related graphics on one side and an RFID chip with an external antenna on the other. As visitors approach an exhibit and place their RFID cards over the reader, information about the user is sent wirelessly to a database to record the ID number of the user, the time of the visit, and exhibit information. The RFID tag also enables users to interact with the exhibit by taking pictures. Pictures can be accessed on the kiosks in the museum with the RFID tags and are also recorded on a website that visitors can access when they leave the museum. On the website, visitors can review their experiences or, in the case of a class trip or assignment, a teacher could log on to the student's website to see what exhibits the student visited.

Similarly, Sung, Hou, Liu, and Chang (2010) developed a mobile guide system for learners to interact with peers and exhibitions in a museum. The research on the system involved the observation and analysis of learning behaviors of 65 sixth-graders from three elementary school classes in Taipei, Taiwan. Students visited the Shihsanhang Museum and used a museum mobile-guide system to interact with exhibits. The program guided learners through exhibits by providing context (including stories) that they could discuss with their peers, and complete the quest by solving a series of questions on their PDAs (Sung et al., 2010). Researchers reported that students using the mobile device as

support for sensemaking showed a high level of interactions in learning-related discussions.

Research on the Use of Mobile Devices in African Higher Education

Whereas there are many studies on mobile devices in education as evidenced by the previous sections, research studies on using mobile devices for learning and teaching at African universities are emerging. Mafenya (2014) explored the use of mobile technologies as a teaching and learning tool with undergraduates taking part in open and distance learning in Africa. The author argued that the proliferation of mobile phones across all sectors of society is supporting evidence that mobile technologies and infrastructure can also be leveraged to deliver flexible-educational opportunities.

Mtebe and Raisamo (2014) focused their examination on behavioral intentions to adopt mobile learning in five universities in Kenya and Tanzania. The study found that students in higher education in the two countries believed that mobile devices could be useful for learning "and will enable them to accomplish their learning activities faster and more efficiently" (p. 15). However, the authors cautioned that educators should also focus on the quality of learning resources deployed, as well as developing tools that will enable student learning.

Summary of Section

The preceding section positioned mobile devices as an educational technology innovation. The section began by presenting how the characteristics of mobile devices make it different from other educational technologies and how it can enable mLearning.

Literature was also provided on how mobile devices can be used in education, especially to facilitate collaboration and also sensemaking. The section concluded with examining how mobile devices have been used in African higher education.

Diffusion of Innovations

Everett Rogers's DoI theory is widely cited in the area of adoption and diffusion (Surry & Ely, 1999). In the present study, it serves as a lens through which to examine factors influencing mobile devices diffusion at UB and UNAM. Since most of the theory is presented in chapter one, the sections that follow clarify the theory by explaining the diffusion process, further justify the decision to focus on the persuasion stage by presenting research on perceived attributes, and conclude with a review of research on DoI in Africa to show how the theory has been applied on the continent on which the study is taking place.

The Diffusion Process

Diffusion is defined as "the process by which an innovation is adopted and gains acceptance by members of a certain community" (Surrey and Farquhar, 1997, p. 1). The diffusion process consists of (1) an innovation (2) communication channels (3) time and (4) members of a group or social system. DoI focuses on the individuals who use the innovation instead of the innovation itself (Hall, 2005; Jazzar & Friedman, 2007) in order to understand why an innovation is or is not taken up.

Research on DoI theory that explains the process outlined in the previous paragraph is vast and spans decades. At a retrospective conference on 40 years of DoI Theory, Rogers (2004) estimated that there were approximately 5,000 research studies

across different disciplines, and he concluded that there were either few or no behavioral science disciplines that do not study diffusion.

Although Rogers' (1995, 2003) DoI is often used to explain how and why technology is or is not adopted in educational structures, the theory itself predates his work. Early work on DoI is attributed to French Sociologist Gabriel De Tarde's 1903 book, *The Laws of Imitation*, in which he laid the foundation for systematically examining factors that influence or hinder the diffusion process. Tarde reasoned that out of 100 different innovations, 10 will spread broadly, while 90 are often forgotten. Diffusion, as envisioned by Tarde, involved imitation of behavior and a passing down of information about an innovation from person to person or group to group (Wejnert 2002; Williams, 2007).

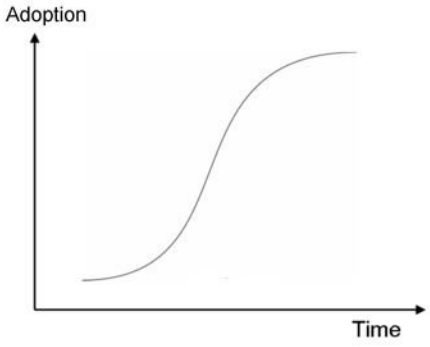


Figure 2-1. S-Curve of innovation

Tarde is credited as the first to propose the S-shaped curve (Figure 2-1) and to argue that innovations follow an S-shaped rate of adoption (Rogers & Shoemaker, 1971). The S-curve illustrates the process of adoption which begins with a slow phase that affects a few people, followed by a middle phase of widespread adoption, until it levels off in the third stage because mass adoption has taken place. However, it was not until 40

years later, when Ryan and Gross (1943) published results of their study on the spread of hybrid corn by Iowa farmers (Rogers, 2004; Williams, 2007), that Tarde's work was brought to prominence.

Ryan and Gross (1943) examined factors that impacted the rate of adoption of an innovation. They studied the diffusion and adoption of hybrid seed corn by farmers in Iowa. Ryan and Gross suspected that sociological factors, such as the influence of neighbors, had an impact on decisions to adopt an innovation. Hybrid-seed corn was seen as an important innovation at the time and offered three advantages:

- it promised to increase farmer's yield of corn by nearly 20 percent,
- it made the corn sturdier and better suited for harvesting with mechanical corn-pickers, and
- it produced corn that could better withstand serious droughts.

The study is relevant to this dissertation and was significant for two reasons: (1) it popularized the term diffusion, and (2) it established the research method of using retrospective surveys that asked adopters or potential adopters their perceptions on the innovation. One of the main findings from Ryan and Gross's (1943) corn study was the importance of a social communication channel in adoption of an innovation. Specifically, neighboring farmers played an important role in convincing other farmers to adopt the innovation rather than farmers being swayed by scientific facts alone. In other words, at the heart of the hybrid-seed corn diffusion process was information exchange about the innovation. Farmers shared their personal and subjective experiences about the new idea, which gradually gave meaning and acceptance to the innovation (Rogers, 2004).

Adoption of an innovation does not occur at the same time by everyone in the population; rather adoption occurs in stages. Rogers divided adopters of an innovation into five categories, but cautioned that although the categories are based on abstractions from empirical research, they are only general guides for the purpose of grouping. The categories, as shown in Figure 2-2, can be mapped using a normal standard frequency distribution.

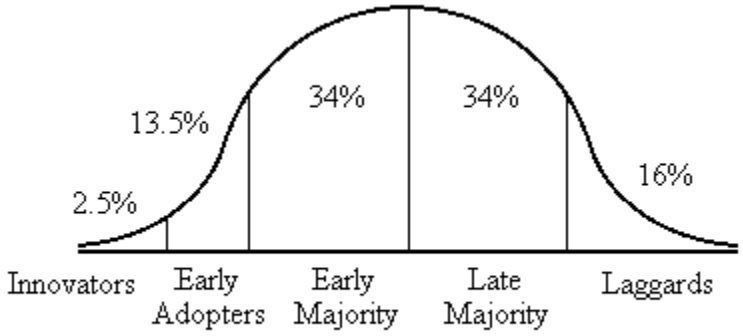


Figure 2-2. Adopter categories

The first category is of *Innovators* who form of 2.5% of the population or group. Innovators are obsessed with new ideas and are characterized by their venturesomeness and "a desire for the rash, the daring, and the risky" (p. 464). The next group labeled as *Early Adopters*, make up 13.5% and are important because they often consist of opinion leaders. They are more important than innovators because people look to the early adopters to provide answers and ease uncertainty. Rogers argued that early adopters can also be considered as the go-to person(s), the individuals that others check with before they adopt an innovation. The majority of the people will fall into the *Early majority* (34%) those who adopt deliberately and *Late majority* (34%) those who adopt though skeptical about the innovation. The category labeled *Laggards* (16%), consists of those

who are last to adopt an innovation, sometimes because they are suspicious and need a longer process to gather necessary information to formulate a decision. The concept of adopter categories is presented here because it further reinforces the idea that diffusion is a process and the absence of adoption based on a time frame does not necessarily mean failure to diffuse. The concept is also "important because it shows that all innovations go through a natural, predictable, and sometimes lengthy process before becoming widely adopted within a population" (Surry & Ely, 1999, p. 1)

DoI postulates that diffusion of an innovation does not occur instantly. The process occurs over time and consists of a series of actions and decisions potential adopters takes as they goes through five stages: *knowledge, persuasion, decision, implementation and confirmation* (see Figure 2-3).

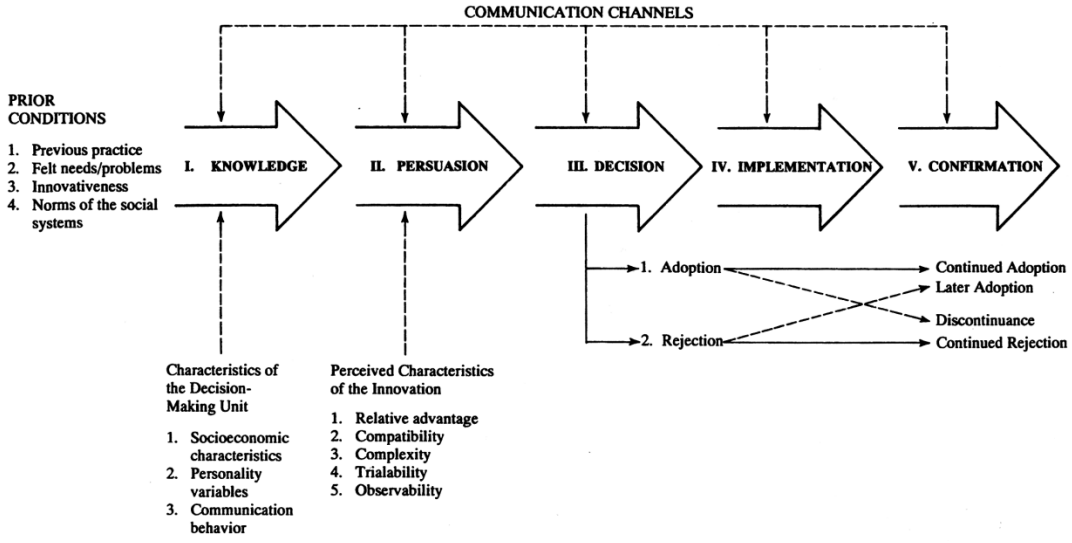


Figure 2-3. Rogers' (1995) Innovation-Decision Process Model

First, at the knowledge stage, an awareness (knowing) of the innovation is formed. At the second stage (persuasion), the potential adopter is persuaded by attributes of the

innovation to form a positive or negative attitude toward the innovation. The decision to adopt or reject the innovation is based on five attributes (Table 1-1): relative advantage, compatibility, complexity, observability, and trialability (Rogers, 2003). Third, during the decision stage, the potential adopter decides whether to adopt or reject the innovation. The success of a DoI process is the adoption of an innovation (decision to use the innovation instead of rejecting) by individuals or organizations, such as a university. However the decision stage should not be viewed as a binary choice of adopting or rejecting. It can also be about deferring a decision to adopt to a later time period when the cost and benefits are clearer (Hall, 2005; Rogers, 2003). Fourth, during the implementation stage, the adopter puts the innovation in practice, and in the fifth stage, the adopter seeks confirmation of the adoption decision and either continues or stops use of the innovation.

Research on Perceived Attributes

The present study focuses primarily on the persuasion stage, which consists of the perceived attributes of an innovation. The persuasion stage has been shown to highly influence 49 to 87% of adoption of an innovation (Rogers, 2003).

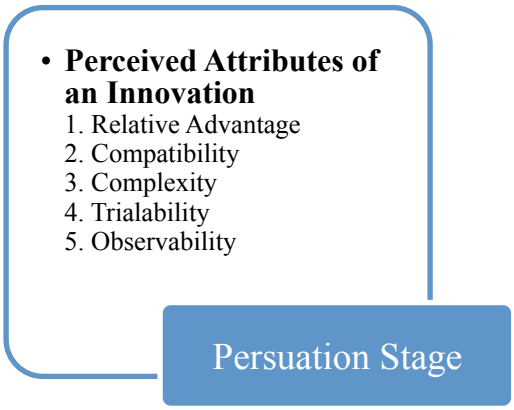


Figure 2-4. Five attributes that influence perception individuals have toward an innovation (persuasion stage)

In addition to Rogers's work, there are many other studies (Al-Gahtani, 2003; Allan & Wolf, 1978; Boz & Akbay, 2005; Davis, 1989; Jacobsen, 1998; Martins, Steil, & Todesco, 2004; Tornatzky & Klein, 1982; Yates, 2001) that confirm the significance of the persuasion stage in the diffusion process. However, as noted earlier in this chapter, research on DoI is vast and spans many decades; as such, it is not possible to present all the research conducted on the topic. To make the review manageable, the literature on the perceived attributes has been organized into two sections, diffusion in higher education and diffusion outside higher education. As will become clear in the following paragraphs, the diffusion literature lacks agreement on which of the five attributes are most influential. The attribute that is found to have most influence on the persuasion stage often depends on the study being conducted and the context and region in which it is being carried out.

Diffusion studies in higher education institutions. Understanding the adoption of mobile devices as educational technologies in higher education institutions such as UB

and UNAM depends on identifying factors that influence the diffusion process. These factors provide information about what can be done to increase the rate of adoption. This section examines how others have employed the persuasion stage attributes to unearth factors impeding the diffusion process.

Using Rogers (2003) DoI theory, Bennett and Bennett (2003) investigated characteristics that influence faculty's integration of instructional technology into teaching. The investigation focused on the effectiveness of a faculty training program designed to encourage faculty to adopt Blackboard, a course management system. The study found that complexity was a significant factor in influencing the diffusion process of instructional technology by teachers, because many faculty members often assume that new technologies will take a lot of time and effort to learn. Moreover, faculty believed that their investments in learning new technologies are often not recognized by the tenure-and-promotion system. The authors reasoned that instructional technologies would not cause any significant change in instructional practices if teachers felt intimidated by the technology. The conclusion drawn from the study is that the diffusion process can be aided by organizing training programs that address factors that influence the diffusion process. Put differently, those interested in driving adoption of innovations in universities should discuss the relative advantages of instructional technology and offer demonstrations of how the technology can be used to enhance teaching and learning. There should also be opportunities to ‘‘test drive’’ the technology (trialability), giving consideration to the participants' level of comfort with technology, and showing how the technology fits with the participants' values and philosophies of teaching" (compatibility;

p. 60). The researchers argued that organizing training programs may help eliminate obstacles that hinder the adoption of instructional innovations.

Bennett and Bennett's (2003) study is particularly relevant to the current dissertation because one must consider why there is little evidence of mobile devices being integrated in the teaching practices at universities in Botswana and Namibia. Contributing factors could include the perception of technology as intimidating, rewards and recognition of lecturers in comparison to other methods of instruction, and the existence or lack of training programs on campus that target utilization of mobile devices.

In another study of diffusion inside higher education, Allan and Wolf (1978) examined relationships between educators' innovation adoption behavior and Rogers's five attributes of innovations. Allan and Wolf (1978) set out to test whether the relative advantage, compatibility, trialability, and observability were positively related to adoption of a new idea as perceived by members of a social system. The authors also tested whether complexity was, inversely related to adoption. Results from the study could only support the hypothesized relationship for complexity.

Diffusion studies outside higher education institutions. Diffusion studies are not limited only to higher education contexts. DoI research has been conducted in other fields such as public health, anthropology, sociology, education, public health, communication, and marketing, just to name a few. Rogers (2004) revealed that the model of DoI itself emerged from a review of studies of literature in various disciplines. The paragraphs that follow present studies that use DoI but take place outside higher education.

Similar to the innovation being investigated in this dissertation study, the research by Makowsky, Guirguis, Hughes, Sadowski, and Yuksel (2013) on the innovation of a prescribing model further emphasizes that even when an innovation is seen as an improvement on current practices, there are other factors that can influence its diffusion. In the context of Botswana and Namibia, the work by Makowsky et al. (2013)—although taking place in the health sector—provides insight into the necessity of examining factors that are not readily apparent but could exert influence on the diffusion of mobile devices at universities.

Makowsky et al. (2013) used DoI to understand factors that influence Canadian pharmacists in Alberta to adopt prescribing privileges that were being proposed. In 2007, the state of Alberta adopted new standards that granted pharmacists more flexibility in prescribing medication. The standards enabled pharmacist to adapt a prescription that a customer brought in from a doctor, prescribe medication in case of an emergency or at initial access, and to manage ongoing therapy. The study used a mix of random and purposeful sampling methods and semi-structured telephone interviews with pharmacists to discuss their prescribing practices as well as barriers they faced in implementation. Three attributes identified as significantly influencing factors were relative advantage, complexity, and trialability.

Pharmacists who perceived relative advantages from the new prescribing standards such as an increased sense of professionalism, increased job satisfaction, and happiness were more likely to adopt the practice. Another relative advantage (RA) came from the ability to adapt prescriptions. Being able to adapt medication, and perhaps give patients access to cheaper and generic medication, generated customer loyalty.

Conversely, pharmacists who saw no RA or felt there were few advantages to prescribing were less likely to adopt the innovation of new standards. For example, some felt that the new standards would lead to pharmacists having to fill more prescriptions while not receiving additional compensation.

Some pharmacists argued that the complexity of knowledge required with regards to product, disease, and patient prescribing scenarios increased in the new model. This meant that they had to know more about the medication and their patients than in the past. The complexity factor thus negatively influenced the diffusion process.

The findings also revealed that trialability was an important attribute because of the perception that the new model increased workload. Pharmacists felt that the new prescribing model required more documentation and increased communication with physicians. The increase in requirements significantly impacted the trialability attribute; even testing the model on a small scale required significant investment on the part of the pharmacist, and as such, trialability appeared to have limited impact on pharmacist adopting new prescribing practices (Makowsky et al., 2013).

Similarly, Al-Gahtani's (2003) study in Saudi Arabia confirmed that the five attributes influenced computer users' consideration of adopting computers in their work. The researchers investigated how perceived attributes of computer technology influenced its rate of adoption in the workplace. Participants in the study were 1,200 managers in 56 organizations across Saudi Arabia. The author confirmed that all the attributes except complexity positively correlated significantly with computer adoption. Complexity was negatively correlated with computer adoption and use, as it was predicted.

In an educational study outside of higher education, Martins et al. (2004) set out to determine factors influencing language schools in Brazil to adopt the Internet as a teaching tool. Data were collected from 92 language schools using a survey instrument mailed to pedagogical managers. Research revealed that observability and trialability attributes were the most significant predictors of adoption while relative advantage and complexity exerted little influence. Findings confirmed that adoption of the innovation is greater when an innovation can be tried out and the effects observed; the diffusion process moves faster with increased visibility.

Sanni, Ngah, Karim, Abdullah, and Waheed (2013) sought to identify factors that influenced Malaysian journal publishers' adoption of e-journal publishing. Using data from 82 Malaysian journal publishers, the study examined whether Roger's (2003) attributes can explain the rate of e-journal publishing adoption. Findings showed that the two attributes that complexity and trialability had a significant impact. Malaysian publishers were more likely to adopt an innovation when they perceived it to be less complex to use and manage. Moreover, publishers who had prior experience with e-journals were more likely to adopt e-publishing.

Diffusion of Innovations Research in Africa

Of the thousands of studies on DoI, few look at diffusion of technology on the African continent. Even more scarce are studies examining diffusion in African education systems. As Agbonlahor (2006) observed, "DoI has been used widely in Australia, North America and other developing countries. However, there is a dearth of studies that apply DoI to research in developing countries, especially in Africa" (p. 264). Similarly,

Dwivedi, Williams, and Lal (2008) reviewed 883 publications on DoI from 1989 to 2007 and documented that 52 countries had a significant body of research on the subject, however African countries only accounted for a total of 11 publications (Botswana 1, Egypt 1, Ethiopia 1, Ghana, Kenya 3, Malawi 1, Nigeria 3, and South Africa 2). Moreover, when DoI research is carried out in university settings, the focus has often been on university libraries (Agbonlahor, 2006). A theme from the literature reviewed in this study was that most DoI studies in Africa fell into three categories: economic impact; lecturers and faculty; and students.

Economic impact. Studies investigating factors influencing the diffusion process of Information Communication Technologies (ICT) in Africa tend to focus on economic development benefits that can be derived from usage, and therefore often look mainly at the policies inhibiting or enabling mass adoption (Avgerou, 2008; Mbarika, Okoli, Byrd, & Datta, 2005). Such studies are primarily conducted in economic giants on the continent like South Africa and Nigeria (Adekoya & Oladele, 2008; Aderinoye, Ojokheta, & Olojede, 2007; Nwangu & Odetumibi 2011; Olatokun & Igbinedion, 2009). An example of an economic diffusion-related study involved intentions of purchasing stoves. To explore whether sharing of ideas by neighbors influenced purchase decisions, Beltramo, Blalock, Levine, and Simons (2014) used DoI to study the effect of peer usage on demand of cook stoves in rural Uganda. The study consisted of 931 participants of whom 168 were early and late buyers and 763 were neighbors. The study took place in 14 parishes, which are administrative units consisting of 3-5 villages with around 6,000 residents in Kampala. The authors explored whether neighbors of those who purchased a stove and had it in their home were more likely to buy a cook stove than neighbors of

those who bought their stove but had not received it at the time of the study. The authors found no peer effects regarding the cook stove purchases, meaning that those who observed the stoves as a result of their neighbors having one were not more likely to be influenced to get one. This study appears to contradict the findings of Tarde (1903) and Ryan and Gross (1943) who emphasized the importance of the social communication channels

Lecturers and faculty. When conducted at African Universities, diffusion studies often focus on lecturers. Agbatogun (2013) investigated how lecturers adopt and integrate interactive digital technologies to enhance teaching and learning in Southwest Nigerian universities. The study focused on factors that motivated lecturers toward or discouraged lecturers from integrating digital technologies into the instructional process. The author concluded that lecturers who are charged with pedagogical responsibility are the ones who drive technological change in universities. As such, if change is to take effect, attention should be paid to factors that motivate or frustrate lecturers.

Because the diffusion process does not only depend on access but also on the users embracing the technology, the factors that influence the diffusion of mobile devices are important. Agbonlahor (2006) used the DoI framework to study motivation for the use of ICT by university faculty in 10 Nigerian universities. The study employed a survey instrument with 1,000 lecturers to understand the characteristics of ICT use and factors that influence the use of ICT among lecturers. The study found that “perceived ease of use (complexity) and perceived usefulness (relative advantage) both significantly influenced the number of IT applications used by lecturers as well the frequency with which they used computers” (p. 273). Although perceived characteristics of an innovation

are important in the diffusion process, similar to the work of Bennett and Bennett (2003), the authors argued that providing training and easy access to the technology is also equally important.

As shown by Ryan and Gross (1943) and Beltramo et al. (2014), social networks greatly influence diffusion. Similarly, in their study, Kandiri and Mtebe (2014) investigated how institutional social networks of project coordinators and team leaders contributed to the success or failure of diffusion of 26 technology innovations across seven higher education institutions in Africa. Data was collected from questionnaires, face-to-face interviews, and focus groups. Findings indicated that institutional project coordinators, team leaders, and members selected for the team influenced the diffusion of technological innovations at the institutions. In other words, those at the center of the communication process and those responsible for communicating the implementations of the innovations in their institutions had significant influence on the diffusion process.

Using a structured questionnaire, Ntemana and Olatokun (2012) investigated the influence of DoI attributes on lecturers' use of ICTs at the National University of Lesotho (NUL). The study tested the underlying relationship between the five attributes, which the authors classify as "ICT adoption determinants" (p. 190) and attitudes held by lecturers in a higher education setting. The attributes "were hypothesized to not positively affect the attitude of lecturers toward use of ICTs, but when tested, three of them (relative advantage, complexity [ease of use], and observability) were found to have a positive effect on the attitude of the lecturers" (p. 190). This study highlights the difference in how some scholars view the DoI constructs. Some use complexity and ease of use interchangeably as seems to have been done in this study. When an innovation is seen as

easy to use, as it was in the works of Ntemana and Olatokun (2012), then the attribute is positively correlated, but when it is labeled as complex, it often negatively influences the diffusion process. As Hall (2005) noted, although the five attributes are recognizable and part of many analyses that have undertaken by researchers, they do at times appear under different names such as the substitution or interchangeability of complexity with ease of use in the study by Ntemana and Olatokun (2012).

Students. When students are included in studies, it is often to examine how they use technology for non-school related activities. Dzogbenuku (2013) set out to determine a set of attributes that influenced adoption of mobile banking innovation among university students in Ghana where most banks began contacting their customers directly via mobile phones. Using Rogers' (2003) attributes as a conceptual model, Dzogbenku collected data from 550 undergraduate students to examine the diffusion of mobile banking. The study revealed that mobile banking spread quickly because it was compatible with the student's lifestyles. Additionally, factors such as relative advantage, compatibility, observability, complexity, perceived risk, trialability, and service satisfaction were also identified as important in the adoption of mobile banking in Ghana.

Another study on mobile devices at an African University not focused on education use is by Nwangwu and Odetumibi (2011) who examined factors influencing the adoption of mobile phones by students at the University of Ibadan in Nigeria. Nwangwu and Odetumibi investigated how perceived characteristics of mobile phones, demographic characteristics of respondents, and psychological variables related to students' adoption of mobile telephony. The authors suggested that in many cases the mass adoption of mobile phones by students is out of necessity. Often attending

university means that students leave their families and other social support systems. Mobile phones serve as a necessary tool for keeping in touch with "persons with whom they already have relationships such as parents and siblings, maintain old friends and make new ones" (p. 110).

Nwagwu and Odetumibi (2011) focused on understanding how perceived characteristics (attributes) related to students' adoption of mobile devices at the University of Ibadan, Nigeria. Analyzed data came from 370 surveys collected from students residing in university hostels. The study reflected that attributes such as relative advantage, complexity, trialability and compatibility explained adoption of mobile devices at the university. However, when examining the data by age, the findings revealed that age was significantly, negatively related to adoption. Specifically, PhD students were less intensive in their adoption of mobile phones than master's and bachelor's degree students.

Few studies have investigated students and mobile devices used for educational purposes. Utulu and Alonge (2012) conducted a study involving 532 undergraduate students in three private universities in Southwestern Nigeria that evaluated the use of mobile phones as a tool for Project-Based Learning (PBL). The results showed that 96.6% of students had mobile phones that were used for communication, interactions, getting information, browsing the Internet, and sharing knowledge any time they were involved in PBL. However, cost was a significant factor for some of the students when participating in learning with mobile devices. Consequently, the authors advised that alternatives that include free access must be explored. The aspect of cost as a factor influencing the diffusion process identified in this study is relevant to the current

dissertation. A question that must be asked is whether students and lecturers financial constraints are influencing the use of mobile devices and as such slowing down the diffusion process in Botswana and Namibia.

Ng'ambi and Knaggs (2008) studied the possibility of using SMS to help university students prepare for exams. The project was motivated by the realization that when questions arise during the study period, there is often no supportive environment for students to get feedback or answers, since students often study off campus during the exam period. Ng'ambi and Knaggs found that students were able to use the SMS system to ask questions of their teachers and peers. Students found the tool very useful for two reasons: (1) it provided responses to subject-related questions, and (2) its use also eased anxiety for students during exam week.

Research on diffusion in Botswana and Namibia. Research on the diffusion process in Botswana and Namibia is scarce. Of the studies conducted, most look at the diffusion process in non-formal education sectors or limit the examination of ICT in education to adoption in secondary schools (Totolo, 2005), computers in libraries (Mutula 2012), and adoption by staff in universities (Shemi & Mgaya, 2002).

Shemi and Mgaya (2002) examined the staff's adoption of ICT at University of Botswana. Findings revealed that although most academic staff frequently used word-processing and electronic mail, ICT continued to be deployed "mainly to automate mundane tasks such as those of student records systems and administrative support services" (p. 1). Moreover, the most common item used in classrooms remained chalk and paper, and the most common technology remained overhead projectors (Shemi & Mgaya, 2002).

There is also little research on diffusion of innovation in Namibia. Although the government has produced various frameworks and pronouncements through policy that articulate the importance for ICT in education for the country, the reasons for the lack of research are unknown. Integration of technology to support teaching and learning at the university level in Namibia is important (Auala & Mbale, 2012). Namibia is one of Africa's largest countries in size; the geographical expanse has led to Namibia having many learning institutions in remote areas. These institutions suffer from problems of understaffing because many qualified lecturers choose to be in urban areas; therefore institutions continue to explore ways to reach out to remote campuses (Auala & Mbale, 2012). Thus, exploring ways to benefit from innovations such as mobile devices and understanding the factors that promote or inhibit the diffusion process can contribute additional methods of connecting the lecturers and institutions.

In addition, Udo, Bagchi, and Kirs (2008) compared diffusion of ICT in Zimbabwe and Albania, as well as in and with Namibia and Venezuela. The objective of the research was to identify national-level factors that were responsible for the diffusion of ICT in developing countries by comparing countries that are economically similar. To answer the question, the researchers hypothesized that there were sets of demographic, economic, regulatory, infrastructural, educational, and affordability factors playing a role in ICT diffusion differences in the selected countries. The findings revealed that poor infrastructure, income inequality, adult illiteracy rates, regulatory and affordability factors were the possible reasons why the ICT diffusion rates differed in the African nations of Zimbabwe and Namibia. Although Udo, Bagchi, and Kirs' (2008) does examine diffusion factors in Africa, it examined them outside of university context. By

examining diffusion of mobile devices in universities in Botswana and Namibia, this dissertation study adds to the breadth of the diffusion of innovation literature in Africa.

Differentiating Diffusion and Adoption

Diffusion and adoption have often been used interchangeably. However, diffusion and adoption are not one and the same. In their work in Botswana, Jain, and Mutula (2001) defined "diffusion as the exploitation and utilization of IT as a tool to improve the productivity of an employee, department, organization and the country at large" (p.237). Diffusion, based on Roger's (2003) DoI model, is a process that involves different stages. Adoption is one facet of the diffusion process and comprises the decision portion of the diffusion model whereby the individual decides whether to adopt or reject the innovation.

The success of a DoI process is the adoption of an innovation (decision to use the innovation instead of rejecting) by individuals or organizations, such as a university. Therein lays the importance of research on how educational technology innovations are adopted. Technological tools are created to meet needs such as improvement of a process. Researching how to speed up the process of adoption or what factors prevent adoption of an innovation is therefore crucial to the field of educational technology.

Section Summary

This section expanded on the diffusion of innovation theory, which was presented in chapter one. The goal was to provide further clarification to the theory and also to present how DoI has been applied by other scholars to explore innovation diffusion. Most of the literature focused on perceived attributes, which serves as the main lens through

which to explore factors that are influencing the diffusion of mobile devices at the University of Botswana and the University of Namibia. The section concluded by reviewing how DoI studies have been conducted in Africa. The main aim here was to position mobile devices as an innovation for the study and to present evidence that DoI is the appropriate theory for exploring these factors. The section also revealed that there is a lack of cohesion in findings from DoI research when it comes to perceived attributes. This means that one cannot simply take findings from one country or context and assume that they will appropriately explain diffusion in another context. As Rogers (2003) advised, it is important to conduct studies in different context using different instruments to accurately examine the diffusion process. The current study aims to contribute the cases of Botswana and Namibia to the body of diffusion literature. The section that follows provides justification for the comparative study.

Comparative International Education

This section defines the comparative method as used in this study and presents example of how others have used the comparative method. Academic research in comparative international education is grounded in the social sciences, education, and cross-national studies (Noah & Eckstein, 1969) and is often concerned with studying and examining educational problems in different national contexts (Carnoy, 2006). Examining ways in which others are educated, the tools that are used, and others' techniques for addressing problems can enable the transfer of solutions for problems or policies to domestic systems (Bignold & Gayton, 2009; Crosselly & Broadfoot, 1992; Nieben, 1982).

Thomas (1998) categorized comparative studies in three ways: space or time, general aims, and qualitative and quantitative (Figure 2-5). Space-based studies focus on categories (i.e., geographical areas such as nations, institutions, or technologies) as they relate to a target feature; time relates to the period in which the study is confined, such as conducting research on a colonial time period. General aim studies are concerned with describing, explaining, exploring, or evaluating educational issues. Lastly, comparative studies can also be viewed on the quantitative and qualitative continuum. Qualitative studies tend to be focused on comparing characteristics of one or more educational entities without concern of amounts or frequencies, for example examining the philosophical foundations of university education in Africa and Europe. In quantitative comparative studies, researchers employ statistical methods, such as investigating correlations between teacher evaluations and teacher burnout in Tanzania and China.

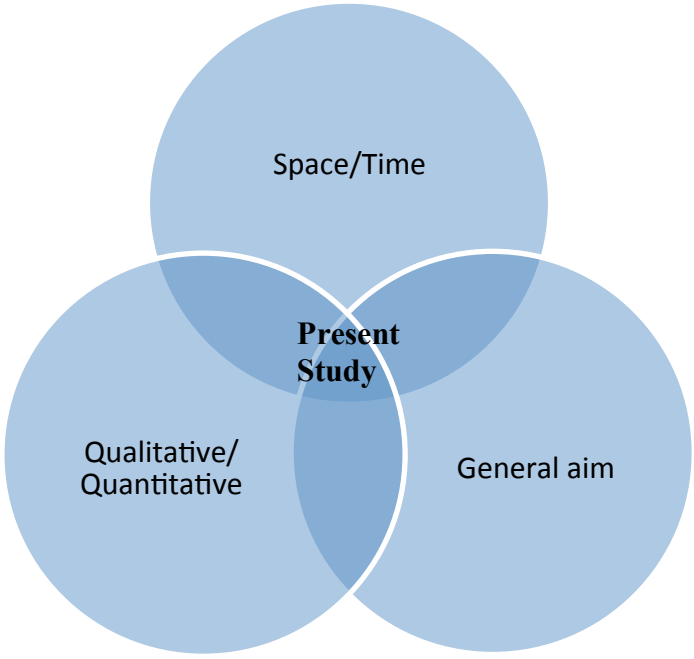


Figure 2-5. Categories of Comparative Studies

Thomas' (1998) classifications are a useful way of classifying different comparative studies. It is, however, worth noting that the classifications are not isolated and can be viewed as overlapping circles, whereby a study can have elements of any or all of the three features. As illustrated in the diagram above, the present study has characteristics of all three classifications: it compares two universities in two countries (space); it is both descriptive and explanatory in nature (general aims); and it uses a survey instrument to collect data (quantitative).

Using the Comparative Method to Study ICT in education

Using the comparative method to study topics related to ICT in education is not common; few comparative studies explore a technological phenomenon, or when they do, it is only discussed indirectly. This omission and gap in the literature contradicts the understanding that comparative research, as an academic activity, demands diverse theoretical explanation and understanding.

When comparative studies are undertaken, researchers do not always provide a justification for why a cross-cultural study is conducted. Often comparative studies conducted internationally are justified as comparative merely by virtue of being conducted in two separate countries. Teo, Su Luan, and Sing (2008) explored the use of personal computers by pre-service teachers in Malaysia and Singapore. Data was collected through an email survey from 495 participants in the two countries. Using the Technology Acceptance Model, the study revealed that perceived usefulness, ease of use, and attitudes toward computers contributed significantly to the intention by pre-service teachers in both countries to use computers. Although the study makes a significant

contribution to the literature on pre-service teachers' intention to use computers in Singapore and Malaysia, it provided little explanation as to why the two countries should be compared.

The comparative method has been used to identify technological adoption similarities or differentiate between countries. Arpaci (2014) conducted a comparative study that examined the effects of culture on adoption behavior of mobile devices and how culture affected adoption decisions of Turkish and Canadian students. The results from the study suggested that "national culture has a significant effect on the adoption mobile learning by undergraduate students, and there are major differences in their adoption behaviour" (p. 2). In other words, comparative studies between countries can help identify how adoption behaviors and conditions differ or are the same cross-culturally to avoid a one-size-fits-all approach.

Others have used the comparative method to contrast populations, settings, or mediums. Sung and Mayer (2012) conducted a study on students' beliefs about mobile devices versus desktop computers in South Korea and the United States. The study asked students to complete a multidimensional scaling questionnaire and asked whether learners held beliefs about learning with a mobile device as opposed to learning with a desktop computer. The study further examined if learners in South Korea, a society well known for its long-standing involvement with mobile technology, differed from learners in the United States where mobile devices are new by comparison. The study found students in the United States took the instructional medium into account; learning material presented on a mobile device was seen as different than the same learning presented on a personal computer. However, the South Korean students made no distinction between mediums

(Sung & Mayer, 2012). In this dissertation, the comparative method is used to study a phenomenon occurring in two countries. Other than the goal of identifying factors that influence the diffusion process, the aim is also to contribute to the gap in the literature on providing adequate justification for examining educational technologies cross nationally

Summary

The purpose of this chapter was to situate the present investigation in a body of established theoretical and empirical literature to provide justification for the study and the scope of research examined in the chapters that follow.

Mobile devices continue to change as individuals worldwide rely on the devices for many things: instant communication, completing everyday tasks such as writing a note, and more complex tasks such as completing medical exams. Educational institutions are also engaged in exploring the diffusion of these devices for both formal and informal education.

Mobile devices can be considered an innovation to be examined through the DoI lens. Studies indicate that mobile devices as a learning technology can improve educational processes and outcomes. One way mobile devices have been used for learning is through student use of the technology to support collaboration and sensemaking practices.

Although research studies on using mobile devices for learning and teaching at African universities are still emerging, few have been conducted on the diffusion attributes and categories of impact using the comparative method. The persuasion stage, which Rogers (2003) argued is a crucial stage in the diffusion process, has been the primary focus of most studies; in fact, the persuasion stage influences up to 89% of the

adoption decision. As such, most literature focuses on how scholars have used DoI to identify factors influencing the adoption process in varied contexts.

Lastly, the comparative method has been used to study ICT in education. This method is rarely used in educational technology studies. Moreover, scholars who do comparative research often do not provide justification for why a cross-cultural study is conducted. As indicated in the chapter, comparative studies in educational technologies are crucial because they provide for opportunities to learn how technologies are used in different cultures and minimize the sometime uncontested and unproven claims of the impact of technology on teaching and learning.

The next chapter details the research questions and the method used in collecting data for this study.

Chapter 3

Method

The goal of this comparative study was to identify factors that influence the diffusion process of mobile devices in higher education in Botswana and Namibia. Data were collected from students and lecturers at the University of Botswana and University of Namibia through a survey questionnaire. This chapter describes the participants, materials, research design and rationale, data collection procedure, research questions, and data analysis.

Participants

The population of this study included students and lecturers at all universities in Botswana and Namibia. See Table 3-1 for the listing of the types of institutions in the two countries.

Table 3-1

Number and type of higher education institutions

	Botswana	Namibia
Publicly-funded universities	2	1
Publicly-funded technical universities	23	1
Privately-funded accredited universities or colleges	7	2
Total number of Universities in country	32	4

Sources: SARUA MoE questionnaires (2011)

From the universities available in the two countries, the University of Botswana (UB) and the University of Namibia (UNAM), were selected, for reasons described below, as locations for this study. UB was officially founded in 1982, after separating from the University of Basutoland, Bechuanaland and Swaziland (UBBS) in 1964, which was a university of three countries: the Kingdom of Lesotho, Republic of Botswana, and Swaziland (Bailey, Cloete, & Pillay, 2011). UB consists of seven faculties, the graduate school and the center for continuing education. The university has an enrollment of 15,484 students, with campuses (see Figure 1-4) in Gaborone, Francistown, and Maun that offer diplomas, as well as undergraduate degrees and various post-graduate degrees.

UNAM was established in 1992, two years after the independence of Namibia. The University is headquartered in Windhoek, the capital of the country, but consists of 11 campuses (see Figure 1-5) spread throughout the country. The institution consists of eight faculties and two schools. The University has an enrollment of 17,536 students. The Windhoek campus at which the present study takes place has 11,564 students (61.5% female, 38.5% male).

UB and UNAM were selected for three main reasons. First, these institutions are the largest and most representative of the students in the two countries. Second, a review of the literature revealed no studies examining diffusion of mobile devices at these institutions, which justified the need for the research. Third, the settings provided for a sample of students within a confined geographic area, thereby facilitating the collection of data.

The composition of the sample illustrated in Table 3-2 was obtained through a snowball sampling technique. Snowball sampling, also referred to as chain-referral

sampling, is a method that provides for access to participants through referrals by people who know of others with characteristics that are of interest to the researcher (Biernacki & Waldorf, 1981).

Table 3-2

Study Sample

		Lecturers			**Student**		
Institution	Campus of study	population	Sample	% of Sample	Population	Sample	% of Sample
University of Botswana	Gaborone Campus	890	33	4	15484	566	3.5
University of Namibia	Windhoek Campus	352	43	12	11564	364	3

The sampling process involved identifying a Main Research Contact (MRC) at each of the data collection sites who could serve as a supervisor for the study. At UB, a lecturer was identified in the Department of Computer Science and at UNAM, a lecturer was identified in the Department of Educational Psychology and Inclusive Education. The MRCs assisted in collecting data throughout the university by facilitating introductions between the researcher and lecturers. Although this method was useful in achieving a large sample, it made calculating the participation rate difficult in the study because it was not always possible to know how many students were in the class. Participation depended not only on students enrolled in a specific course, but also on the students who were present in the class on the specific day that the instrument was administered.

Materials

The material used for this study consisted primarily of a survey questionnaire, while the literature and documents collected provided secondary information. This section provides a brief justification for using a survey in this study as well as a description and design of the instrument.

Justification for using a survey

Survey questionnaires have three distinct characteristics that make them useful for research. Frist, they provide standardized quantitative information from and/or about the subjects being studied. Second, data are collected from a large sample on which statistical analyses can be performed and generalized to the larger population. Thirdly, data to be analyzed are collected through structured and predefined questions about the unit of analysis.

A survey questionnaire was useful in this study for several reasons. Given that Roger's attributes are about perception, a survey was particularly effective for this study because the researcher was interested in obtaining opinions, attitudes, and beliefs from a small sample that can be generalized to the rest of the population (Babbie, 1990; Creswell, 2009; Fowler, 2009). Moreover, when conducting studies on diffusion of innovation, Tornatzky and Klein (1982) suggested that surveys are appropriate because they allow for both replicability and cross-study comparability, while also providing for generalization about the innovation. Survey methods also allow for collection of a large amount of data in a manner that is both efficient and economical. They provide an opportunity to discover a range of factors and concepts that come from the population of

interest that can be further developed and investigated at a later time (Pinsonneault & Kraemer, 1993).

Admittedly, the use of survey research is not without challenges or critics. For example, Kelley, Clark, Brown, and Sitzia (2003) argued that researchers may focus on collecting large data sample and range of coverage but ignore the implications the data has on relevant issues, problems, or theories. Moreover, the data collected may lack in-depth details for the topic being investigated since the researcher may not always obtain a desired response rate and may not be able to ask follow up probing questions of participants. Although such criticisms may be valid, the survey method remains efficient for collecting a large volume of data that can be used for statistical analysis (Coleman, 1958; Groves, Fowler Jr, Couper, Lepkowski, Singer, & Tourangeau, 2011). Survey research was also considered an effective method for the present study because the findings can provide a starting point of "where future inquiry might be fruitful" and may provide further evidence of a phenomenon occurring (Holloway, 1996, p. 1112).

Description and Design of Instrument

This quantitative study employed a new cross-sectional survey (see Appendix A) to collect data. The defining feature of a cross-sectional survey is that it compares different population groups. Unlike panel surveys, for which respondents are followed over time, cross-sectional surveys take a snapshot of the population at a single point in time (Hall, 2008). A benefit of cross-sectional survey is allowing researchers to compare many different variables (e.g., university status, gender, age in relation to diffusion attributes). Cross-sectional surveys are also useful for determining the frequency of

performing an action and in assessing practices, attitudes, knowledge, and beliefs of a sample in relation to a particular attribute.

The decision to create a new instrument rather than using an established one was based on two factors. First, evidence in the literature advises for the creation of a new instrument, because the ways in which the five perceived attributes are expressed differs in each study, therefore, "the measures of these attributes should be uniquely created afresh in each investigation" (Rogers, 2003, p. 619). Second, a standardized survey instrument was not available that served the purpose of collecting data in Botswana and Namibia. However, studies by Jacobsen (1998), Medlin (2001), and Surendra (2001) were found to closely align with the present study and were used as a guide in crafting the questionnaire. The three authors were contacted for permission to use and modify the instrument, which was granted.

Items on the instrument were grouped into three sections: demographic information, technology ownership and usage and, diffusion items. The first section (questions 1.1-1.8) gathered demographic data such as gender, age, location, and field of study. All the items were closed-ended except those relating to location and field of study. Such items were open-ended because it would have required a long list to present all location choices in two countries or to present all fields of studies across two universities. The second section (2.1-2.11) contained questions about participants' technological ownerships, access, and usage. The third section (3.1-3.6) contained six questions on diffusion of mobile devices. Four of the items used the following rating scales:

- Item 1: 1 for *never* to 5 for *everyday*

- Item 2: 1 for *not at all important* to 5 for *very important*
- Item 3: 1 for *strongly disagree* to 5 for *strongly agree*
- Item 5: 1 for *yes* and 2 for *no*

Questions 4 and 6 were open-ended, providing participant an opportunity to enter text. The last question asked for comments or feedback on the instrument. The end of the survey gave participants a chance to provide their email address to be entered into a drawing. Although the last section collected personal information (i.e., an email address), data from this field was entered into a Google spreadsheet that was stored independently so that responses did not identify any individuals.

The majority of the items were closed-ended questions in which the participants had to either click a radio box or select from a set of choices. The decision to design the survey in this manner was made because ease of response has been found to maximize the returns (Fowler, 2009). However, open-ended questions were also included in the instrument because they can provide anecdotal data (Fowler, 2009).

Once the instrument was created it was submitted to peers, the Penn State University Survey Research Center, and to the dissertation committee for review and feedback; changes were incorporated accordingly. The instrument was sent to a small group of potential participants at UB and UNAM to ensure that language and word choices were acceptable and made sense in both countries. A focus group was also conducted with students in a class at the Polytechic of Namibia, a university located in the same city as UNAM. Each question was projected to the board and discussed with students in the class to ensure clarity. In the case of Botswana, the instrument was also submitted to the UB's Office of Research for IRB approval.

The researcher coded the items on the survey according to the five attributes (relative advantage, compatibility, complexity, trialability, observability), and submitted it for review to four experts. For the purpose of this study, an expert was an individual with a PhD who had conducted research related to diffusion of innovation and/or taught a university-level class on the topic. The survey document was sent to experts with the following directions:

> *The following survey questions are coded to correspond to Roger's attributes. Please read each statement and decide if you agree with the coding assigned to it. If you agree, please mark X in the box labeled "Mark if agree." If you do not agree, please place the code that you believe corresponds to the item in the box labeled "Suggest Correct Coding."*

Once responses were received from the experts, the researcher combined choices and calculated an "agree or disagree" percentage for each question. Items with an 80% or higher agreement by experts were retained, and any items lower than 80% were not included in the analysis. Table 3-3 shows, the 35 items that were maintained (Relative Advantage—3 items; Compatibility—11 items; Complexity—5 items; Trialability—6 items; Observability—10 items).

Table 3-3

Survey question keyed to diffusion attributes

Items	Attribute
• The Ministry of Education offering rewards to those using a certain technology • Rewards from the University for using a technology • Mobile phones can help with learning tasks, such as writing, analyzing data, or solving problems.	Relative Advantage
• Requiring lecturers to allow student to use mobile devices in class would cause stress and confusion within the University. • The lecturer (lecturer/professor) is the most important person in the classroom • A mobile phone is for socializing, not for education. • There will be less control over classroom if mobile devices such as tablets and phones are used.	Compatibility

• The Ministry of Education has policies that support the use of mobile phones and tablets in education. • University administration encourages the use of devices in education (e.g., phones, mp3 players, tablets etc.) • Learning is a partnership between the lecturer, student, and learning materials • Technology is a distraction to learners in the classroom. • Mobile devices are not appropriate for university teaching and learning. • Students learn best when the lecturer is at the front of the classroom, teaching and asking questions • Mobile devices minimize the authority of the lecturer • Students get excited about the subjects in which they use mobile devices	
• It is easy to access learning materials through my Mobile phone • Having the needed Physical Resources (Equipment/Software) readily available • Mobile phones and tablets are too complicated to understand and use. • I do not know how mobile devices such as phones or tablets can be effectively included into teaching and learning. • Mobile devices are easier to use than traditional computers (i.e., laptops or desktop computers)	Complexity
• Most lecturers put learning materials on line for students to access • I would like to try using mobile devices in education in a module/section of my class • There are too few training opportunities for students to gain new technology knowledge and skills. • There are too few training opportunities for lecturers to learn new technology knowledge and skills. • I am willing to attend training sessions on teaching and learning with mobile phones.	Trialability
• Seeing my mentors/role model use a technology • Seeing friends use a technology • Most students use mobile devices for learning. • There is not enough information showing that using technology improves learning. • Other Universities are using mobile devices in education while our university is not. • I have seen students using mobile devices for teaching and learning • I have read about using mobile devices in education from books, journals, magazines, newspapers, etc. • I have had conversations about mobile devices in education with my friends • I have heard about lecturers using mobile devices in their classes here at the university • There is pressure from the community outside the University to use mobile phones in education.	Observability

Research Design and Rationale

This section provides details on the design and rationale of the study. Specifically the section explains the comparative method as well as how comparability and equivalence were established.

Comparative Method

This study employed the Comparative Method, defined as the analytical examination of educational problems or phenomena through the application of comparison techniques (Bereday, 1964; Rosselló, 1963). Research in comparative international education have three characteristics:

- they are concerned with issues or objects in two or more national/cultural contexts;
- the method employed is comparative and drawn from various disciplines such as social sciences, education and cross-national studies, and
- the purpose is to provide understanding between nations and in their respective societal contexts (Manzon, 2007; Noah & Eckstein, 1969, 1998).

Reasons for employing the comparative international education method are varied, but many focus on similarities or difference (Thomas, 1998). The first aim of this study is to look both at the similarities and differences between Botswana and Namibia; this study examined how a phenomenon manifests itself in two different national contexts (Carnoy, 2006). As the world becomes increasingly globalized, it is necessary to look at educational issues through different national perspectives and learn how others deal with educational changes and challenges (Arnove, 1999; Bignold, & Gayton, 2009).

Comparing internationally and examining how phenomena present themselves in different national contexts is of critical concern given the nature of education today, where different nations face many of the same or similar educational challenges.

Secondly, comparative research can assist in defining problems and suggesting solutions when examining countries that share a common problem. In comparing Botswana and Namibia, two countries that have articulated in national plans the need to maximize benefits of ICT in education, one may discover instances where the two countries can learn from each other and perhaps influence the mLearning discourse throughout the continent. Scholars agree that examining how others educate and observing others' techniques for addressing educational phenomena can enable transferring solutions for problems or policies from one system to another (Crosselly & Broadfoot, 1992; Nieben, 1982).

Comparability and Equivalence

When conducting an international comparative study, the researcher must identify dimensions against which cases or contexts can be compared (Steiner-Khamsi, 2009). This means that comparativists must provide a *tertium comparationis,*"the terms of comparison" (Manzon, 2007, p. 128), which consists of establishing comparability and equivalence.

Comparability. The concept of comparability can be understood as the ability of an object, issues or a system, to be comparable. For example in comparing students' understanding of math in junior college in the United States and in Pakistan, one would have to justify the basis on which the two are comparable. The junior college in Pakistan

consists of 12th grade; whereas, junior college in the USA refers to post-secondary institutions such as vocational schools or community colleges. Therefore, conditions must exist similarly in the contexts being studied and be expressed in the same units to make direct comparison possible (Raivola, 1985). Comparability is important in the comparative method because indicators, must have the same construction and meaning in the countries being studied for the comparison to be valid (Leal, 2013). In the present study, the unit of comparison (comparability) is the use of mobile devices at the University of Botswana and University of Namibia.

Equivalence. Equivalence is the ability for something to have the same value, function, or meaning (Merriam-Webster's online dictionary, n.d.). The analogy of comparing "apples" to "oranges" is perhaps best suited to explain equivalence. If one is to compare apples to oranges, one must justify why such a comparison is possible, since apple and oranges are different. The objects could be compared based on the first dimension that they are both apples, which would be inaccurate. The comparison would also be equally inaccurate if one compared based on the second dimension of both being oranges. In this analogy, equivalence could be that both apples and oranges are fruits, which establishes a third dimension (Raivola, 1985) on which a comparison can be accomplished. To establish equivalence, the current investigation is guided by Nowak's (1977) six types of equivalencies as shown in Table 3-4.

Table 3-4

Nowak's Six Elements for Comparing a Phenomenon

Type	Definition
Cultural equivalence	Objects or phenomena are perceived or evaluated in a similar way in different cultures.
Contextual equivalence	Objects (persons, institutions, communities) belong to the higher-level aggregates or systems classified previously as being similar with respect to their specific properties.
Structural equivalence	Objects (persons, institutions, groups) occupy the same (absolute or relative) position within certain structural systems, which have been defined previously as similar with respect to some of their properties.
Relational equivalence (functional equivalence)	Objects play the same role in the functioning of the systems compared (e.g., by socializing the newcomers or by enforcing the norms existing in the given system, whatever these norms or socialized patterns would be).
Correlation equivalence	The phenomena are equivalent if they are empirically correlated in a similar way to a criterion variable, either phenomenologically identical in all systems compared or found, on the basis of previous research, as being relationally equivalent in any of the senses of this term.
Genetically equivalent	The phenomena are genetically equivalent, if they are defined as coming from a similar source.

Source: Nowak (1977)

The present study fits into two of the equivalences from Table 3-4. This study is comparative based on *Contextual equivalence*, because the phenomenon being examined occurs in the same context in the two countries. The context of the study is the UB and UNAM, the largest institutions in the respective countries, where students converge from all regions to undertake tertiary courses.

The study is also comparative based on the *Correlative Equivalence*, which is met when phenomena correlate empirically in the same way with the dependent variable (i.e. criterion variable) in the countries being studied. In other words, the variable being manipulated (i.e. the independent variable) must be the same in both contexts (countries) where the analysis is undertaken. In this equivalence, Nowak (1977) referenced statistical correlation and the need to ensure that criteria match in the cultures or countries being

studied. If the research instrument and the data collection used in a study "could be shown to be reliable and valid for each culture, then it would be justifiable to compare correlations between constructs measured and other variables within each culture" (Watkins, 2007, p. 302). In the current study, the correlative equivalence condition is met in the following ways:

1. the use of the same instrument in the two countries,
2. administration of the instrument in the same method, and
3. collection of data from similar target populations at two different institutions.

Furthermore, the survey instrument was designed and field-tested in the two countries before it was administered. As such, comparison can be made because the units of analysis are parallel in both countries.

Data Collection Procedure

Data collection procedures are an important component of research. Decisions made on what data to collect and how to collect that data ultimately determine whether research questions can be answered. As illustrated in Table 3-5, the purpose of collecting data was to answer the research questions for this study.

Table 3-5

Data Collection Matrix

Research Question	Purpose	Data to Answer Question	Data Source	Contact for Access	Data Collection Timeline
RQ1. How much access to mobile phone, tablets and computers do participants have and	To understand how currently available technologies are used at the	Student surveys; document analysis	Surveys administered to University; government/ university	Office of Research and Development at UB and UNAM;	July - August 2013 and

how are they used?	universities		documents.	Students; Teachers	February – March 2014
RQ2: Do perceptions toward diffusion attributes differ by institution?	To find out if the perceived attributes are influencing the diffusion process	Student surveys; document analysis	Surveys administered to University; government/ university documents.	Office of Research and Development at UB and UNAM; Students; Teachers	
RQ3: Do perceptions toward diffusion attributes differ by university status?	To find out if the perceived attributes differ by students and lecturers	Student surveys; document analysis	Surveys administered to University; government/ university documents.	Office of Research and Development at UB and UNAM; Students; Teachers	
RQ4: Do perceptions toward diffusion attributes differ by gender?	To find out if the perceived attributes differ by gender	Student surveys; document analysis	Surveys administered to University; government/ university documents.	Office of Research and Development at UB and UNAM; Students; Teachers	
RQ5: Do diffusion patterns in Namibia and Botswana differ from those exemplified by the Rogers DOI model?	To find out if the diffusion pattern advocated by Rogers in the literature is the same or different from that of UB and UNAM	Student surveys; document analysis	Surveys administered to University; government/ university documents.	Obtained from Statistical analysis	
RQ6. What do participants believe are the advantages of using mobile devices over other technologies for learning?	To learn of the advantages of using mobile devices	Student surveys; document analysis	Surveys administered to University; government/ university documents.	Office of Research and Development at UB and UNAM; Students; Teachers	
RQ7. What do participants perceive as barriers preventing the use of mobile devices in teaching and learning?	To learn of the barriers to using mobile devices	Student surveys; document analysis	Surveys administered to University; government/ university documents.	Office of Research and Development at UB and UNAM; Students; Teachers	

Each question was crafted for a specific purpose and a decision made on what type of data that would provide answers. The design of research questions involved the researcher determining what he needed to know, deciding why it was needed, the kind of

data that would answer the question, where the data could be found, whom to contact for access, and a data collection timeline. In the next section, the procedures for administering the survey, collecting data in Botswana and collecting data in Namibia are explained.

Administering the survey

The process of collecting data took a week and a half at each location. The survey questionnaire was available in two forms: online—one version was created through Qualtrics, an online survey tool; and paper-based—an identical copy printed out in anticipation of classes that did not have computers available.

Online Survey Procedure. The online survey was administered only in Botswana and followed procedures that were similar to those employed with the paper version. The researcher went to the classes where he had permission from the instructor and briefly introduced the research purpose and the rights of the participants. The survey website address was written on the board, and students were requested to enter it in their browsers and to complete the survey. The first screen of the survey contained informed consent information with an option of agreeing or disagreeing to continue. This item was the only one in the instrument that required a response. Participants were not able to proceed until an option to agree or decline to participate in the study was selected.

Paper-Based Survey Procedure. After receiving approval from the lecturer, the researcher travelled to the classroom to administer the survey. The researcher briefly introduced the research, its purpose, and expected role of participants and that

participation was voluntary and confidential. Consent information was also provided as the first page on the front of the survey and participants were advised to read and keep the page since it had the researcher's contact information.

The survey was given to all students present in the classroom. The researcher advised once again that participation was not required nor did students have to answer all of the questions. Completion of the survey took approximately 15-20 minutes. Data from paper-based surveys were entered manually into Qualtrics, so that all data were in one program that could then be exported to SPSS.

Data Collection in Botswana

Conducting research at UB involved obtaining an ethical clearance. To obtain the ethical clearance, the researcher provided the following documents to the university's office of research protection as part of obtaining IRB approval (completed application available in Appendix B):

- Detailed proposal
- Data collection tools (interview guide, questionnaire where applicable)
- Informed consent document (for research involving human participants of consenting age)
- Assent form (for research involving minors)
- Completed government research permit application forms
- Budget for the study
- Letter of support from the supervisor or course coordinator
- CVs of key researchers

Once clearance was given, the researcher travelled to UB from February–March 2014 to collect data in accordance with approval from the IRB office at Penn State University. Since the MRC was based in the computer science department, this gave the researcher access to computer labs and classes of students who could complete the survey online. Surveys at UB were administered online and on paper in classes where computers were not available.

Data Collection in Namibia

At the time of the study, UNAM was in the process of reviewing its Institutional Research Protocol. The researcher was not required to obtain university-wide approval but rather obtained permission from the host faculty and department.

Data collection at UNAM occurred from July–August 2013. All surveys at UNAM were administered on paper, because previous experiences by the researcher led to a determination that a paper-based instrument would be most effective and efficient, since Internet access was slow and computer labs were not readily available to the researcher.

Research Questions

The overall question that this dissertation aimed to answer was: *What factors influence the use of mobile devices in higher education in Botswana and Namibia?* To obtain data that answer the main research question, this study was guided by the following sub-questions:

RQ1: How much access to mobile phone, tablets and computers do participants have and how are they used?

RQ2: Do perceptions toward diffusion attributes differ by institution?

RQ3: Do perceptions toward diffusion attributes differ by university status?

RQ4: Do perceptions toward diffusion attributes differ by gender?

RQ5: Do diffusion patterns in Namibia and Botswana differ from those exemplified by the Rogers DOI model?

RQ6: What do participants believe are the advantages of using mobile devices for learning over other technologies?

RQ7: What do participants perceive as barriers preventing the use of mobile devices in teaching and learning?

Data Analysis

The purpose of engaging in data analysis is to determine the extent to which research questions can be answered by the data collected (Blaikie, 2003). In the present study, data analysis began with translating collected survey data for computer analysis. To accomplish this, the study was guided by four steps outlined by Fowler (2014): deciding how to organize data, constructing codes, data entry, and data cleaning. Table 3-6 shows how the steps were implemented.

Table 3-6:

Four Steps used in translating survey data for computer analysis

Steps	Implementation in study
Deciding on how to organize data	The first step into an analysis is a decision on how data will be organized. The first decision in this study was to have all data in Qualtrics to enable consistency in format. Every participant had a record in Qualtrics, which was either generated automatically for participants who took the survey online or created when individual paper surveys were entered.
Constructing a code	Constructing a code involved assigning a numerical value to each response. This enabled SPSS to conduct calculations. Codes were assigned in a Microsoft Word document and transferred to SPSS. An example is coding female as (1) male as (2)
Data entry	Data entry was done for the paper-based survey. Each survey was entered using the online form in the same manner that a responded would have filled it out if they were taking the survey online.
Data cleaning	Once all the data was entered into the online system, the researcher commenced a data-cleaning process, which consisted of making sure that the data was uniform. This pertained only to open-ended items such as names of cities, majors, etc. For example, in some instances participants entered BS or BSc for bachelor of science. In this case, the label Bachelor of Science was adopted. Another example is of spelling the capitals as Gabs for Gaborone or WHK for Windhoek; in such cases, the full name was used. Cleaning data was done to ensure the accuracy in analyzing the data so that items are not counted twice because of the way they were labeled.

Data were downloaded from Qualtrics and exported to the Statistical Package for the Social Sciences (SPSS) Version 21 software for analysis. SPSS was used to compute and analyze data for frequencies, means, and standard deviations. Descriptive statistics also enabled the organization and summary of data using numbers to understand characteristics of the sample (Gall, Gall, & Borg, 1999). The next sections detail separate analyses for each research question.

Analysis for Research Question 1

The purpose of this research question was to obtain information on technologies at UB and UNAM. Participants were asked if they had access to a mobile phone, a tablet

device or a computer at home (laptops and desktops). Collecting data on technological access and use provided a glimpse of what technologies participants had available to them and how they used them.

Seeking information on technologies that participants have and how they are used is a descriptive inquiry. Descriptive analyses involved organizing data into a frequency distribution, displaying data in graphs or tables when appropriate. Measures of central tendency were used to determine scores for groups by providing the mean, while measures of variability determined the spread between groups. Standard deviations were presented as the main index of variability (Gay, Mills, & Airasian, 2012). When describing difference in usage of technologies, a range was given which described the highest and lowest scores in the sample.

In addition to obtaining access and use of mobile phones, tablets, and computers for the whole population, RQ1 also sought to determine how the results differ by populations and by institutions. As such, the analysis also compared students and lecturers as well as UB and UNAM to determine if there were differences in access or uses. Comparisons were conducted by examining the percentages across the three types of technologies.

There were three open-ended questions related to RQ1. Participants were asked to detail the three things they did most often with their 1) mobile phone, 2) computer and 3) tablets. Three spaces were provided for each question, which meant that a participant could have up to nine different responses. Open-ended items associated with RQ1 were coded for thematic analysis; a process described in further detail in the analysis of open-ended questions section.

Analysis for Research Questions 2 - 4

Research questions 2 through 4 consisted of multiple dependent and independent variables. Specifically, data analysis for these items was based on three independent variables and five dependent variables, as outlined in Figure 3-1.

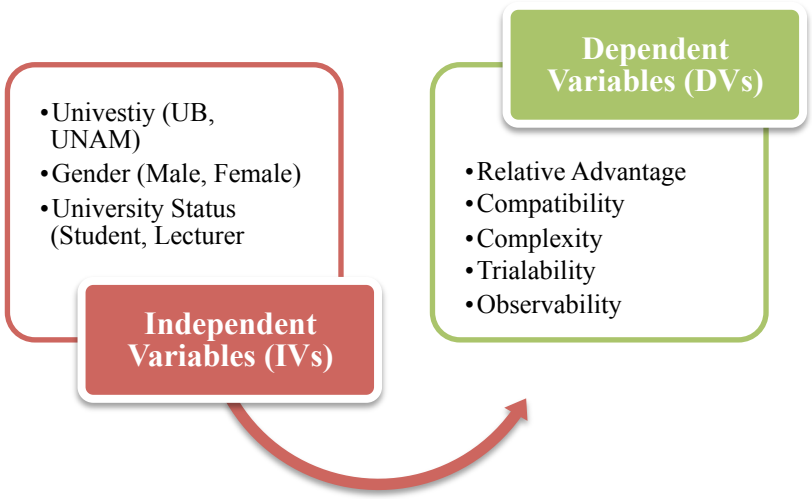


Figure 3-1. Variables

RQ2 - RQ4 were analyzed using a three way multivariate analysis of variance (MANOVA). A MANOVA was used because the research had multiple dependent and independent variables, and because MANOVAs are best at indicating the strength of the relationship while reducing statistical error (Mayers, 2013).

Analysis for Questions 5

Analysis of RQ5 was completed in two steps. The first step consisted of performing a statistical analysis on the entire data set to obtain the mean scores of the five diffusion attributes. The reason for obtaining mean scores was to determine if the pattern advocated by Rogers (2003) is the same in the present study. As a reminder Rogers

(2003) divides diffusion attributes into two groups (Figure 3-2) where RA, CY, TR, OB serve as positive factors in one group promoting diffusion and CX is a negative factor slowing the diffusion process. The mean and standard deviation scores for participants in the study were calculated for each diffusion attribute.

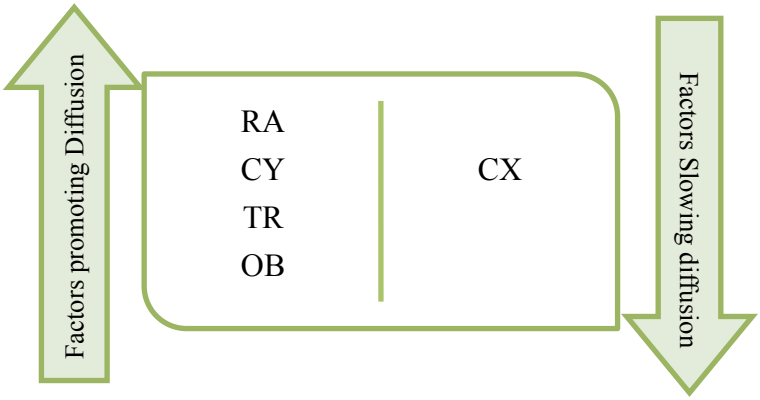


Figure 3-2: Rogers' persuasion stage model illustrated

The second step involved determining if the differences in means of the five attributes were significant. To accomplish this, a post hoc comparison Tukey's Honestly Significant Difference (HSD) was conducted to ascertain whether the difference between groups were statistically significant.

Analysis for Questions 6 - 7

Data for research questions 6 and 7 were obtained from open-ended responses, which permitted participants to respond in their own words. A thematic analysis was conducted for both questions. The specific procedures for the analysis are reported in the analysis for open-ended questions.

Analysis for open-ended questions

Survey instruments typically do not permit researchers to ask follow up questions. Including open-ended items enables the researcher to probe deeper into issues (Sudman and Bradburn, 1992; Oppenheim, 1992). In the present study, opened-ended questions were included to provide data that answers RQ1, RQ6, and RQ7. Analysis of open-ended responses in this study was completed through a thematic analysis.

Thematic analysis is an effective method for identifying, analyzing and reporting patterns within data (Braun & Clarke 2006) as well as quantifying content (Berelson, 1952) of participants' open-ended responses. In this study thematic analyses involved searching across data from open-ended items to find repeated patterns of meaning. An inductive approach was taken to identify codes and themes that are linked to the data themselves (Patton, 1990). Once generated, the codes and themes were checked and rechecked against data (Taylor & Ussher, 2001).

Thematic analysis for open-ended questions in this study was informed primarily by the works of Braun and Clarke (2006) and Graneheim and Lundman (2004). The process consisted of data familiarization, generating initial codes, creating categories, searching for themes, conducting peer review of themes and finalizing themes.

Data Familiarization. Braun and Clarke (2006) advise that it is vital to immerse oneself in the data so as to become familiar with its breadth and depth. To accomplish this, data was exported to an Excel sheet where participants' responses to open-ended questions were read to obtain a sense of what was in the dataset. No coding was done in the familiarization stage.

Generating initial codes. During the second reading, the researcher assigned codes to meaning units in the data set. Meaning units are "words, sentences or paragraphs containing aspects related to each other through their content and context" (Graneheim & Lundman 2004, p. 106). Each entry by an individual was treated as a single meaning unit. Codes were assigned systematically across the entire data set, using words that identify a feature of the data. However, a reading of texts revealed that some participants had different ideas in their meaning units which could fit into different codes. Graneheim and Lundman (2004) advice condensing the meaning units so that they are easier to code. This process consists of shortening the text while preserving the main idea of the participant. For RQ1 however, condensing meaning units was unnecessary because participants' submissions were short and referred to a specific task or activity. Each meaning unit was assigned a code that aligned with the text, however in some instances a meaning unit was assigned more than one code to reflect the different ideas represented therein and to enable a frequency count of each code. An example of how this process was accomplished for RQ1 is provided in Table 3-7.

Table 3-7

An example of converting meaning units to codes

Meaning Unit	**Code**
Call, send and receive messages and emails	Make & Receive Calls
	Send & receive SMS
	Check & send email
Listen To Music And Take Photos	Listen to Music
	Take Photos
Play games on my phone	Play games

The same coding procedure describe for RQ1 was followed for RQs 6 and 7. The main difference however was that the condensing of meaning unit procedure was implemented rather than move from meaning unit to coding. The reason for this decision

was that the responses entered by participants were much longer in length and in instances more descriptive. An example of the process is provided in Table 3-8. Once the coding scheme was completed the subtotal function in Excel was used to count the frequency of each code in the data set.

Table 3-8

The process of moving from meaning unit to condensed unit to code

Meaning Unit	Condensed Meaning Unit	Code
RQ 6 - Advantages		
NOWADAYS MOST PEOPLE HAVE ACCESS TO MOBILE DEVICES ESPECIALLY CELLPHONES SO USING THEM WILL BE OF AN ADVANTAGE SINCE THE LEARNING PROCESS WILL BE QUICK THEREFORE BECOMING EFFECTIVE AND EFFICIENT.	Nowadays most people have access to mobile devices especially cellphones	Everyone Has Access
	Using mobiles will make the learning process effective	Effective For Learning
	Using mobiles make learning process efficient.	Efficient Learning
RQ7 - Barriers		
slow speed of the internet, lack of knowledge on how to integrate technology and learning, lack of technological skills on both students and lecturers; lack of technical support from administration, i.e. timeously removing viruses, speedily responding when system is down, better management of overall IT infrastructure	Slow Speed Of The Internet	Infrastructure
	Lack Of Knowledge On How To Integrate Technology And Learning,	Lack Of Knowledge & Skills
	Lack Of Technological Skills On Both Students And Lecturers	Lack Of Knowledge & Skills By Students & Lecturers
	Lack Of Technical Support From Administration, I.E. Timeously Removing Viruses, Speedily Responding When System Is Down, Better Management Of Overall It Infrastructure	University Administration

To confirm the accuracy of the codes assigned were consisted with the text entered by participants; the researcher placed all open-ended responses from in RQ6 and

RQ7 into a world cloud generator (wordcloud.net). Word clouds create visual representation of the frequency of terms within a text (McKie, 2007), where font sizes indicates the frequency of a term in a body of text (Sinclair & Cardew-Hall, 2008). The higher the frequency, the larger the word appears. Word clouds have been used to analyze texts such as election campaign speeches and presidential addresses (Mehta, 2008). In education, Ramsden and Bate (2008) used word clouds to assess students' blog entries about their educational experiences. Word clouds in this study aided in confirming codes and themes identified by the researcher. They enabled the researcher to glance quickly at the words used most in the body of text and also served to supplement research tool for the triangulation of data (McNaught & Lam, 2010)

Generating sub-categories and categories. All codes were group together into subcategories. To condense the data set further, all sub-categories were reviewed and condensed into categories. Table 3-9 shows an example of how the process was implemented. Researchers have argue that creating categories is an important feature in the thematic analysis process where the goal should be to ensure that categories are not only exhaustive and mutually exclusive but that no data are excluded because of lack of suitable categories (Graneheim & Lundman, 2004; Krippendorff, 1980).

Table 3-9

An example of steps followed to convert codes to subcategories and subcategories to categories

Codes	Browse Internet For School Work (2) Browse The Internet (10) Read News (1) Research On The Internet (6) Save Notes From The Internet (1)	Download & Play Music (2) Download Notes (1) Downloading (1) Listen To Music (39) Listen To Radio (1) Media (1) Play Games (2) Use The Media Player (1) Watch Videos (1)
Sub-Category	Consume Information	Consume Media
Category	*Consumption of content*	

Searching for themes. Once codes were assigned to the dataset, a secondary analysis was conducted on codes to identify themes. Themes were analyzed to reduce overlap and facilitate description.

Peer Review of themes. A challenge to coding and generating thematic analyses is that text entered by participants may have multiple meanings and always involved interpretation (Graneheim, & Lundman, 2004). To evaluate whether the codes, subcategories, categories and themes were trustworthy, the researchers submitted the Excel file with the comments, codes, and themes for peer review and verification. An email was sent to four peers who reviewed the data for validity. Peers in this context involved researchers who were in the process of completing their dissertation or had recently defended. All peers had experiences in conducting research that included analyzing textual data.

Finalizing themes. Once feedback from peers was received, the researcher reviewed the comments and concluded the thematic coding process. An example of the completed coding scheme is shown in Table 3-10. The table reflects the process, starting with the codes and their frequency in the data set listed in parenthesis. Codes are then placed in sub-categories which were converted to categories and from which themes were created.

Table 3-10

Example of the completed coding scheme

Code	Access University online learning material (Blackboard, Moodle) (3) emails & class discussion (1) LEARN SOME BASIC THINGS IN THE COMPUTER (1) School Assignments (Research, Type, Read lecture notes./slides) (124)	Access Social Networking sites (39)	Check emails (9)	Browse Internet (22) Online news (1) Read (eBooks, PDFs) (5) search fashion trends (1)	Browse through Photos (4) Download Content (Videos, Movies, Games, Music) (20) Listen to music (60) Play Games (22) Take Photos (5) Watch Videos & Movies (107)	DOWNLOAD PDF'S (1) guitar (1) keep records of my files (1) Format documents (1) Listen to Christian teachings (1) look for health or medical information (2) personal stuff (2) Programming (2) read material on personal development (1) READ NOTES AND E-BOOKS (1) READ STORED DATA ON DISCS AND FLASH DRIVES (1) READING ANY INFORMATION SAVED ON EXTERNAL DRIVES RELEVANT TO ASSIGNMENTS (1) reading downloaded pdf (1) rugby (1) Shopping (1) transferring/exchanging data (1) Typing Assignments & personal stuff (1) 20	mix via virtual dj (1) Record and produce music (1)
Sub - Category	*School Access*	Social Networking	Communi cate	Consume Information	Consume Media	*Personal Management*	
Category		*Communication*		*Consumption of content*			Create
Theme	**Computers are used for academic purposes**	**Computers are used for communication**		**Computers are used to consume content**		**Computers are used for personal management**	**Computers are used to create content**
	28.92%	10.76%		55.38%		4.48%	0.45%

Summary

This chapter outlined the method used in the study investigating factors that influence diffusion of mobile devices within higher education in Botswana and Namibia. Included in this chapter was information on participants, materials used in the study, research design—which describe the comparative method, data collection procedure, research questions—and data analysis method. Results of data analysis and interpretation will follow in Chapter 4.

Chapter 4

Results

This comparative study sought to identify factors that influence the diffusion process of mobile devices in higher education in Botswana and Namibia. Through a questionnaire completed by students and lecturers at the University of Botswana and the University of Namibia, participants' responses documented their perceptions towards mobile devices as an educational technology and the benefits and challenges associated with their use.

This chapter presents data collected and analyzed using the method described in Chapter 3. The first part presents an overview of the data collected. The second part provides descriptive information on participant demographical data. The third part presents results for each of the seven research questions. To measure the difference between the means of groups, the researcher used a one-way MANOVA. The chapter concludes with a summary of the findings.

Overview of data collected

This section provides an overview of the data collected, including the instrument reliability and validity. A survey instrument was designed to collect three types of data. The first section of the survey (questions 1-8) gathered demographic data such as gender, age, location, and field of study. The second section contained 11 questions about

participants' technological ownerships, access, and usage. The third section contained thirty-eight items on diffusion of mobile devices. The last question asked for comments or feedback on the instrument. The complete survey instrument is available in Appendix A.

Reliability and Validity

Reliability and validity have for a long time been linked. As Amrein-Beardsely (2014) argues, validity is essential of any measurement, and reliability is a necessary or qualifying condition for validity. However having one does not necessarily mean having the other. This is to say that even if reliability is supported, it does not simply mean that validity will follow; similarly the converse also holds true. This section reports on how reliability and validity were established in the study.

Reliability. Reliability is a statistical measure for how a survey instrument's data are reproducible (Litwin, 1995). It is concerned with the extent to which a measure produces the same results on repeated trials (Carmines & Zeller 1995). To obtain a reliability score, Cronbach's alpha has been the gold standard and widely used in the social sciences (Bonett & Wright, 2015). In the present study, reliability analysis was conducted using SPSS to establish the extent to which the five attributes were reliably measured by the instrument. As shown in Table 4-1, the scores are between .46 and .63.

Table 4-1

Reliability Measurement of Diffusion Attributes

Attributes	Cronbach's Alpha	N of Items
Relative advantage	0.64	3
Compatibility	0.50	11
Complexity	0.20	5
Trialability	0.30	6
Observability	0.46	10

A high reliability score increases the power of the inference that can be made based on the data. However, there is no universally acceptable minimum reliability value (Bonett and Wright, 2015). Although the reliability score also serves to assist the researcher in interpreting the effect size of the result, the focus should not only be placed on the score above, but also on interpreting the overall data because a reliability score does not necessarily invalidate the whole dataset.

Validity. Validity refers to whether an instrument can measure what it is supposed to measure. Validity is important in research because it enables the researcher to make inferences based on the data gathered. For this study, experts in the field of diffusion of innovation examined the instrument to establish internal and content validity by providing expert judgment on the establishments of scales in Table 4-1. The instrument was submitted to two professors in the researcher's department, one professor at another doctoral granting institution in the US, and one researcher based in Africa. Table 4-2 provides an example of the feedback given.

Table 4-2

Example of Expert Feedback

Items	**Researcher Coding**	**Initial if Agree**	**Suggest correct Coding**	**Agreement percentage**	**Decision**
Mobile phones can help with learning tasks, such as writing, analyzing data, or solving problems.	RA	*Expert1, Expert2, Expert3, Expert4*		100.00	Kept
It is easy to access learning materials through my Mobile phone	CX	*Expert1, Expert2, Expert3*	*Expert4* – RA	80.00	Kept
University makes it compulsory to have/use a certain technology	TR	*Expert3* (but maybe OB OR CY?)	*Expert1*-Not Sure / *Expert2*– Not sure / *Expert4* – N/A * Seems that the mandatory nature of the use of the technology trumps the adoption model altogether. Or, it could be a CY (compatibility) as the culture would seem to value it, since they require it.	40.00	Deleted

The instrument was adjusted based on feedback from the panel of experts as detailed in chapter 3. The items that had an agreement of less than 80% were not included in the subscales.

Demographic of Participants

This study included 1006 participants, of whom approximately 60% were from the University of Botswana and 40% from the University of Namibia. The descriptive statistics of the demographic data include university status (i.e. student or lecturer), gender, years in school (for students), and length of employment at the university (for

lecturers). Participants were free to skip questions, hence the sample size for each item fluctuated. Table 4-3 presents further demographic data by university while Table 4-4 provides information on the distribution across 12 faculties (i.e. colleges/schools) at the two institutions.

Table 4-3

Participant Demographics

		University of Botswana		**University of Namibia**		**Total**
		N	**%**	**N**	**%**	
University Status	Student	566	94.50	364	89.40	930
	Lecturer	33	5.50	43	10.60	76
Gender	Female	355	61.50	267	66.10	622
	Male	222	38.50	137	33.90	359
Age	18 - 24	363	62.70	308	76.00	671
	25 - 33	110	19.00	44	10.90	154
	34 - 44	77	13.30	31	7.70	108
	45 - 54	19	3.30	13	3.20	32
	54 - 65	9	1.60	9	2.20	18
	66 or older	1	0.20	0	0.00	1
Year in school (students only)	1st Year	201	35.50	67	18.40	268
	2nd Year	51	9.00	161	44.23	212
	3rd Year	181	32.00	109	29.95	290
	4th Year	25	4.42	14	3.85	39
	Post Graduate	78	13.78	3	0.82	81
	Other	2	5.30	10	2.75	12
Length employed at school (lecturers only)	1 to 3 years	2	6.25	2	4.65	4
	3 to 5 years	4	12.50	2	4.65	6
	5 to 10 years	6	18.75	11	25.58	17
	10 years +	19	59.38	25	58.14	44
	20 years +	1	3.12	3	6.98	4

Table 4-4

Sample representation across faculties at UB & UNAM as a percentage

	University of Botswana		**University of Namibia**	
Faculties	*Student*	*Lecturer*	*Student*	*Lecturer*
Faculty of Agriculture and Natural Resources	n/a	n/a	0.00	9.30
Faculty of Business	2.00	21.90	0.00	2.30
Faculty of Economics and Management Science	n/a	n/a	0.00	16.30
Faculty of Education	40.00	46.89	71.80	25.60
Faculty of Engineering	0.70	0.00	0.70	0.00
Faculty of Health Science	0.60	0.00	0.60	0.00
Faculty of Humanities	2.60	0.00	n/a	n/a
Faculty of Humanities and Social Sciences	0.00	21.90	9.90	30.20
Faculty of Science	33.00	9.40	1.00	14.00
Faculty of Social Sciences	20.70	0.00	n/a	n/a
School of Medicine	n/a	n/a	16.00	0.00
School of Nursing and Public Health	n/a	n/a	0.00	2.30
Other	0.40	0.00	n/a	n/a

n/a = faculty does not exist at the university
**Numbers are a percentage of the total for the column*

UB and UNAM students came from all parts of the countries to attend school. To ascertain the representativeness of the sample population, the instrument included an option where a participant could indicate where she or he grew up. Figure 4-1 shows the districts (in Botswana) and regions (in Namibia) from which the participants in the study originated.

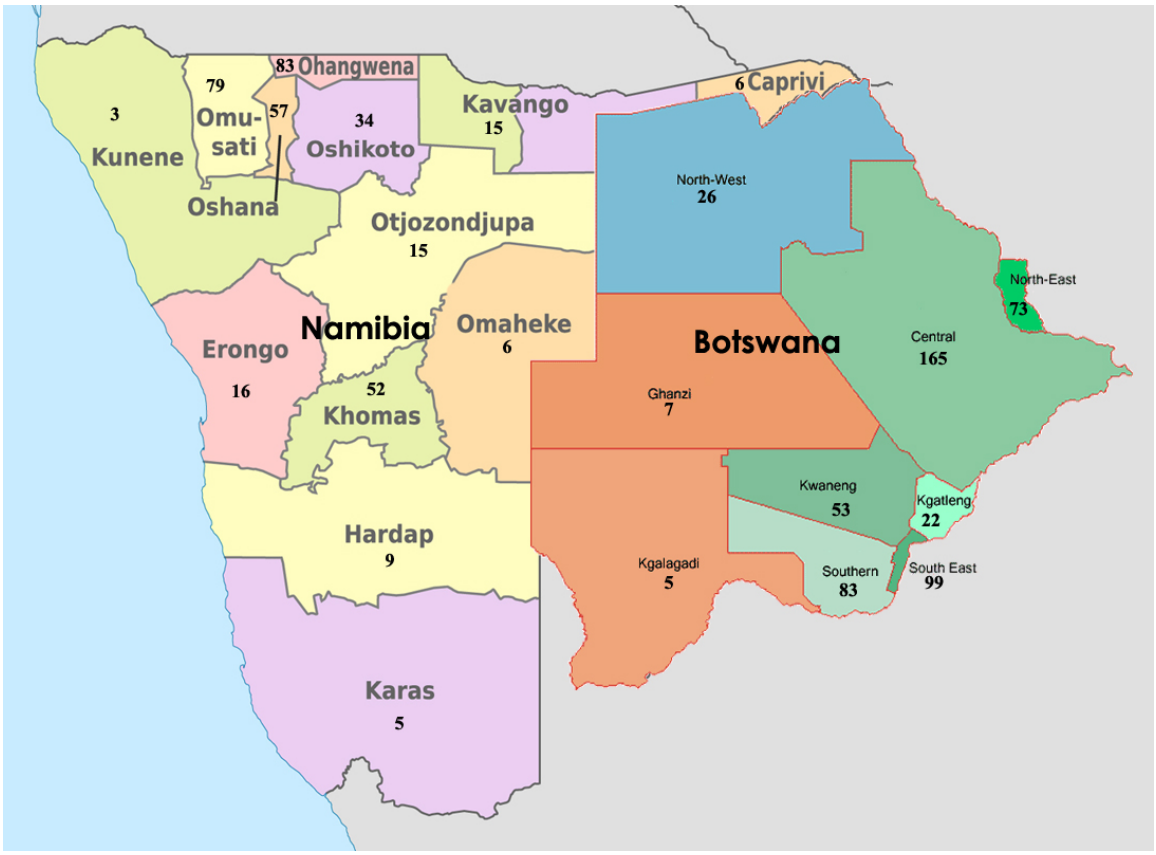


Figure 4-1: regional representation

Data from the question *"In which district /region did you grow up?"* revealed that all regions and districts were represented in the sample. In Botswana, the three areas with most representations were Central District (25%), which is also the largest district by population in the country, Southern District (12%), and Gaborone City (9%). In Namibia, Ohangwena (20%), Omusati (19%) and Oshana (14%) were the three regions with the highest representation in the sample.

Results by research Question

This section reports findings from the study. The research questions that guided the study were developed using Rogers' (2003) theoretical framework for diffusion of innovations. Data to answer RQ2 – RQ4 were obtained from a MANOVA test, results of which are presented in tables Table 4-5 and

Table 4-6.

Table 4-5: *MANOVA Table for RQ 2- RQ4*

Effect	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Observed Power[a]
Intercept	.034	5027.92	5	881	0.00	.966	1.00
University Affiliation	.990	1.81	5	881	0.11	.010	0.62
University Status	.966	6.28	5	881	0.00	.034	1.00
Gender	.993	1.33	5	881	0.25	.007	0.47
University Status * Gender	.996	0.65	5	881	0.66	.004	0.24
University Status * University Affiliation	.997	0.53	5	881	0.75	.003	0.20
Gender * University Affiliation	.993	1.24	5	881	0.29	.007	0.44

Table 4-6 *Tests of Between-Subjects Effects*

Source		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Observed Power
University Status	RA	10.62	1	10.62	8.97	0.003	0.010	0.85
	CY	3.86	1	3.9	23.43	0.000	0.026	1.00
	CX	1.64	1	1.64	5.80	0.016	0.007	0.67
	TR	0.96	1	0.96	3.63	0.057	0.004	0.48
	OB	1.94	1	1.94	9.10	0.003	0.010	0.85
Error	RA	1047.52	885	1.18				
	CY	145.79	885	0.16				
	CX	250.29	885	0.28				
	TR	234.11	885	0.26				

OB	188.77	885	0.21

RQ1. What types of technologies do participants have and how are they used?

Survey results indicated that nearly all participants had access to mobile phones, but little access to tablet devices. At both institutions, 99% of participants indicated that they owned a mobile phone. For tablet devices however, the findings were reversed (see Figure 4-2). Only 14% of participants responded that they had access to a tablet device.

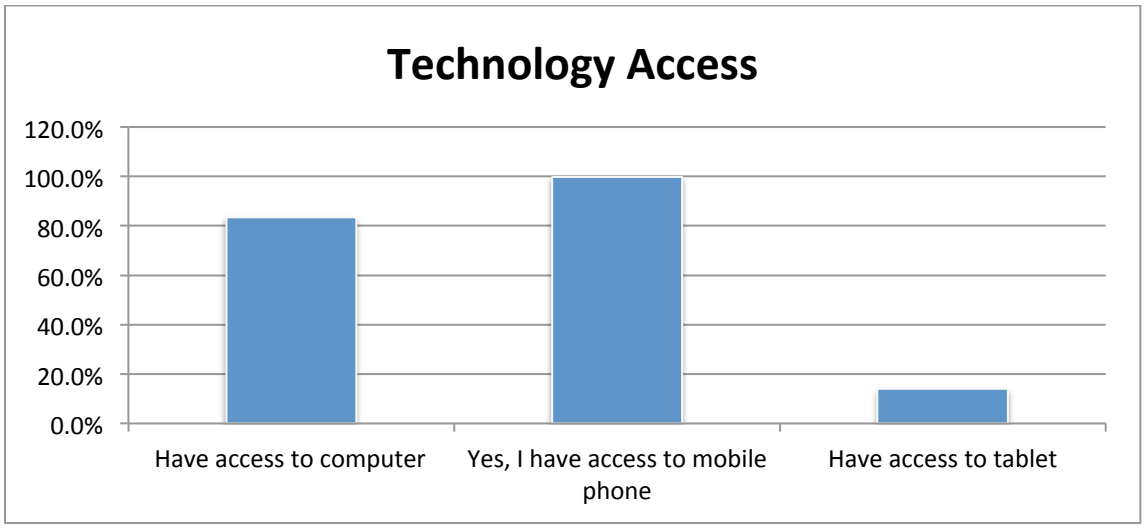


Figure 4-2: Technology Access

A secondary goal for this question was to understand how available technologies were used by participants. The instrument contained items that asked how participants used their mobile phones, tablets and computers.

Mobile phones access. Participants were provided with a list of 13 activities and asked to report the frequency with which they performed each activity. The majority of students and lecturers in both countries used their mobile phones primarily for social purposes as shown in Table 4-7 and Table 4-8 *(Numbers in the tables represent a percentage of the total in each row).*

Table 4-7

Student mobile phone use by institutions as a percentage

	Institution	Never	1-3 times a month	2-3 times a week	Once a week	Everyday
Access social networking sites (i.e. Facebook, Twitter, etc.).	UB	18	4	12	5	61
	UNAM	14	6	15	7	58
Access university online learning materials	UB	33	12	20	9	26
	UNAM	26	11	19	11	33
Banking	UB	13	44	16	14	13
	UNAM	27	35	12	14	12
Download songs, videos, games or ringtones	UB	29	26	16	14	15
	UNAM	23	33	19	9	16
Look for health or medical information	UB	47	26	10	8	9
	UNAM	32	25	15	12	16
Record Lectures	UB	74	9	6	6	5
	UNAM	68	13	7	4	8
Record video clips	UB	37	30	12	10	11
	UNAM	30	34	13	9	14
Research information for school assignments	UB	27	13	20	10	30
	UNAM	16	15	25	10	34
Send and receive email	UB	35	16	15	8	26
	UNAM	23	20	14	8	35
Send and receive SMS	UB	0	1	6	1	92
	UNAM	1	1	2	1	95
Share files through Bluetooth	UB	20	32	20	12	17
	UNAM	12	21	25	13	29
Take notes	UB	54	12	10	8	17
	UNAM	49	10	9	7	25
Use for time management/schedule	UB	20	13	6	6	55
	UNAM	17	9	7	7	60

Table 4-8

Lecturers mobile phone use by institutions as a percentage

	Institution	Never	1-3 times a month	2-3 times a week	Once a week	Everyday
Access social networking sites (i.e Facebook, Twitter, etc.).	UB	53	22	6	6	13
	UNAM	39	8	8	3	42
Access university online learning materials	UB	66	9	13	3	9
	UNAM	56	5	5	10	23
Banking	UB	31	31	13	13	13
	UNAM	47	16	11	13	13

Download songs, videos, games or ringtones	UB	77	23	0	0	0
	UNAM	59	22	5	5	8
Look for health or medical information	UB	65	19	10	6	0
	UNAM	47	32	8	5	8
Record Lectures	UB	94	0	0	6	0
	UNAM	84	5	5	0	5
Record video clips	UB	63	31	6	0	0
	UNAM	47	13	8	13	18
Research information for school assignments	UB	71	6	10	3	10
	UNAM	43	14	16	8	19
Send and receive email	UB	47	9	9	6	28
	UNAM	32	3	11	5	50
Send and receive SMS	UB	3	0	6	0	91
	UNAM	3	3	3	0	92
Share files through Bluetooth	UB	69	25	3	3	0
	UNAM	59	19	8	5	8
Take notes	UB	77	6	10	6	0
	UNAM	66	13	5	0	16
Use for time management/schedule	UB	22	13	25	3	38
	UNAM	18	13	13	8	47

Participants were also provided with an open-ended question that asked *"What are three things you do most often with your mobile phone?"* Table 4-9 presents the thematic analysis results from the open-ended item.

Table 4-9

How students and lecturers use mobile phones as a percentage

Students						
Theme	**1st Most Use**		**2nd Most Use**		**3rd Most Use**	
	UB	UNAM	UB	UNAM	UB	UNAM
Academic Purposes	1.39	0.75	4.12	3.02	9.28	5.43
Communication	84.52	90.98	71.35	65.31	40.43	39.40
Consume Content	12.00	6.77	14.98	23.37	28.62	35.87
Personal Management	1.74	1.50	6.74	5.28	15.86	11.41
Create Content	0.35	0.00	2.81	3.02	5.81	7.89
Lecturers						
	1st Most Use		**2nd Most Use**		**3rd Most Use**	
	UB	UNAM	UB	UNAM	UB	UNAM
Academic Purposes	0.00	0.00	0.00	0.00	0.00	2.70
Communication	88.88	96.00	90.32	85.37	26.67	27.03
Consume Content	5.56	4.00	0.00	4.88	23.33	24.32
Personal Management	5.56	0.00	9.68	7.32	40.00	40.54
Create Content	0.00	0.00	0.00	2.44	10.00	5.41

**numbers are expressed as a percentage of each column*

Computer access. Participants were asked about their access to desktop computers or laptops. As Figure 4-3 shows, over 80% of students and lecturers (UB: students N= 530; lecturers N=33-lecturers and UNAM: students N= 358, Lecturers N=39) reported having access to desktop computers and laptops in their homes.

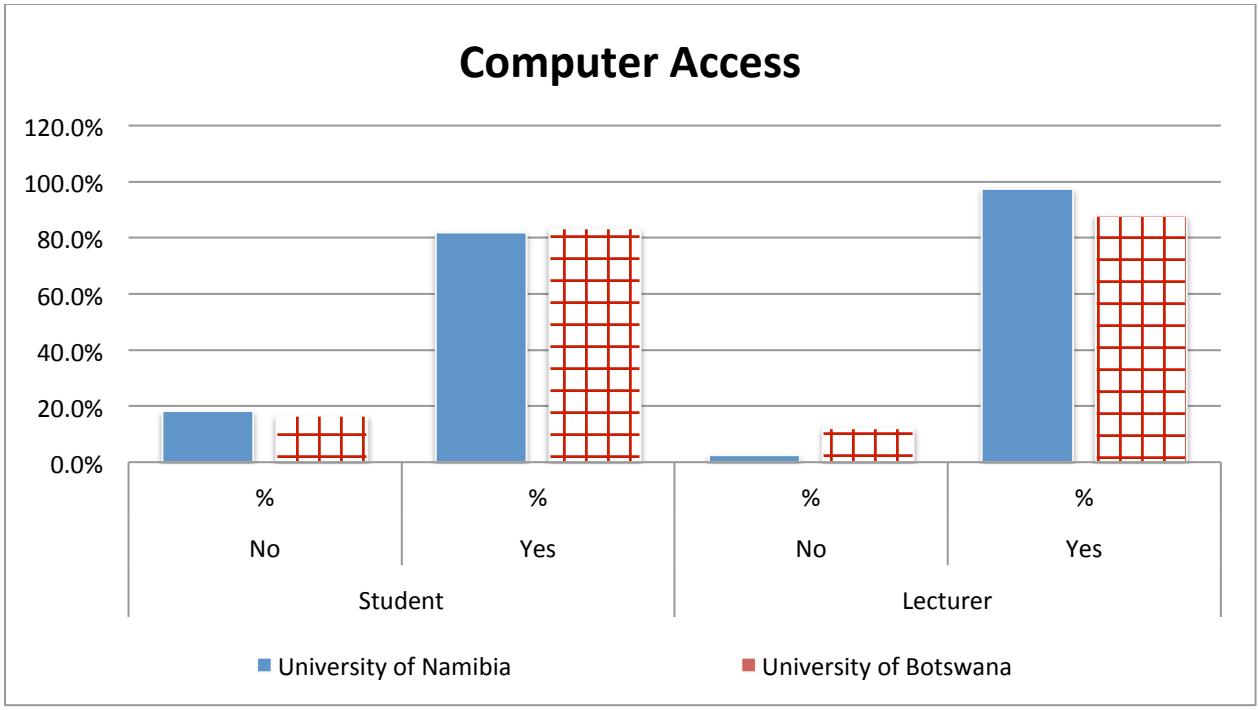


Figure 4-3: Access to desktop and laptop computers

To learn further how participants used their computers and laptops, an open-ended question was provided. Participants were asked *"What three things do you do most often on your computer?*" Responses were coded and assigned themes as described in chapter 3. Data contained five themes: Academic purposes, Communication, Consume content, Personal management, and Create content. Table 4-10 presents a breakdown of the themes by students and lecturers.

Table 4-10

How students and lecturers use computers *

	Students					
	1st Most Use		2nd Most Use		3rd Most Use	
	UB	UNAM	UB	UNAM	UB	UNAM
Academic Purposes	58.31	47.81	28.92	33.12	20.87	17.88
Communication	8.91	10.00	10.76	11.9	12.61	14.24
Consume Content	30.1	40.31	55.39	49.51	58.03	59.93
Personal Management	1.34	0.94	4.48	4.18	3.21	4.64
Create Content	1.34	0.94	0.45	1.29	5.28	3.31
	Lecturers					
	1st Most Use		2nd Most Use		3rd Most Use	
	UB	UNAM	UB	UNAM	UB	UNAM
Academic Purposes	50.00	40.54	38.46	43.24	25	30.3
Communication	21.43	24.32	23.08	29.73	37.49	18.18
Consume Content	28.57	27.03	15.38	16.22	16.67	39.4
Personal Management	0.00	8.11	19.23	10.81	16.67	12.12
Create Content	0.00	0.00	3.85	0.00	4.17	0.00

**numbers are expressed as a percentage of each column*

Tablet Device Access. Participants who reported having tablet devices were also asked about their uses. Responses were coded and assigned themes as described in chapter 3. Data from students and lecturers at UB and UNAM who have tablet devices is presented in Table 4-11.

Table 4-11

How Students and Lecturers use Tablet Devices

	Students					
	1st Most Use		2nd Most Use		3rd Most Use	
	UB	UNAM	UB	UNAM	UB	UNAM
Academic Purposes	21.31	22.22	1.64	6.38	12.50	10.26
Communication	44.26	28.89	50.82	27.66	16.07	28.21
Consume Content	21.31	31.11	31.15	51.06	46.43	43.59
Personal Management	8.20	8.89	14.75	12.77	14.29	15.38
Create Content	4.92	8.89	1.64	2.13	10.71	2.56
	Lecturers					

	1st Most Use		2nd Most Use		3rd Most Use	
	UB	UNAM	UB	UNAM	UB	UNAM
Academic Purposes	0.00	9.52	16.67	5.26	0.00	5.56
Communication	33.33	23.81	0.00	47.37	16.67	27.77
Consume Content	66.67	33.33	33.33	26.32	83.33	22.22
Personal Management	0.00	33.33	16.67	21.05	0.00	38.89
Create Content	0.00	0.00	33.33	0.00	0.00	5.56

**numbers are expressed as a percentage of each column*

RQ2: Do perceptions towards diffusion attributes differ by institution?

The second research question sought to identify differences between UB and UNAM in the participants' perceptions towards diffusion attributes. Examining Table 4-5 reveals that no significant differences between the two institutions were found among the five dependent measures of diffusion attributes, Wilk's $\Lambda = 0.990$, $F(5, 881) = 1.810$, $p > .05$. Hence the data collected does not reveal any difference between University of Botswana and University of Namibia participants' perception towards diffusion attributes.

RQ3: Do perceptions towards diffusion attributes differ by university status?

There was a significant difference between Students and Lecturers' perceptions of diffusion attributes, Wilk's $\Lambda = 0.966$, $F(5, 881) = 6.285$, $p < .05$. An ANOVA test was conducted (

Table 4-6) as a follow up and revealed that there was a significant difference between students and lecturers on all attributes except trialability.

RQ4: Do perceptions towards diffusion attributes differ by gender?

No significant differences between females and males were found among the five dependent measures of diffusion attributes, Wilk's $\Lambda = 0.993$, $F(5, 881) = 1.331$, $p < .05$.

RQ5: Does the diffusion pattern in the study differ from the one advocated by Rogers?

RQ5 sought to identify whether the means of the five attributes (Table 4-12) conform to or differ from Roger's model. The mean scores indicate that the pattern in this sample is different from that of Rogers.

Table 4-12

Statistical means of diffusion attributes

	Relative Advantage (RA)	Compatibility (CY)	Complexity (CX)	Trialability (TR)	Observability (OB)
Mean	3.43	3.36	3.41	2.85	2.68
N	919	907	915	902	918
Std. Deviation	1.11	0.42	0.57	0.52	0.50

A follow up test was conducted to determine if the difference in the means was significant. A post hoc comparison Tukey's HSD (Table 4-13) revealed that the mean difference is significant ($p < 0.05$) for the trialability and observability.

Table 4-13

Posthoc five pairwise comparisons

		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
RA	CY	0.0696	0.0313	0.1720	-0.0159	0.1551
	CX	0.0118	0.0313	0.9960	-0.0735	0.0971
	TR	0.5740	0.0314	0.0000	0.4884	0.6596
	OB	0.7449	0.0312	0.0000	0.6597	0.8302
CY	RA	-0.0696	0.0313	0.1720	-0.1551	0.0159
	CX	-0.0578	0.0314	0.3480	-0.1434	0.0277
	TR	0.5044	0.0315	0.0000	0.4185	0.5903
	OB	0.6753	0.0313	0.0000	0.5898	0.7608
CX	RA	-0.0118	0.0313	0.9960	-0.0971	0.0735
	CY	0.0578	0.0314	0.3480	-0.0277	0.1434
	TR	0.5622	0.0314	0.0000	0.4765	0.6479
	OB	0.7332	0.0313	0.0000	0.6479	0.8185
TR	RA	-0.5740	0.0314	0.0000	-0.6596	-0.4884
	CY	-0.5044	0.0315	0.0000	-0.5903	-0.4185
	CX	-0.5622	0.0314	0.0000	-0.6479	-0.4765
	OB	0.1710	0.0314	0.0000	0.0853	0.2566
OB	RA	-0.7449	0.0312	0.0000	-0.8302	-0.6597
	CY	-0.6753	0.0313	0.0000	-0.7608	-0.5898
	CX	-0.7332	0.0313	0.0000	-0.8185	-0.6479
	TR	-0.1710	0.0314	0.0000	-0.2566	-0.0853

*. The mean difference is significant at the 0.05 level.

RQ6: What do participants believe are the advantages of using mobile devices over other technologies for learning?

Data to answer RQ6 was obtained from 730 responses provided by participants from the two universities (UB =450; UNAM=280). A thematic analysis was conducted as detailed in chapter 3.The following three themes were discerned from the data set:

- *Theme 1 - Mobile devices are easier to use and provide for access to information and anytime anywhere.*
- *Theme 2 - Mobile devices enable learner autonomy and improve teaching and learning.*
- *Theme 3 - Mobile devices are more convenient, portable and multipurpose than other learning technologies.*

Table 4-14 shows the codes from the data set that had a frequency of 50 or above. A complete listing of the codes is provided in appendix C.

Table 4-14

Perceived advantages of using mobile devices for learning

Researcher Code	Frequencies	Example
Portability	229	▪ Its portability makes it very safe to have and carry around since it cannot be easily detected thus stolen ▪ Mobile phones are portable, we have them all the time with us, so you can access information on the internet anytime
Easier to use	122	▪ Mobile devices are easier to use than traditional computers ▪ Learners are more comfortable with using devices so learning will be more easier
Anytime-Anywhere Learning	95	▪ I think the advantages are wherever and at any time one can access their course material. For example I have over 4 gig of pdf books in my desktop and therefor if I was to have a mobile device which access these it would mean I could access my books at any time weather on the bus or waiting for someone at the mobile. ▪ You can learn anywhere, even at the cattlepost.
Faster	95	▪ Mobile devices are faster than computers ▪ Faster access to school material
Less expensive/ They're cheap	70	▪ Generally cheaper than laptops or computers. ▪ They will be able to read books on the tablet which would be cheaper, and they can search for information even during lectures.
Easily Accessible	55	▪ You can easily access the phone wherever you are because it is portable ▪ Mobiles phones have become so widespread and easily accessible in even the most remote areas. So the use of mobile will obviously be the technology that people will be able to relate to the best and utilize most effectively for learning purposes. ▪ One can do research right on the spot. E.g. No need to print lecture slides if you have them on your tablet

RQ7: **What do students and lecturers perceive as barriers preventing the use of mobile devices in teaching and learning?**

Data to answer RQ7 is obtained from 599 responses provided by participants from the two universities (UB =358; UNAM=241). Each participant entry was read and assigned a code. A thematic analysis was conducted as detailed in chapter 3.The following four themes were discerned from the data set:

- Mobile devices are seen as disruptive to teaching and learning experiences.
- The cost of mobile devices, the technology and infrastructure form a barrier to their use in education.
- The environment at the institution is currently not supportive of using mobile devices for teaching and learning.
- There is a lack of knowledge and skills by lecturers and students on how to integrate mobile into teaching and learning

Table 4-15 shows the codes from the data set that had a frequency of 50 and above, the rest of the codes are provided in Appendix D.

Table 4-15

Barriers to using mobiles in teaching & learning at UB & UNAM

Code by Researcher	Frequencies	Example
Distraction/Disturb	220	▪ Students get over-exited and end up losing focus on what they should use the device for. ▪ No order in classes, disrespecting the lecturer
Affordability	133	▪ Not every student has money to buy those mobile devices and it wouldn't be fair if the lecturer tell students to use them while others have no access to them ▪ Not all students can afford to buy mobile phones that can access internet; hence not all can manage to use their phones to do academic work such as researching and accessing online materials.
Infrastructure	89	▪ Un-availability of Wi-Fi on campus at all points ▪ The bandwidth of the Internet services the university is able to subscribe to. Too many units on narrow bandwidth slows done download drastically.
Distraction from social media	69	▪ Students may end up going to social networks instead of actually learning in class ▪ Student's attention will be taken by social networking. / Music listening. / Watching videos.
Conflict with values	52	▪ The mindset of people that use of mobile phones are a distraction ▪ Reduces lecturer/ learner interaction
Technology	52	▪ Lack of memory card, can't save stuff. ▪ Some of the mobile devices does not access internet, e.g. Sedilame (Nokia 1208)

Summary

This study was designed to investigate factors that influence diffusion of mobile devices at UB and UNAM. This chapter presented demographic information, data on reliability and validity of the instrument, and the findings for each of the research questions. To make sense of the data presented, Chapter 5 will discuss the findings, implications, and recommendations.

Chapter 5

Summary, Discussions and Recommendations

This final chapter begins with a brief description of the study followed by a discussion of the findings. The findings of the study are discussed in the context of relevant literature where appropriate. Recommendations for further research conclude this chapter.

Description of the study

In African countries such as Botswana and Namibia diffusion of mobile devices occurred at unprecedented rates (Aker & Mbiti, 2010; ICT Update, 2008; Kalba, 2008; Mbarika & Mbarika, 2006). Mobile devices are popular among students (Ng'ambi, 2005) for outside class activities such as texting and accessing social media websites, but their use in higher education in Africa has not gained the same degree of popularity as they have in social settings.

A review of literature revealed no studies focused on the mobile device diffusion paradox in Botswana and Namibia, whereby they are used in everyday life, but appear to be absent at universities, which are expected to be the hub of innovation and new discoveries. To examine this paradox, the present study used the DoI theory focusing specifically on the five attributes (RA, CY, CX, TR, and OB) of the persuasion stage to examine factors that influence the diffusion process of mobile devices at UB and UNAM.

Beyond studying a phenomenon, the comparative case of Botswana and Namibia was chosen because of a desire to add to the body of literature on DoI theory in Africa. A review of literature confirmed Agbonlahor's (2006) observation, that studies applying DoI to research in African countries are very few. Moreover, studies investigating factors influencing the diffusion process of ICT in Africa are primarily conducted in economic giants on the continent like South Africa and Nigeria. This study makes a contribution by adding a case of smaller countries such as Botswana and Namibia.

Discussion of the findings

The data collected and presented in Chapter 4 provided responses to the main research question: *What factors influence the diffusion process of mobile devices in higher education in Botswana and Namibia?* In this section, the findings are discussed and explanations given to draw meaning from the data as well as situate the findings within relevant literature. Research questions are discussed in the same order that they are presented in Chapter 4 and not necessarily by importance of the findings. Discussions of the findings will focus primarily on the participants in the study. A low reliability score reported in Table 4-1 means that inference that can be drawn from these findings are limited in their generalization to the larger population.

RQ1 Discussion: What types of technologies do participants have and how are they used?

The first research question sought information on types of technologies to which participants have access. As articulated in Chapters 1 and 2, African countries such as

Botswana and Namibia are often described as having impoverished infrastructure such as electricity grids that make it difficult to support computer access. These statements are articulated in reports from various international organizations such as the United Nation's International Telecommunication Union (ITU). For example, ITU (2014) developed an ICT Development Index (IDI) benchmark that monitors and compares developments in ICT across countries. As shown in Figure 5-1, although Botswana and Namibia are above the average score for African countries, they are below the average score for the rest of the world and fall even further when compared to economically developed countries.

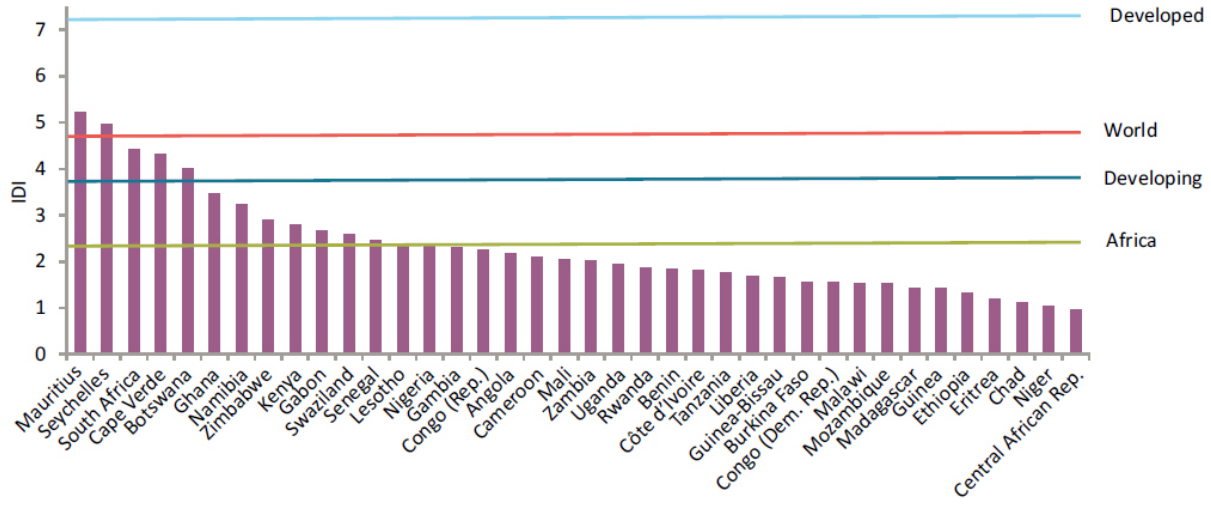


Figure 5-1: Africa IDI Index (ITU, 2014)

A consensus has formed in the literature that insufficient infrastructure is the reason for Africa having low distribution of computers compared to anywhere else in the world (Aker & Mbiti, 2010; ITU, 2009; World Bank, 2009). RQ1 sought to examine this claim by identifying the technologies available to students and lecturers as well as how they are used. Collecting data on access and use provides a glimpse of technologies available to participants at the two institutions.

Three main findings can be discerned from responses collected to answer RQ1: UB and UNAM have (a) high mobile phone and low tablet access, (b) high computer access, and (c) a boundary exist between social and academic uses of these technologies.

High Mobile phones and low tablets access. In this study, nearly all participants had access to mobile phones and low access to tablet devices. At both institutions, 99% of participants indicated that they owned a mobile phone. For tablet devices however, the findings were reversed. Only 14% of participants indicated that they had access to a tablet device. As such, tablet devices are still an emerging technology at the two institutions where very few people have access to them.

High Computer access. Access to computers at UB and UNAM does not fully reflect what is stated in the literature. Participants in the sample indicated surprisingly high access to personal computers. Researchers have cited limited access to desktop computers and laptops as a hindrance to diffusion of ICT in African universities (Keats and Schmidt, 2007). Improving ICT infrastructure, including increasing computer availability and Internet bandwidth on the continent are seen as preconditions to making use of ICT for teaching and learning (Lwoga, 2012). Although it is indeed true that there are numerous institutions globally and in Africa where infrastructure has limited access to computers, the data collected in this study do not support such assertions at UB and UNAM.

Students and lecturers in the sample are not characterized by lack of access to a desktop computer. As Figure 4-3 showed, over 80% of students and lecturers reported having access to desktop computers and laptops in their homes. Looking at only the data

for those with computers access also reveals that 57% of students and 79% of lecturers reported having Internet connectivity at their home.

Many reasons might account for differences regarding technology and Internet access in the present study and what is reported in the literature. Two reasons are provided here. Firstly, there may be a difference in how ownership and access are measured in the literature. As Porter, Hampshire, Abane, Munthali, Robson, Mashiri, and Tanle (2012) report, when it comes to technology, ownership and access can be synonymous. For example, sharing a mobile phone is a common practice in many African countries because subscriber identity module (SIM) cards can be purchased even if one does not have a mobile handset device. Depending on how the question is asked, an individual can report having a mobile phone even if the mobile phone is shared between different people who swap out SIM cards (Aker & Mbiti, 2010). Hence, when an individual reports having a technology it can mean *having access* to said technology in the household or *being the sole owner*.

Second, when it comes to information on infrastructure, especially those that enable access to the Internet, researchers may be applying a non-African lens to an African context. As James and Versteeg (2006) suggested, some researchers equate lack of wiring with limited access to technology. For example, connecting to the Internet in the U.S.A especially from one's home is dependent on wired infrastructures from telecommunications companies such as Comcast, AT&T and others. After signing up for a contract with a preferred company and once all necessary equipment is installed, the user plugs an Ethernet cable into a port and connects it to the computer. In other cases a

wireless modem is connected to a wired connection and sends out a signal to which devices can connect (See example B in Figure 5-2).

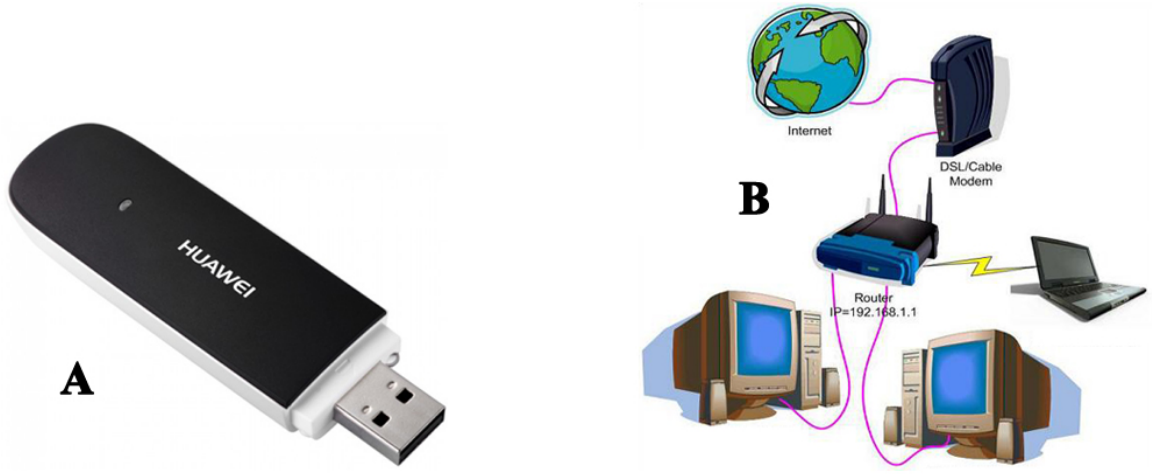


Figure 5-2: Equipment for needed to connect to the Internet in Botswana, Namibia, and USA

In the case of Botswana and Namibia the situation is different. Students and lecturers go to a store and purchase a device similar to the one labeled “A” in Figure 5-2. The device comes loaded with Internet credits, which can be replenished when exhausted. A user plugs the device into a USB port of a computer and immediately connects to the Internet. Although connecting to the Internet may be relatively easy, access to the Internet does not necessarily equal quality. A person can connect but a signal may be poor, or power outage my interrupt a connection. Nonetheless, given that there is little required equipment with which participants can connect, it is not surprising that Internet connectivity - as measure by the ability to get on line and not the quality - is high. The implication here is that the infrastructure that is often cited as inhibiting connectivity does not seem to have limited access to the Internet by the participants in this sample.

No studies that provide information on computer access or ownership by students and lecturers in Botswana and Namibia have been found. However a related study on computer access in Nigeria and Kenya revealed a similar result. In their study of 200 academics at 10 universities, Oyelaran-Oyeyinka and Adeya (2004) found that in Nigeria 87.7% of respondents and 98.2% in Kenya used computers. Most usage was on computers at the university because respondents did not have computers at home. The present study adds another dimension to the literature by presenting access and use of computers in two southern African countries.

Data from RQ1 should not be interpreted to mean that Botswana and Namibia do not have infrastructure issues. Furthermore the access to computers reflected in this data may not be representative of the entire population of the two countries. What it does contradict however is that high ownership of mobile phones by participants in this study is because of lack of access to computers. The implication here is that an exploration of using mobile devices at the two universities should be based on how they provide a relative advantage to existing technologies not from the perspective of mobile devices being the only available tool.

Academic and social use boundaries. At both UB and UNAM, students and lecturers used their technologies for different purposes. The data indicate that mobile devices were used primarily for activities that were social in nature. The majority of participants in both countries, as reflected in Table 4-7 and Table 4-8, used their mobile phones primarily for non-university related tasks as evidenced by their response to what activity they perform the most every day. These tasks included accessing social networks, or sending SMS. Confirming the work of Ng'ambi (2005) and Utulu and Alonge (2012),

the two top activities performed every day were sending SMS (93%) and checking social networking sites such as Facebook (58%). Also not surprising is that the activities for which participants used mobile devices the least were recording lectures (74%) and taking notes (54%).

Contrasting mobile device with computers use revealed differences. Analysis of the open-ended questions on use of mobile phones, tablets, and computers yielded the following themes: *Academic Purposes, Communication, Consume Content, Personal Management and Create Content.* Although the five themes were used to categorize the uses across the three technologies, participants reported using computers more than mobile devices for academic purposes. Findings on computer use in this sample are similar to those found by Oyelaran-Oyeyinka and Adeya (2004) in their study of 200 academics at 10 universities Nigeria and Kenya. These researchers found a high use of computers for productivity (word processing, spreadsheet/data), entertainment, and communication. Although Oyeyinka and Adeya's study did not include students in the sample, the themes identified align with those in RQ1 on computer access.

Other researchers have also compared mobile devices and computers as learning tools. Differences were found in Sung and Mayer's (2012) comparative study of South Korea and the USA. In the USA students viewed instructional learning materials on mobile devices as less realistic than those on desktop computers and had more positive feelings about desktop computers than mobile devices. In contrast, students in South Korea saw no distinction between the two mediums but had a more positive view towards mobile devices than computers. The distinction that USA students in the Sung and Mayer

(2012) study made between mobile devices and desktop computers is similar to the distinction reflected in the data for RQ1.

Results from RQ1 indicate that students and lecturers use mobile devices primarily for socializing and that their use of computers is primarily focused on academic and productivity related tasks. This perception may be a contributing factor to why mobile devices have not been diffused at the universities. Further, the popularity of mobile devices described by Ng'ambi (2005) could be connected to the separation it provides from what is academic and what is social.

RQ2 Discussion: Do perceptions towards diffusion attributes differ by institution?

The application of the comparative method in this study is based on a premise that engaging in research cross-culturally and cross-nationally provides an opportunity for deeper understanding of mobile devices diffusion. In this study there are two main reasons for employing the comparative method. The first aim is to identify how similarly or differently the phenomenon manifests itself in two different national contexts. Comparing internationally and examining how phenomena present themselves in different national contexts is of critical concern given the nature of education today where different nations face many of the same or similar educational challenges. Secondly, in comparing Botswana and Namibia, two countries that have articulated in national plans the need to maximize the benefits of ICT in education, the goal of examining similarities and difference is to discover instances where the two countries can learn from each other. Comparative scholars agree that examining how others educate and observing others' techniques for addressing educational phenomenon can enable

transferring solutions for problems or policies from one system to another (Crosselly & Broadfoot, 1992; Nieben, 1982).

This research question sought to determine how UB and UNAM differed in their perceptions of diffusion attributes. As Table 4-5 shows, no significant differences were found between University of Botswana and University of Namibia participants' perception toward the five dependent measures of diffusion attributes (RA, CY, CX, TR, and OB).

RQ3 Discussion: Do perceptions towards diffusion attributes differ by university status?

RQ3 was aimed at determining if there were differences between students' and lecturer's perceptions towards diffusion attributes. Results indicated that there was a significant difference between students and lecturers on all attributes except trialability. In other words, the four diffusion attributes in the persuasion stage, which Rogers (2003) argued influence up to 87% of adoption of an innovation (Rogers, 2003) are perceived differently by students and lecturers in the sample.

This study employed Cohen's (1992) effect sizes categories of small, medium, and large to assess the practical importance of the difference between students and lecturers. The three categories consist of small, medium, and large. Cohen (1988), advises that a score of 0.2 or less indicates a small effect size. Evaluating the Partial Eta Squared values in

Table 4-6, reveals that all the values between 0.01 - 0.026 which fall within the category of small effect size. Put differently, although there was a statistical significant difference between students and lecturers perceptions towards the diffusion attributes,

the practical importance is small and may be due to large sample size (Coe, 2002; Turcios, 2015).

This finding may have an implication for how diffusion of ICT in Africa is investigated. Research on diffusion of ICT in education in Africa often prioritizes teachers. For example, Agbatogun (2013) reasoned lecturers drive technological innovations at universities since they are the ones charged with pedagogical responsibilities. Agbatogun argued that if diffusion is to occur, attention should be paid to factors that motivate or frustrate lecturers. The data from this study does not reveal a practical difference between students and lecturers that can justify prioritizing one group over the other.

RQ4 Discussion: Do perceptions towards diffusion attributes differ by gender?

The purpose of this question was to determine whether there was any difference by gender on perceptions of diffusion attributes. Gender has been found to be a factor in the diffusion of ICT. In a study at a university in the USA, Ilie, Craig, Green, and Hao (2005) found that gender had an effect on participants' perception of diffusion attributes. Similarly Goh and Sun (2014) and Riquelme and Rios (2010) also found that gender had an effect in the adoption of mobile banking Malaysia and Singapore.

In this study however, no significant difference between females and males were found among the five dependent measures of diffusion attributes. In other words, there are no statistically significant differences that lead one to assume that women at UB and UNAM would view RA, CY, CX, TR and OB differently than the men in the sample. These results are consistent with Snell and Snell-Siddle (2013) who also found no

significant difference by gender in their study at a tertiary institution in New Zealand that was using mobile phones for learning. The implication here is that there is no evidence that support the notion that females and males perceive the innovation of mobile devices differently.

RQ5: Do diffusion patterns in Namibia and Botswana differ from those exemplified by the Rogers DOI model?

As stated earlier in the document, the persuasion stage (RA, CY, CX, TR and OB) has been found to explain what impedes the diffusion process. Generally, innovations will be more readily adopted if they (a) are perceived by potential adopters to provide greater relative advantage than what is already used; (b) are more compatible with the individuals' values; (c) can be tried out by the user before fully committing; (d) can be observed while being used; and (e) are perceived as uncomplicated (Rogers, 1983).

Using the attributes advanced by Roger's framework, this study proposes that, High RA, High CY, Low CX, Low TR, Low OB are the main factors affecting diffusion of mobile devices at UB and UNAM. Put differently, data collected from questions aligned with the diffusion attributes were aimed at assessing the following five assumptions:

1. Data from participants would reveal a high RA, which reflects an agreement by participants that mobile devices present a Relative Advantage in teaching and learning at their institutions.
2. A high CY score would result from the data, which would indicate that at UB and UNAM mobile devices are compatible with the values that the majority of participants hold about education.

3. The third assumption is that there would be a low CX score, which would mean that mobile devices are seen as not complicated to use or integrate in the teaching and learning practices of the participants.
4. A low TR score was expected from the data, which would confirm that a main factor for why mobile devices were not diffused at the institutions was due to lack of trialabilty (i.e. being able to try out the use of mobile devices (the innovation) on a small scale).
5. Lastly, a low OB score was expected from the data, which would confirm that another factor affecting the diffusion of mobile devices at the universities was that they were not observed at the institutions. In other words, usage of mobile devices for teaching and learning is rarely seen at the two universities, hence lecturers and students do not have an example or someone to go to, who has integrated mobiles in educational experiences should they have questions to ask.

To examine these assumptions the mean scores from Table 4-12 were used. The data confirm all assumptions except assumption 3. Looking across all participants in the dataset, RA and CA had a high mean score indicating that participants are aware of the relative advantage of mobile devices and that they are compatible with their values. Similarly, TR & OB have a low score as was expected which confirms the assumption that mobile devices are not widely tried out at the universities and as such are not widely observed. The complexity score however is not among the lowest scores in the sample as was projected, which means the assumption that mobile devices are seen as not

complicated to use or to integrate into the teaching and learning practices of the participants is not supported.

Another way to represent the mean scores is through Figure 5-3. As a reminder, Rogers' model argues that high RA, CY, TR, and OB act as promoting factors in the diffusion process by influencing the decision to adopt or reject an innovation. A high perception of complexity however acts as a negative factor in the diffusion process. For diffusion to occur, the score of negative factors should ideally be lower than the score of the promoting factors. In other words, for someone to make a decision to adopt an innovation, the perception that the innovation provides relative advantage, that it is compatible with one's values, that it can be tried out before committing, and it can be observed in practice, must all outweigh the perception that an innovation is too complicated. The results from this question reveals that high CX, low TR and low OB are the factors that may explain why mobile devices have not yet diffused at the University of Botswana and the University of Namibia.

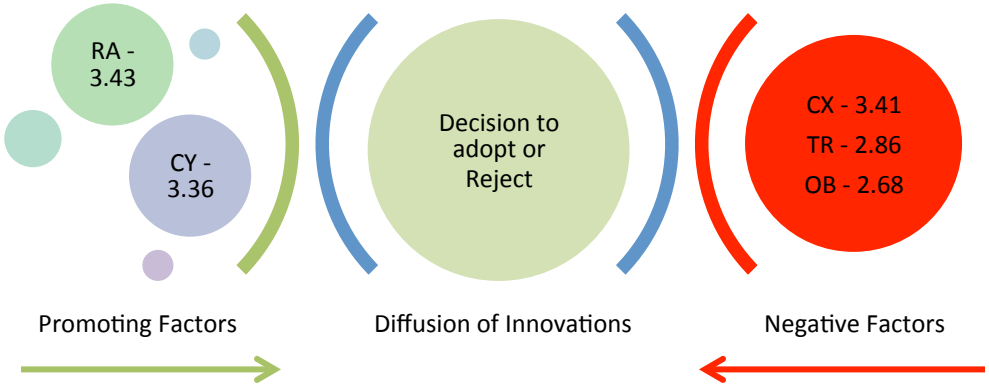


Figure 5-3: Attributes Mean Scores

Situating the above analysis in the existing body of literature presents a challenge. There are no established mean scores for attributes to which the scores from this study can be compared. Rogers (1995, 2003) has not provided a numerical value of how high or low a mean score has to be in order for it to be considered a negative factor or a promoting factor. Subsequent studies also have not established an agreed upon metric that can be used for comparison.

However comparing the means of the present studies to those that have examined successful adoptions does give the argument proposed credibility. Sanni, Ngah, Karim, Abdullah, & Waheed (2013) used the perceived diffusion attributes to study diffusion of e-journals in the Malaysian publishing industry. The mean scores obtained in their study are presented in Table 5-1 and contrasted with the present study.

Table 5-1

Means comparison

	Present study		Sanni et al. (2013)	
Attributes	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**
RA	3.4323	1.09742	4.09	0.9
CY	3.3585	0.4111	3.92	1.36
CX	3.4069	0.53573	3.07	1.02
TR	2.8548	0.51507	3.5	0.99
OB	2.6759	0.4658	3.58	85

Diffusion was occurring in the publishing industry in Malaysia and was supported by the perception attributes proposed by Rogers (2003). In the Sanni et al. study (2013), complexity had the lowest mean whereas the other attributes where all higher. This validates earlier statements in this document that in the diffusion process, the decision to adopt is made when perception of CX - that an innovation is too complicated - is low in relation to the other attributes.

RQ6 Discussion: What do participants believe are the advantages of using mobile devices for learning over other technologies?

The search for how to harness the power of portable and personal devices in education has been ongoing for many years. The motivation behind RQ6 was to ascertain from the population of interest the advantages of using mobile devices as a learning tool. Participants were asked, *"What do you think are the advantages of using mobile devices for learning over other technologies?"* The open-ended question analysis method outlined in Chapter 3 revealed three themes, which are discussed in this section.

Theme 1: *Mobile devices are more convenient, portable and multipurpose than other learning technologies.*

One of the most mentioned advantages in this dataset was the convenience mobile devices provide because they are portable and multi-purpose. The following are two examples of how participants expressed perceptions of portability:

> *Example 1:*
> *Its portability makes it very safe to have and carry around since it cannot be easily detected thus stolen.*
> *Example 2:*
> *Mobile phones are portable, we have them all the time with us, so you can access information on the Internet anytime*

The finding of portability being an advantage in this study is consistent with what is reported in the literature. Kusulska-Hulme and Traxler (2007) noted that the appeal for mobile devices in education is because they are portable, lightweight and often small enough to fit in a pocket or in the palm of one's hand. This portability construct was consistent across all institutions and demographic groups. Having a tool that is easy to carry around was viewed favorably as a common advantage in the sample.

Theme 2: *Mobile devices are easier to use and provide for fast access to information anytime anywhere.*

Another advantage that participants identified as important concerned the ease of use and fast access to information anytime and anywhere. The notion that mobile devices are easy to use has support in the literature. Participants in Motiwalla's (2007) study also indicated that ease of use was an advantage of mobile handheld devices.

Although many participants indicated that mobile devices are easier to use, it is also important to remember that this perception was based on participants envisioning what type of learning could occur through mobile devices and not a reflection of a

particular program that they were asked to evaluate. These perceptions could also be based on the ease with which participants have in using mobile devices for social activities. Presenting participants with mobile applications for learning on their devices would further clarify whether or not they would still be regard mobile devices as *easier to use* than other learning technologies.

The codes of *"anytime anywhere learning"* and *"faster"* both had a frequency of 95, making them the highest referenced advantage in the dataset. The concept of anytime anywhere learning has long been touted as a benefit of using mobile devices in education (Kukulska-Hulme & Shield, 2008; Pea & Maldonado, 2006; Sharples, 2002). Participants in the present study confirm that for UB and UNAM an advantage of mobile devices is that they can access content from anywhere and thereby enable their learning at any time of their choosing. The perception that mobile devices are *fast* may reflect that the process of powering up a mobile devices is shorter than starting up a desktop computer. Faster may also refer to the computers that are available to participants. If the computers that participants have are slow, one must ask whether the perception of mobiles as faster would still be an advantage if faster computers were made available.

Theme 3: *Mobile devices enable learner autonomy and improve teaching and learning.*

A third theme that emerged from the data concerned the perception that mobile devices enable learner autonomy as well as improving current teaching and learning practices. Examples of improvement in teaching and learning that was cited included providing users the *"ability to network with peers across the globe"*; and *"permit individual and group problem-solving, research, communication and class interaction"*.

Learner autonomy was also seen as an important advantage as exemplified by comments such as *"learners can be independent in learning"* and *"can support students individually using a differentiation approach"*.

Further analysis of the open-ended responses was conducted using word clouds. All text from the question *"What do you think are the advantages of using mobile devices for learning over other technologies?"* were placed into a word cloud generator. The picture in Figure 5-4 emerged.

Figure 5-4: Advantages in a word cloud

Words such as *"Easy, Information, Access, Portable, Learning, Use, and Carry"* were the most often used when describing advantages that participants discerned from mobile devices when compared to other learning technologies. As noted in chapter 3, word clouds create visual representation of frequently used terms (McKie, 2007), where

font size indicates the frequency of a term in a body of text (Sinclair & Cardew-Hall, 2008). The higher the frequency, the larger the word appears. Although the visual representation in Figure 5-4 enabled the researcher to glance quickly at the words used most in the body of text, and supports that portability, ease of use and ease of access to information are commonly used with regards to perceptions of advantages to using mobile devices, it is also limited as an analysis tool because it does not specify how the words were used.

RQ7 Discussion: What do participants perceive as barriers preventing the use of mobile devices in teaching and learning?

Identifying barriers can enable the formulation of solutions that address those factors inhibiting the diffusion process if change is desired. RQ7 asked participants to state any barriers that they perceived as preventing use of mobile devices in teaching and learning.

There were 599 responses to the question on how mobile devices may be a barrier to teaching and learning. A thematic analysis of the data yielded four themes that are discussed below.

Theme 1: *Mobile devices are seen as disruptive to teaching and learning experiences.*

For participants in this study, a major barrier preventing the use of mobile devices in teaching and learning is the perception that they are disruptive. The disruption can result from lack of control in the classroom or the fear that students will constantly be on social media.

What was worthy of note in this question is the perception of mobile devices as distracting to learning experiences when compared between students and lecturers. Students were twice as likely as lecturers to state that the use of mobile devices would be a distraction or cause a disturbance in learning experiences (Table 5-2).

Table 5-2

Barriers comparison by university status

Students		**Lecturers**	
Codes		**Codes**	
Distraction/Disturb	29%	Affordability	19%
Affordability	16%	Infrastructure	17%
Infrastructure	10%	Distraction/Disturb	14%

Theme 2: The cost of mobile devices, the technology and infrastructure form a barrier to mobiles in education. The affordability of mobile devices and the variance in mobile technologies and infrastructure, particularly on campus, were identified as a barrier by participants. An example of a meaning unit that captures this is presented in example 2.a.

> *Example 2.a.*
> *1. The type of phone that both staff and students can afford is a huge barrier, most none-smart phones have no adequate storage capacity to retrieve documents from the internet. / 2. The Bandwidth of the Internet services the university is able to subscribe to. Too many units on narrow bandwidth slows done download drastically. / 3. University of Namibia Internet system as a matter of unwritten policy is tuned such that any document of size over 5MB is not delivered to increase system functionality.*

Example 2.a. illustrates how cost, mobile technology variability, and infrastructure coalesce to form a barrier against use of mobile devices for teaching and learning. Literature on mobile devices in education is often concerned with the technical specification of devices. For example, a limitation cited against mobile devices as tools

for teaching and learning is that devices such as mobile phones have small size screens (Cook 2010) and that their battery life does not last long (Kondratova, 2009). Another cited concern for mobile devices as learning tools is the lack of uniformity and standards across different devices. Depending on whether the user has, for example an Apple iOS or an Android device, the programs that one can use may be limited. The findings from RQ7 support these as barriers in the population examined. It is however noted that, as reflected in Appendix D for both countries, although the cost of mobile technology, variability in the mobile devices that participants have access to, and infrastructure are perceived as barriers, these barriers are not perceived as being as significant as the perceived disruption they might represent. In other words, these issues may be less problematic or are simply not as important to the population as the issues related to disruption.

Theme 3: The environment is currently not supportive of using mobiles in education. A theme that emerged from what participants in this sample reported is that there are barriers in their environment that hinder using mobile devices at UB and UNAM. Students particularly felt that lecturers were a barrier because they were either ill equipped to incorporate mobile devices in their teaching or misunderstand how students use the devices. As one student reported, *"The lecturers will need a fair amount of training before they are comfortable with incorporating technology into their teaching and since that will take a fair amount of time and money, no one feels like it's worth the trouble."* This statement captures the perception in the dataset that lecturers are barriers and that there may be insufficient resources that can be deployed to address this barrier. Another example came from a student who remarked that "lecturers thinks[sic] we are on

social networks so they dont[sic] allow students to press their mobile devices in classroom". This statement exemplifies that there are perception in the environment, regarding students ability to control their social network access, which may be forming a justification for why mobiles cannot be used at UB and UNAM.

Participants listed stakeholders such as the government, lecturers and university administrators as barriers to using mobile devices for teaching and learning. Some participants reported that there were government laws and "policies set by the ministry of education which restrict the use of mobile phones by students in schools", however a review of government documents revealed no existence of such policies a law.

Theme 4: There is a lack of knowledge and skills by lecturers and students for how to integrate mobiles into teaching and learning. The final theme unearthed from the responses to RQ7 concerns the knowledge and skills of students and lecturers. In their responses, participants seem to indicate that the skills needed to make use of mobile devices for teaching and learning are insufficient at UB and UNAM. The following four statements exemplify this theme in the data set:

- *Not everyone is at the same level when it comes to being informed and educated on mobile devices*
- *Students lack knowledge on how to use mobile devices*
- *Lack of understand about the functionality of mobile devices.*
- *Limited knowledge of lecturers on how to use smartphones in teaching and learning methods.*
- *A number of lecturer's are not trained on how to use the devices.*
- *Lack of resources and knowledge on how to use mobile devices for the right reasons by students*

The above statements show that the perception of lack of skills applies across university status. There was no evidence that indicated that students were seen as more lacking in skills and knowledge than lecturers or vice versa. Rather the overall perception

was that the skills needed to make use of mobile devices at UB and UNAM are insufficient.

Results for RQ7 revealed four themes that need be addressed if the diffusion of mobile devices is to occur. The barriers that have been identified however are not insurmountable and solutions could be designed if diffusion of mobile devices is a desired goal. For example, the perceptions that mobile devices are disruptive, the existence of an environment that is not supportive of using mobile devices for teaching and learning or the lack of knowledge and skills all can be addressed in numerous ways such as through workshops. Additionally the challenge of cost can be addressed through partnerships between public and private entities (Khan, Al-Shihi, Al-khanjari, & Sarrab, 2015) that subsidize the cost of devices for those in education. Such solutions can increase trialability by enabling an environment in which potential adopters can try out the innovation. Trying out an innovation increases observability which in turn reduces the barriers or more specifically the perception of complexity.

Conclusion and Implications

This study set out to explore factors that influence the diffusion of mobile devices in Higher Education in Botswana and Namibia. The study was predicated on the premise that mobile devices which are popular for outside class activities such as texting and accessing social media websites, have not gained the same degree of popularity for academic purposes in higher education. To examine this paradox, the five attributes (RA, CY, CX, TR, and OB) of the persuasion stage which have been found in previous studies

to influence the innovation diffusion process were used to explore factors that influence the diffusion process of mobile devices at UB and UNAM.

Data were gathered for the study to answer the main question of: *What factors influence the use of mobile devices in higher education in Botswana and Namibia?* For the participants in this study, Complexity, Trialability, and Observability appeared to be the three factors that shed light on why mobile devices have not yet diffused. In other words, data imply that mobile devices are seen by participants in this study as complicated and are limited in their trialability and observability. Complexity however can also be related to the low trialability. This means that if there are limited opportunities to try out mobile devices for teaching and learning, observability may also be limited which may lead to the perception that mobile devices as an innovation are complicated.

The main implication here is that if mobile devices are to fully diffuse for participants in this study, complexity issues must be revealed and attempts made to reduce them. Similarly, attempts should be made to promote environments that provide opportunities to try out mobile devices for teaching and learning. Opportunities to tryout an innovation lead to an increased chances for observability.

Limitations

Data from this study are bound by two main limitations that must be acknowledged. First, the reliability scores of the five scales used in this study as reported in table 4-11 are between 0.6 – 0.25, which falls below the often cited Cronbach's alpha reliability score of higher than 0.70 (Lance, Butts & Michels, 2006; Nunnally, 1978). The

low reliability score provides a challenge in generalizing the findings beyond the 1006 participants in the study. In other words, the low reliability score of the five scales does not invalidate the results, rather it implies that if this instrument is administered on multiple occasions to other participants, similar result cannot be guaranteed. The lack of consistent result however also presents an opportunity for further research discussed in the section on further research.

The second limitation pertains to the location of the study and the choice of participants. The sample from this study consisted of students and lecturers who were present on the days that the researcher was at UB and UNAM campuses. The campuses included in the study were all located in the capital cities of the two countries because resources limited the inclusion of other campuses. By virtue of being located in the capital, access to technologies, communication grids and other infrastructures may be different from the campuses in rural areas. Although participants came from all corners of the countries, it is foreseeable that inclusion of other campuses and other universities could have provided different results. As such administering the same instrument in other regions of the two countries may yield different valuable insights. Moreover, participants in this study were limited to students and lecturers, insights from other actors that may influence the diffusion process was non-existent. The perceptions of university administrators or politicians in the ministries of education have not been included and could have provided different information.

Recommendations for Future Research

There are three main findings in this study that can be used as basis for future research. The first finding is that there was a difference in perceptions from students and lecturers towards mobile devices as an educational technology. The interaction between the university status (students, lecturers) and the dependent variable (RA, CY, CX, TR, and OB) should be explored further because it could provide additional information on perceptions students and lecturers hold regarding the role of technology in education. Such a study could also be expanded to include more adopter units such as administrators, ministry officials and other members of the community. Surry and Brennan, (1998) offers an example of a possible research question that can be asked "How do university administrators, deans, faculty, staff, and students interact to facilitate or impede the adoption of an innovation at a university?" (p. 9). Such a research question recognizes the role that each group plays in the process but also acknowledges that the interaction between the groups can have an influence.

The second possible area of research concerns the factors of complexity, trialability and observability. If adoption of mobile devices is a desired outcome, research that further examines these three factors should be conducted. One way to accomplish such as study is to create more opportunities for lecturers and students to try out mobile devices in their teaching and learning practices. Research could be conducted on whether increasing observability and trialability could potentially lessen aspects of complexity.

Thirdly, further research is needed regarding DoI model in these two countries using a survey instrument. As reported in Table 4-1, the Cronbach alpha for this survey instrument was low for the individual dependent variables. This low score was surprising

because the items in each scale were validated by experts, and the three instruments used as a guide in developing the tool did not have low reliability. Explanations for a low Cronbach's alpha can be many. One reason could be that the five attributes do not measure well in the context of Botswana and Namibia. Follow up research should be conducted to improve the scales and further test the instrument in the two countries and the region.

Survey studies provide information on participants' perception at a certain point in time. The results are often based on the participants recall and on how they are feeling at that specific time. Although surveys do provide useful overview information, follow up studies that use qualitative methods will be useful in providing further clarity on what is going on. Put differently, a survey study provides a general picture of what is going on, but to fully understand the picture, additional studies that include interviews and observation will be needed.

References

Abeli, W., Pillay, P., FitzGerald, P., Hodgson, S., Ishengoma, J., Mgaya, Y., & Lokina, R. (2010). Investment in higher education for development: New directions. *SARUA Leadership Dialogue Series, 2*(2), Johannesburg, South Africa: South African Regional Universities Association. Retrieved from http://hdl.voced.edu.au/10707/209667

Abraham, A., Petre, M., & Sharp, H. (2008). Information seeking: Sensemaking and interactions. Paper presented at the CHI 2008 Workshop on Sensemaking. Florence, Italy.

Adekoya, A. E., & Oladele, O. I. (2008). Improving technology perception through information and education: A case of biotechnology in Nigeria. *Agriculturae Conspectus Scientificus (ACS)*, *73*(4), 239-243.

Aderinoye, R. A., Ojokheta, K. O., & Olojede, A. A. (2007). Integrating mobile learning into nomadic education programme in Nigeria: Issues and perspectives. *The International Review of Research in Open and Distance Learning*, *8*(2). Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/347/919

Adubifa, O. A. (2000). *Towards the introduction and application of information and communication technologies in African universities.* (A collaboratory investigation of key issues and guidelines by the Carnegie Corporation of New York and the Association of African Universities (AAU). Accra: AAU.

African Union. (2006). Second decade of education for Africa (2006–2015), Plan of Action revised August 2006. COMEDAF 2+ Meeting. Addis Ababa Retrieved from http://www.nepad.org/system/files/Second%20Decade%20of%20Education%202006-2015.pdf

Agbatogun, A. O. (2013). Interactive digital technologies' use in Southwest Nigerian universities. *Educational Technology Research and Development*, *61*(2), 333-357.

Agbonlahor, R. O. (2006). Motivation for use of information technology by university faculty: A developing country perspective. *Information Development*, *22*(4), 263-277.

Aker, J. C., & Mbiti, I. M., (2010). Mobile phones and economic development in Africa (June 1, 2010). *Center for Global Development Working Paper No. 211*. http://dx.doi.org/10.2139/ssrn.1693963

Al-Gahtani, S. S. (2003). Computer technology adoption in Saudi Arabia: Correlates of perceived innovation attributes. *Information Technology for Development*, *10*, 57-69.

Allan, G. S., & Wolf, W. C. (1978). Relationships between perceived attributes of innovations and their subsequent adoption. *Peabody Journal of Education*, *55*(4), 332-336.

Ally, M. (Ed.). (2009). Mobile learning: Transforming the delivery of education and training. Athabasca University Press.

Alrasheedi, M., & Capretz, L. F. (2013, August). A meta-analysis of critical success factors affecting mobile learning. In *Teaching, Assessment and Learning for Engineering (TALE), 2013 IEEE International Conference* (pp. 262-267). doi: 10.1109/TALE.2013.6654443

Alrasheedi, M., Capretz, L. F., & Raza, A. (2015). A Systematic Review of the Critical Factors for Success of Mobile Learning in Higher Education (University Students' Perspective). Journal of Educational Computing Research, 0735633115571928.

Amrein-Beardsley, A. (2014). Rethinking value-added models in education.Critical perspectives on tests and assessment-based accountability. New York, NY: Routledge.

Arnove, R. F. (1999). Reframing comparative education: The dialectic of the global and the local. In R. F. Arnove, & C.A. Torres (Eds.), *Comparative education: The dialectic of the global and the local* (pp. 1–23). Lanham, MD: Rowman & Littlefield Publishers.

Arpaci, I. (2014). A comparative study of the effects of cultural differences on the adoption of mobile learning. *British Journal of Educational Technology*. Advance online publication. doi: 10.1111/bjet.12160

Ashurst, M. (2001). Now, a 'Quiet Revolution.'. *Newsweek*, *138*(9), 32.

Asino, T. I., Wilder, H. & Ferris, S. P. (2011). Innovative use of ICT in Namibia for nationhood. In R. N. Lekoko & L. M. Semali (Eds.), *Cases on Developing Countries and ICT Integration: Rural Community Development*. Hershey, PA: Idea Group.

Auala, R. K. & Mbale, J. (2012). Equipping ICT skills to graduate trainee teachers whilst at tertiary institutions impacts the quality of national manpower development – case study for University of Namibia. *International Research Journal of Arts and Social Sciences*, *1*(3), 39-46.

Avgerou, C. (2008). Information systems in developing countries: A critical research review. *Journal of Information Technology*, *23*, 133–146. doi: 10.1057/palgrave.jit.2000136

Babbie. E. (1990). *Survey research methods (2nd ed.)*. Belmont, CA: Wadsworth.

Bailey, T., Cloete, N. & Pillay, P (2011) Case Study - Botswana and University of Botswana. higher education and economic development in Africa. *Center for Higher Education Transformation*. Wynberg: African Minds. Retrieved from http://chet.org.za/files/uploads/reports/Case%20Study%20-%20Botswana%20and%20University%20of%20Botswana.pdf

Beltramo, T., Blalock, G., Levine, D., & Simons, A. (2014). Does peer use influence adoption of efficient cookstoves? Evidence from a randomized controlled trial in Uganda. UC Berkeley: Center for Effective Global Action. Retrieved from: https://escholarship.org/uc/item/4k77c9wb

Bennett, J., & Bennett, L. (2003). A review of factors that influence the diffusion of innovation when structuring a faculty training program. *The Internet and Higher Education*, *6*(1), 53-63.

Bereday, G. (1964). *Comparative method in education*. New York, NY: Holt, Rinehart and Winston.

Biernacki, P., & Waldorf, D. (1981). Snowball sampling: Problems and techniques of chain referral sampling. *Sociological Methods & Research*, *10*(2), 141-163.

Bignold, W., & Gayton, L. (Eds.). (2009). *Global issues and comparative education*. Exeter, UK: Learning Matters.

Blaikie, N. 2003. Analyzing Quantitative Data: From Description to Explanation. Sage, London

Bonett, D. G., & Wright, T. A. (2015). Cronbach's alpha reliability: Interval estimation, hypothesis testing, and sample size planning. *Journal of Organizational Behavior*, *36*(1), 3-15.

Boz, I., & Akbay, C. (2005). Factors influencing the adoption of maize in Kahramanmaras province of Turkey. A*gricultural Economics*, *33*(3), 431–440.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, *3*(2), 77-101.

Briceño-Garmendia, C., & Pushak, N. (2011). *Botswana's infrastructure: A continental perspective*. World Bank Policy Research Working Paper Series #5887. World Bank. Retrieved from https://wdronline.worldbank.com/handle/10986/3655 License: Creative Commons Attribution CC BY 3.0.

Brown, I., Cajee, Z., Davies, D., & Stroebel, S. (2003). Cell phone banking: Predictors of adoption in South Africa - an exploratory study. *International Journal of Information Management*, *23*, 381-394.

Brown, T. (2004). The role of mLearning in the future of e-learning in Africa. In D. Murphy, R. Carr, J. Taylor, & W. Tat-men (Eds.), *Distance education and technology: Issues and practice* (pp. 1197–1216). Hong Kong, China: Open University of Hong Kong Press.

Carnoy, M. (2006). Rethinking the Comparative—and the International. *Comparative Education Review*, *50*(4), 551-570.

Chang, A. Y., Ghose, S., Littman-Quinn, R., Anolik, R. B., Kyer, A., Mazhani, L., & Kovarik, C. L. (2012). Use of mobile learning by resident physicians in Botswana. *Telemedicine and e-Health*, *18*(1), 11-13.

Chipangura, B. (2013, October). Categorizing the provision of mobile centric information access and interaction for higher educational institutions. In *Proceedings of the South African Institute for Computer Scientists and Information Technologists Conference* (pp. 101-110). ACM.

Coleman, J. S. (1958). Relational analysis: The study of social organizations with survey methods. *Human Organization*, *17*(4), 28-36.

Collis, B., & Moonen, J. (2001). *Flexible learning in a digital world: Experiences and expectations*. Sterling, VA: Stylus Publishing.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Cohen, J. (1992). A power primer. *Psychological bulletin*, *112*(1), 155.

Creswell, J. (2009). Research design: Qualitative, quantitative, and mixed methods approaches. Thousand Oaks, CA: SAGE Publications.

Davidrajuh, R. (2005). Java bluetooth wireless technology for evaluating student performance in classroom. *Communications of the IIMA*, *5*(4), 33–38.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319-339.

Deloite, & GSMA. (2012). *Sub-Saharan Africa Mobile Observatory 2012*. Retrieved from http://www.gsma.com/publicpolicy/wp-content/uploads/2012/03/SSA_FullReport_v6.1_clean.pdf

Dennen, V. P., & Hao, S. (2014) Paradigms of use, learning theory, and app design. In C. Miller & A. Doering (Eds.). *The New Landscape of Mobile Learning: Redesigning Education in an App-based World* (pp. 20-41). London, England: Routledge.

Donner, J., & Gitau, S. (2009). New paths: exploring mobile-centric internet use in South Africa. Paper presented at Mobile 2.0: Beyond Voice? Pre-conference workshop at the International Communication Association (ICA) Conference, Chicago, IL. May 20–21, 2009.

Donner, J., & Tellez, C. A. (2008). Mobile banking and economic development: Linking adoption, impact, and use. *Asian Journal of Communication*, *18*(4), 318-332.

DuToit, P. (1995). *State building and democracy in Southern Africa: Botswana, Zimbabwe, and South Africa*. Washington, DC: United States Institute of Peace Press.

Dutta, S., Bilbao-Osorio, B., & Geiger, T. (2012). The networked readiness index 2012: Benchmarking ICT progress and impacts for the next decade. *The Global Information Technology Report 2012: Living in a Hyper-connected World*, 3-34.

Dwivedi, Y. K., Williams, M. D., & Lal, B. (2008). The diffusion of research on the adoption and diffusion of information technology. In G. Léon, A. M. Bernardos, J. R. Casar, K. Kautz, & J DeGross (Eds.), *Open IT-Based innovation: Moving towards cooperative IT transfer and knowledge diffusion* (pp. 3-22). Boston, MA: Springer.

Dzogbenuku, R. K. (2013). Banking innovation in Ghana: Insight of students' adoption and diffusion. *Journal of Internet Banking and Commerce*, *18*(3), 1.

eLearning Africa (2012). The University of Namibia goes wireless. Retrieved from http://www.elearning-africa.com/eLA_Newsportal/the-university-of-namibia-goes-wireless/

Fails. J. A., Druin, A., & Guha, M. L. (2010). Mobile collaboration: Collaboratively reading and creating children's stories on mobile devices. First International Workshop on Interactive Storytelling for Children. IDC 2010, June 9–12, 2010, Barcelona, Spain.

Farrell, G., Isaacs, S., & Trucano, M. (2007). *Survey of ICT and Education in Africa (Volume 2): 53 Country Reports*. Washington, DC: *info*Dev / The World Bank. Retrieved from http://www.infodev.org/en/Publication.354.html

Fowler, F. J. (2009). *Survey research methods*. Thousand Oaks, CA: Sage Publications.

Gall, J. P., Gall, M. D., & Borg, W. R. (1999). Applying educational research: A practical guide (4th ed.). New York, NY: Longman.

Gay, L. R., Mills, G. E., & Airasian, P. W. (2012). Educational research: Competencies for analysis and applications. Boston, MA: Pearson.

Gerhan, D. R., & Mutula, S. M. (2005). Bandwidth bottlenecks at the University of Botswana: Complications for library, campus, and national development. *Library Hi Tech*, *23*(1), 102-117.

Gerhan, D. R., & Mutula, S. M. (2007). Testing a recent model of ICT in development: Botswana and its university. *Information technology for development*, *13*(2), 177-197.

Goh, T., & Sun, S. (2014). Exploring gender differences in Islamic mobile banking acceptance. *Electronic Commerce Research, 14*(4), 435-458. doi: 10.1007/s10660-014-9150-7

Government of the Republic of Namibia (2004). *Namibia Vision 2030: Policy Framework for long term National Development.* Windhoek, Namibia: Office of the President. Retrieved from https://www.africaportal.org/sites/default/files/Namibia%20Vision%202030_0.pdf

Graneheim, U. H., & Lundman, B. (2004). Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. Nurse education today, 24(2), 105-112.

Greenhalgh, T., Robert, G., MacFarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organisations: Systematic review and recommendations. *The Milbank Quarterly*, *82*(4), 581-629.

Groves, R. M., Fowler Jr, F. J., Couper, M. P., Lepkowski, J. M., Singer, E., & Tourangeau, R. (2011). *Survey methodology (Vol. 561)*. Hoboken, NJ: John Wiley & Sons.

Hall, B. H. (2005). Innovation and Diffusion. In J. Fagerberg, D. Mowery and R. R. Nelson (Eds.), *The Oxford Handbook of Innovation* (pp. 459-484).Oxford, UK: Oxford University Press.

Hall, J. (2008). Cross-Sectional Survey Design. In P. J. Lavrakas (Ed.), *Encyclopedia of Survey Research Methods.* Thousand Oaks, CA: Sage Publications, Inc. doi: http://dx.doi.org/10.4135/9781412963947.n120

Holloway, R. (1996). Diffusion and adoption of educational technology: A critique of research design. In D. Jonassen (Ed.), *Handbook of Research for Educational Communications and Technology* (pp. 1107-1133). New York, NY: Macmillan.

Hsi, S. & Fait, H. (2005). RFID enhances visitors' museum experience at the Exploratorium. *Communications of the ACM*, *48*(9), 60-65. doi: 10.1145/1081992.1082021

ICT Update. (2008). *African governments and E-Society.* Retrieved from http://ictupdate.cta.int/index.php/en/Links/Documents/African-Governments-And-E-Society.

Ilie, V., Craig, V. S., Green, G., & Hao, L. (2005). Gender differences in perceptions and use of communication technologies: A diffusion of innovation approach. *Information Resources Management Journal, 18*(3), 13-31. Retrieved from http://search.proquest.com/docview/215882152?accountid=13158

International Telecommunication Union (ITU). (2014). *Measuring the Information Society Report 2014.* Geneva, Switzerland: ITU. Retrieved from http://www.itu.int/en/ITU-D/Statistics/Documents/publications/mis2014/MIS2014_without_Annex_4.pdf

International Telecommunication Union (ITU). (2010). *World telecommunication/ICT development report 2010: monitoring the WSIS targets, a mid-term review*. Geneva, Switzerland: ITU. Retrieved from http://www.itu.int/dms_pub/itu-d/opb/ind/D-IND-WTDR-2010-PDFE.pdf

Isaacs, S. (2012). *Turning on mobile learning in Africa and the Middle East: Illustrative initiatives and policy implications.* UNESCO Working Paper Series on Mobile Learning. Paris, France: United Nations Educational, Scientific and Cultural Organization. Retrieved from http://unesdoc.unesco.org/images/0021/002163/216359e.pdf

Isaacs, S. (2007). *Survey of ICT and education in Africa: Botswana country report*. Washington, DC: World Bank.

Jacobsen, D. M. (1998). *Adoption patterns of faculty who integrate computer technology for teaching and learning in higher education*. Proceedings of the ED-MEDIA AND EDTELECOM 98: World Conference on Educational Multimedia and Hypermedia & Educational Telecommunications, Freiburg, Germany, 20-25 June, 1998. Retrieved from http://people.ucalgary.ca/~dmjacobs/phd/phd-results.html

Jain, P., & Mutula, S. M. (2001). Diffusing information technology in Botswana: A framework for Vision 2016. *Information Development*, *17*(4), 234-241.

Jairak, K., Praneetpolgrang, P., & Mekhabunchakij, K. (2009). An acceptance of mobile learning for higher education students in Thailand. In *The Sixth International Conference on eLearning for Knowledge-Based Society* (pp. 36.1-36.8). Thailand.

James, J., & Versteeg, M. (2007). Mobile phones in Africa: how much do we really know?. *Social indicators research*, *84*(1), 117-126.

Jazzar, M, & Friedman, A. (2007). Highly effective it leadership that promotes student achievement. Retrieved July 14, 2007, from http://cnx.org/content/ml4114/latest/

Joseph, S., Binsted, K., & Suthers, D. (2005, November). PhotoStudy: Vocabulary learning and collaboration on fixed & mobile devices. In *WMTE '05 Proceedings of the IEEE International Workshop on Wireless and Mobile Technologies in Education* (pp. 206-210). IEEE. November 28-30, 2005, Tokushima, Japan.

Kafyulilo, A. (2012). Access, use and perceptions of teachers and students towards mobile phones as a tool for teaching and learning in Tanzania. *Education and Information Technologies*, *19*(1), 115-127.

Kajumbula, R. (2006). The effectiveness of mobile short messaging service (SMS) technologies in the support of selected distance education students of Makerere University, Uganda. Paper presented at *PCF4, the Fourth Pan-Commonwealth Forum on Open Learning*, Jamaica, (30 October–3 November 2006). Retrieved from http://pcf4.dec.uwi.edu/viewpaper.php?id=98

Kalba, K. (2008). The adoption of mobile phones in emerging markets: Global diffusion and the rural challenge. *International Journal of Communication, 2,* 631-661.

Mtebe, J. S. & Kandiri, J. (2014). "Determinants of the Successful Diffusion of Technology Innovations in Higher Education Institutions in Africa: A social network approach" Johannesburg, South Africa: South African Institute for Distance Education (Saide).

Karsenti, T. (2009). *The PanAfrican Research Agenda on the Pedagogical use of ICT*. Ottawa, Canada: CRDI.

Keats, D.W., & Schmidt, J.P. (2007). The genesis and emergence of Education 3.0 in higher education and its potential for Africa. *First Monday, 12*(3,). Retrieved from: http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1625/154.

Kelley, K., Clark, B., Brown, V., & Sitzia J. (2003). Good practice in the conduct and reporting of survey research. *International Journal for Quality in Health Care, 15*(3), 261–266. doi: 10.1093/intqhc/mzg031

Khan, A. I., Al-Shihi, H., Al-khanjari, Z. A., & Sarrab, M. (2015). Mobile Learning (M-Learning) adoption in the Middle East: Lessons learned from the educationally advanced countries. *Telematics and Informatics*.

Klopfer, E., Squire, K., & Jenkins, H. (2002). Environmental detectives: PDAs as a window into a virtual simulated world. In *Proceedings of IEEE international workshop on wireless and mobile technologies in education* (pp. 95–98). Vaxjo, Sweden: IEEE Computer Society.

Krippendorff, K. (2012). *Content analysis: An introduction to its methodology*. Thousand Oaks, CA: Sage.

Kukulska-Hulme, A., & Traxler, J. (2005). Mobile teaching and learning. In A. Kukulska-Hume & J. Traxler (Eds.), *Mobile learning: A handbook for educators and trainers*. London: Routledge.

Kukulska-Hulme, A., & Shield, L. (2008). An overview of mobile assisted language learning: From content delivery to supported collaboration and interaction. *ReCALL*, *20*(03), 271-289.

Lance, C. E., Butts, M. M., & Michels, L. C. (2006). The sources of four commonly reported cutoff criteria what did they really say?. *Organizational Research Methods*, *9*(2), 202-220.

Law, C. L., Roe, P., & Zhang, J. (2013). BioCondition Assessment Tool: A mobile application to aid vegetation assessment. In D. Tjondronegoro (Ed.), *Tools for Mobile Multimedia Programming and Development* (pp. 228-247). Hershey, PA: IGI Global.

Lekaukau, M. (2001, July 25). Botswana Telecommunication Authority. *Botswana Gazette*, p. B9.

Litwin, M. S. (1995). Reliability. In The Survey Kit: How to measure survey reliability and validity. Thousand Oaks, CA: SAGE Publications, Inc. doi: 10.4135/9781483348957.n2

Lwoga, E. (2012). Making learning and Web 2.0 technologies work for higher learning institutions in Africa. *Campus - Wide Information Systems, 29*(2), 90-107. doi: 10.1108/10650741211212359

Mafenya, P. N. (2014). Increasing undergraduate throughput and success rate through mobile technologies: A South African distance learning case study. *Mediterranean Journal of Social Sciences*, *5*(14), 428.

Makowsky, M. J., Guirguis, L. M., Hughes, C. A., Sadowski, C. A., & Yuksel, N. (2013). Factors influencing pharmacists' adoption of prescribing: qualitative application of the diffusion of innovations theory. *Implementation Science*, *8*(1), 109.

Manzon, M. (2007). Comparing places. In M. Bray, B. Adamson, & M. Mason (Eds.), *Comparative education research: Approaches and methods* (pp. 85–121). Dordrecht, Hong Kong: Springer, Comparative Education Research Centre, The University of Hong Kong.

Martins, C. B., Steil, A. V., & Todesco, J. L. (2004). Factors influencing the adoption of the Internet as a teaching tool at foreign language schools. *Computers & Education*, *42*(4), 353-374.

Mayer, R. E. (2005). Introduction to multimedia learning. In R. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 31-48). New York, NY: Cambridge University Press.

Mayers, A. (2013). *Introduction to statistics and SPSS in psychology*. Boston, MA: Pearson.

Mbarika, V., & Mbarika, I. (2006, May). Africa calling: burgeoning wireless networks connect Africans to the world and each other. *IEEE Spectrum*, *43*(5), 56-60.

Mbarika, V. W. A., Okoli, C., Byrd, T. A., & Datta, P. (2005). The neglected continent of IS research: A research agenda for sub-Saharan Africa. *Journal of the Association for Information Systems*, *6*(5), 130–170.

Mbatha, B. T., Ocholla, D. N., & Le Roux, J. (2011). Diffusion and adoption of ICTs in selected government departments in KwaZulu-Natal, South Africa. *Information Development*, *27*(4), 251-263.

Mbuende, K. (1986). *Namibia the broken shield: Anatomy of Imperialism*. Malmo, Sweden: Liber.

McKie, S. (2007). Scriptcloud.com: Content clouds for Screenplays. *Proceedings of the Second International Workshop on Semantic Media Adaptation and Personalization, IEEE Computer Society, (SMAP 2007),* London, United Kingdom, 17-18 December 2007.

McNaught, C., & Lam, P. (2010). Using Wordle as a supplementary research tool. *The Qualitative Report*, *15*(3), 630-643.

Mehta, C. (2008). "US Presidential Speeches Tag Cloud." Retrieved April 30, 2015 from http://chir.ag/phernalia/preztags/ >

Medlin, B. D. (2001). The factors that may influence a faculty member's decision to adopt electronic technologies in instruction (Doctoral dissertation), Virginia Polytechnic Institute and State University, Blacksburg, VA.

Mogae, F. (2005). Botswana: "How we created an African success story." *New African*, *435*, 32-36.

Mtebe, J. S., & Raisamo, R. (2014). Investigating students' behavioural intention to adopt and use mobile learning in higher education in East Africa. *The International Journal of Education and Development Using Information and Communication Technology (IJEDICT)*, *10*(3), 4-20.

Mugimu, C.B. (2006). Implementing E-learning in a Traditional University: What works? In Educational Research: Process and Dissemination of findings (2006), Being part of paper presented in the National Education Graduate Students' Conference proceedings, School of Education, Kampala, Uganda

Mutula, S. M. (2012). Library automation in sub-Saharan Africa: Case study of the University of Botswana. *Program*: *Electronic Library and Information Systems*, *46*(3), 292-307.

Ng'ambi, D. (2005). Mobile dynamic frequently asked questions (DFAQ) for student and learning support. *Mobile Technology: The future of learning in your hands*, 116-119.

Ng'ambi, D., & Knaggs, A. (2008). Using mobile phones for exam preparation. *Proceedings of the IADIS International Conference on Mobile Learning*. Algarve, Portugal, 11-13 April 2008, pp. 35-42. Algarve, Portugal.

Nieben, M. (1982). Qualitative aspects in cross-national comparative research and the problem of functional equivalence. In M. Nieben & J. Peschar (Eds.), *International comparative research. Problems of theory, methodology, and organizations in Eastern and Western Europe* (pp. 83-104). Oxford, England: Pergamon.

Noah, H., & Eckstein, M., (1969). *Toward a science of comparative education*. New York, NY: Macmillan.

Noah, H. J., & Eckstein, M. A. (1998). *Doing comparative education: Three decades of collaboration*. Comparative Education Research Centre (CERC); University of Hong Kong.

Nonyongo, E., Mabusela, K., & Monene, V. (2005). *Effectiveness of SMS communication between tertiary and students.* (Institute for Continuing Education, UNISA). Retrieved from www.mlearn.org.za/CD/papers/Nonyongo&%20Mabusela.pdf.

Nowak, S. (1977). The strategy of cross-national survey research for the development of social theory. In A. Szalai, R. Petrella, & S. Rokkan (Eds.), *Cross-national comparative survey research* (pp. 3-48). Oxford, England: Pergamon.

Ntemana, T. J., & Olatokun, W. (2012). Analyzing the influence of diffusion of innovation attributes on lecturers' attitudes toward information and communication technologies. *Human Technology*, *8*(2), 179-197.

Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill

Nutley, S., Davies, H., & Walter, I. (2002). *Conceptual Synthesis 1: Learning from the Diffusion of Innovations*. ESRC UK Centre for Evidence Based Policy and Practice, working Paper 10. London: Queen Mary, University of London.

Nwagwu, W. E. (2010). Educational communication uses of short messaging services by students in Nigerian universities. *World Journal of Science, Technology and Sustainable Development*, *7*(4), 335-353.

Nwangwu, W., & Odetumibi, S. (2011). Factors influencing the adoption of mobile telephony by students at the University of Ibadan, Nigeria. *Asian Journal of University Education*, *7*(2), 109-142.

Olatokun, W. M., & Igbinedion, L. J. (2009). The adoption of automatic teller machines in Nigeria: An application of the theory of diffusion of innovation. *Issues in Information Science and Information Technology*, *6*, 373-379

Oliver, B. &. Goerke, V. (2008). Undergraduate students' adoption of handheld devices and Web 2.0 applications to supplement formal learning experiences: Case studies of Australia, Ethiopia and Malaysia. *International Journal of Education and Development Using ICT*, *4*(3). Retrieved from http://ijedict.dec.uwi.edu/ viewarticle.php?id=522.

Oppenheim, A. N. (1992). *Questionnaire design, interviewing and attitude measurement*. New York, NY: Bloomsbury Publishing.

Oyelaran-Oyeyinka, B., & Adeya, C. N. (2004). Dynamics of adoption and usage of ICTs in African universities: A study of Kenya and Nigeria. *Technovation*, *24*(10), 841-851.

Patton, M.Q. 1990: Qualitative evaluation and research methods, second edition. Sage.

Paul, J., & Seth, R. (2012). Japan-India diplomacy and relationship marketing, In J. Paul (Ed.), *International marketing: Text and cases, (2nd ed.)* (pp. 178-180). New Delhi: Tata McGraw-Hill Education.

Pea, R. D., & Maldonado, H. (2006). WILD for learning: Interacting through new computing devices anytime, anywhere. In K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 852-886). New York, NY: Cambridge University Press.

Pinsonneault, A., & Kraemer, K. L. (1993). Survey research methodology in management information systems: An assessment. *Journal of Management Information Systems*, *10*(2), 75-105.

Porter, G., Hampshire, K., Abane, A., Munthali, A., Robson, E., Mashiri, M., & Tanle, A. (2012). Youth, mobility and mobile phones in Africa: Findings from a three-country study. *Information Technology for Development*, *18*(2), 145-162.

Prensky, M. (2001). Digital natives, digital immigrants part 1. *On the Horizon*, *9*(5), 1-6. doi: 10.1108/10748120110424816

Prensky, M. (2005). What can you learn from a cell phone? Almost anything! *Innovate, 1*(5), 1-8.

Radijeng, K. (2010) Open access in institutions of higher learning in Botswana. *Meeting: 138. Africa World Library and Information Congress: 76th IFLA General Conference and Assembly*, .10-15 August 2010, Gothenburg, Sweden. Retrieved from http://www.ifla.org/en/ifla76

Raivola, R. (1985). What is comparison? Methodological and philosophical considerations. *Comparative Education Review*, 362-374.

Ramsden, A., & Bate, A. (2008). *Using word clouds in teaching and learning*. University of Bath. Retrieved from http://opus.bath.ac.uk/474/

Riquelme, H. E., & Rios, R. E. (2010). The moderating effect of gender in the adoption of mobile banking. *The International Journal of Bank Marketing*, 28(5), 328-341. doi: 10.1108/02652321011064872

Rogers, E. (1983). *Diffusion of Innovations (3rd ed.)*, New York, NY: Free Press.

Rogers, E. M. (2003). *Diffusion of innovations (5th ed.)*. New York, NY: The Free Press.

Rogers, E. M. (2004): A prospective and retrospective look at the Diffusion Model. *Journal of Health Communication: International Perspectives*, *9*(S1), 13-19

Rogers, E. M. & Shoemaker F. (1971). Communication of Innovations: a Cross-Cultural Approach. New York, NY: Free Press.

Rogers, Y., Connelly, K., Hazlewood, W., & Tedesco, L. (2010). Enhancing learning: A study of how mobile devices can facilitate sensemaking. *Personal Ubiquitous Computing*, *14*(2), 111-124. doi: 10.1007/s00779-009-0250-741

Rosselló, P. (1963). Concerning the structure of comparative education. *Comparative Education Review*, *7*(2), 103–107.

Ryan, B., & Gross, N. C. (1943). The diffusion of hybrid seed corn in two Iowa communities. *Rural Sociology*, *8*, 15-24.

Sanni, S. A., Ngah, Z. A., Karim, N. H. A., Abdullah, N., & Waheed, M. (2013). Using the Diffusion of Innovation concept to explain the factors that contribute to the adoption rate of e-journal publishing. *Serials Review*, *39*(4), 250-257.

SARUA. (2010). ICT infrastructure and connectivity: New capacity, new opportunities. *SARUA Leadership Dialogue Series*, *2*(3). Johannesburg: SARUA.

Searson, M. (2014). Foreword: The failure of education's first mobile device. In C. Miller & A. Doering (Eds.), *The new landscape of mobile learning: Redesigning education in an app-based world*. London: Routledge.

Sebudubudu, D., & Botlhomilwe, M. Z. (2012). The critical role of leadership in Botswana's development: What lessons? *Leadership*, *8*(1), 29-45.

Semali, L., & Asino, T. (2013). Postliteracy in the digital age: Use of mobile phones to support literacy practices in Namibia and Tanzania. *PROSPECTS--Quarterly Review of Comparative Education. Prospects*, *44*(1). doi: 10.1007/s11125-012-9254-6

Sharples, M. (2002). Disruptive devices: mobile technology for conversational learning. *International Journal of Continuing Engineering Education and Life Long Learning*, *12*(5), 504-520.

Sharples, M. (Ed.). (2007). *Big issues in mobile learning: Report of a workshop by the Kaleidscope Network of Excellence Mobile Learning Experience*. Nottingham, England: Learning Sciences Research Institute.

Sharples, M. & Roschelle J. (2010). Guest editorial: Special issue on mobile and ubiquitous Technologies for learning. *IEEE Transactions on Learning Technologies*, *3*(1), 4-6.

Shemi, A. P., & Mgaya, K. V. (2002). Adoption of Information and Communication Technology in higher education: The case of University of Botswana. *Journal of Institutional Research*, *11*(2), 80-91.

Sinclair, J., & Cardew-Hall, M. 2008, The folksonomy tag cloud: When is it useful? *Journal of Information Science 34 (15) 15-29*

Snell, S., & Snell-Siddle, C. (2013). Mobile learning: The effects of gender and age on perceptions of the use of mobile tools. In *The Second International Conference on Informatics Engineering & Information Science (ICIEIS2013)* (pp. 274-281). The Society of Digital Information and Wireless Communication. Kuala Lumpur, Malaysia, Nov. 12-14, 2013

Song, D. (2014). A framework for mobile learning app design: DCALE. In C. Miller & A. Doering (Eds.). *The new landscape of mobile learning: Redesigning education in an app-based world* (pp. 120-137). London: Routledge.

Steiner-Khamsi, G. (2009). Comparison: Quo Vadis?. In *International handbook of comparative education* (pp. 1141-1158). Netherlands: Springer.

Sudman, S., & Bradburn, N. M. (1992). *Asking questions*. San Francisco, CA: JosseyBass.

Sun, G., & Shen, J. (2014). Towards organizing smart collaboration and enhancing teamwork performance: A GA-supported system oriented to mobile learning through cloud-based online course. *International Journal of Machine Learning and Cybernetics*, 1-19. doi: 10.1007/s13042-014-0269-6

Sung, E. & Mayer, E. M. (2012). Students' beliefs about mobile devices vs. desktop computers in South Korea and the United States. *Computers & Education*, *59*(2012), 1328–1338.

Sung, Y.-T., Hou, H.-T., Liu, C.-K., & Chang, K.-E. (2010), Mobile guide system using problem-solving strategy for museum learning: a sequential learning behavioural pattern analysis. *Journal of Computer Assisted Learning*, *26*, 106–115. doi: 10.1111/j.1365-2729.2010.00345.x

Surendra, S. S. (2001). Acceptance of web technology based education by professors and administrators of a College of Applied Arts and Technology in Ontario (Doctoral dissertation), University of Toronto, Toronto.

Surry, D. W., & Brennan, J. P. (1998). Diffusion of instructional innovations: Five important, unexplored questions. Syracuse, NY: ERIC Clearinghouse on Information and Technology. (ERIC Document Reproduction Service No. ED422892)

Surry, D. W., & Ely, D.P. (1999). Adoption, diffusion and implementation and institutionalization of educational technology. Retrieved from http://www.coe.usouthal.edu/faculty/dsurry/papers/adoption/chap.htm

Surry, D. W., & Farquhar, J. D. (1997). Diffusion theory and instructional technology. *Journal of Instructional Science and Technology*, *2*(1), 24-36.

Tarde, G. (1903). *The Laws of Imitation*. Translated by Elsie Parsons. New York, NY: Holt and Co.

Taylor, G. W., & Ussher, J. M. (2001). Making sense of S&M: A discourse analytic account. *Sexualities*, *4*(3), 293-314.

Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. *Information Systems Research*, *6*, 144–176.

Teferra, D., & Altbach, P. G. (Eds.). (2003). *African higher education: An international reference handbook*. Bloomington, IN: Indiana University Press.

Teo, T., Su Luan, W., & Sing, C. C. (2008). A cross-cultural examination of the intention to use technology between Singaporean and Malaysian pre-service teachers: An application of the technology acceptance model (TAM). *Educational Technology & Society*, *11*(4), 265–280.

Thomas, R. M. (1998). *Conducting educational research: A comparative view*. Westport, Conn: Bergin & Garvey.

Tornatzky, L. G., & Klein, K. J. (1982). Innovation characteristics and innovation adoption implementation: A meta-analysis of findings. *IEEE Transactions on Engineering Management*, *29*(1), 28-43.

Totolo, A. (2005). Information technology adoption in Botswana secondary schools and implications on leadership and school libraries in the digital age. In S. Lee, P. Warning, D. Singh, E. Howe, L. Farmer, & S. Hughes (Eds.), *IASL Reports 2005: Information leadership in a culture of change* (p. 78). Erie, PA: International Association of School Librarianship.

Traxler, J. (2007). Defining, discussing and evaluating mobile learning: The moving finger writes and having writ…. *The International Review of Research in Open and Distance Learning*, *8*(2), 63-64.

Traxler, J., & Leach, J. (2006, November). Innovative and sustainable mobile learning in Africa. In *Wireless, Mobile and Ubiquitous Technology in Education, 2006. WMUTE'06 : Proceedings of the IEEE 4th International Workshop on Wireless, Mobile and Ubiquitous Technologies in Education*, Los Alamitos, CA: IEEE Computer Society.

Trotter, H., Kell, C., Willmers, M., Gray, E., Mchombu, K., & King, T. (2014). *Scholarly communication at the University of Namibia: Case study report*. Retrieved from http://openuct.uct.ac.za/sites/default/files/media/03%20SCAP%20Case%20Study%20University%20of%20Namibia.pdf

Turcios, R. A. S. (2015). Demystification of the significance of p in statistical tests. *Revista Mexicana de Cardiologia*, *26*(1), 56-58.

Udo, G., Bagchi, K., & Kirs, P. (2008). Diffusion of ICT in developing countries: A qualitative differential analysis of four nations. *Journal of Global Information Technology Management*, *11*, (1), 6–27.

Utulu, S., & Alonge, A. (2012). Use of mobile phones for project based learning by undergraduate students of Nigerian private universities. *International Journal of Education and Development using ICT*, *8*(1), 4-15.

Valk, J. H., Rashid, A. T., & Elder, L. (2010). Using mobile phones to improve educational outcomes: An analysis of evidence from Asia. *The International Review of Research in Open and Distance Learning*, *11*(1), 117-140.

Vavoula, G. N., & Sharples, M. (2009). Meeting the challenges in evaluating mobile learning: A 3-level evaluation framework. *Mobile and Blended Learning*, *1*(2), 54–75.

Vosloo, S. (2012). *Mobile learning and policies: Key issues to consider mobile learning*. Paris, France: UNESCO. Retrieved from http://unesdoc.unesco.org/images/0021/002176/217638E.pdf

Wabwoba, F., Omieno, K. K., Simiyu, C. N., & Sisungo, Z. W. (2011). The role of wireless technologies in taking education to rural villages in developing countries. *International Journal of Information and Communication Technology Research*, *1*(7), 300–305.

Watkins, D. (2007). *Comparing ways of learning*. In M. Bray, B. Adamson, & M. Mason (Eds.), *Comparative education research: Approaches and methods* (pp. 299-313). Hong Kong: Comparative Education Research Centre and Springer.

Wejnert, B. (2002). Integrating models of Diffusion of Innovations: A conceptual framework. *Annual Review of Sociology*, *28*, 297–326.

Williams, G. (2007). *Gabriel Tarde and the imitation of deviance*. Retrieved from http://www.criminology.fsu.edu/crimtheory/tarde.htm

Wilson-Strydom, M. & Fongwa, S. M. (2012). A profile of higher education in Southern Africa. Volume 1: A regional perspective. Johannesburg: SARUA. Retrieved from www.sarua.org/files/publications/SARUA%20leadership%20Dialogue%20Series/SARUA%20Profiles%20of%20HE%20Vol%201.pdf

World Bank. (2012). *Information and communications for development 2012: Maximizing mobile*. Retrieved from http://elibrary.worldbank.org/doi/book/10.1596/978-0-8213-8991-1#. doi: 10.1596/978-0-8213-8991-1

World Bank & African Development Bank. (2012). *eTransform Africa: The transformational use of information and communication technologies in Africa*. Retrieved from www.eTransformAfrica.org

Yates, B. L. (2001). Applying diffusion theory: Adoption of media literacy programs in schools. Paper presented at the *International Communication Association Conference*, Washington, DC.

Appendix A

Instrument

Implied Informed Consent Form for Social Science Research
The Pennsylvania State University
Title of Project: *A Diffusion and adoption of mobile devices survey*

Welcome to the Diffusion and adoption of mobile devices survey. Before taking part in this study, please read the consent form below.

SURVEY CONSENT FORM

This research study seeks to understand factors that influence diffusion (use) of mobile devices at the university. **Please note, for the purpose of this survey, mobile devices refer to mobile phones and tablets.** The survey will take about 15 minutes to complete and your participation in the research is completely voluntary and confidential. You can stop at any time and can choose not to answer some questions. The survey does not ask for any information that would identify who the responses belong to. You do not have to give your name or other personal information. You must be 18 years of age or older to take part in this research study.

Although there is no payment for participation, at the end of the survey you have a choice of providing your email address to be entered in a drawing for a recharge phone card/voucher. Your email address is only being collected for the purpose of the drawing and will not be stored after the drawing is completed or associated with the information you provided in the survey. If you have any questions or concerns about this study, please contact Tutaleni I. Asino at tutaleni@psu.edu.

Completion and return of the survey implies that you have read the information in this form and consent to take part in the research.

Please keep this form for your records or future reference.

Thank you for your attention and participation

Section 1: DEMOGRAPHIC INFORMATION

1. **Gender?** ○ Male ○ Female
2. **In which country were you born?** ○ Botswana ○ Other (please specify):_____
3. **In which city, town, or village were you born?** _____
4. **In which district (Botswana) / region (Namibia) did you grow up?** _____
5. **In which district / region did you grow up?** _____
6. **What is your age group?** ○18-24 ○25-33 ○34-44 ○45-54 ○54-65 ○66 or older
7. **A. What year are you in school? (Appeared on student survey only)** ○1st ○2nd ○3rd ○4th ○Post Graduate (Graduate) ○Other:_____
   B. How long have you been working at the University? ○Less than 1 year ○1 to 3 years ○3 to 5 years ○5 to 10 years ○10 years + ○ Other (please specify) _____
8. **A. Which faculty/school are you enrolled in?**_____
   B. Which faculty/school do you work in?_____
9. **What is your major (what are you studying)?**_____

Section 2: Technology Ownership

1. **Do you have access to a mobile phone?**
   a. ○ Yes, I own a mobile phone b. ○ Yes, I have a mobile phone that I share
   c. ○ I own a SIM card, that I can use but no phone d. ○ No, I do not have access to a mobile phone
2. **What kind of phone do you have (e.g. "Nokia 1166", "Samsung B910", iPhone 4 etc.)?**
   Brand (e.g. "Nokia", etc)? _____Model (e.g. "N97", etc.)? _____○ I don't know
3. **How often do you do the following on your mobile phone (please mark the best option below with "X")?**

		Never	1-3 times a month	Once a week	2-3 times a week	Every day
1	Access university online learning materials					
2	Access social networking sites (i.e Facebook, Twitter, etc.).					
3	Record Lectures					
4	Take notes					
5	Banking (i.e. check bank account(s), pay bills, etc.)					
6	Download songs, videos, games or ringtones					
7	Share files through Bluetooth					
8	Look for health or medical information					
9	Send and receive SMS (text messages)					
10	Research information for school assignments					
11	Send and receive email					
12	Use for time management/schedule					
13	Record video clips					

4. **What are three things you do most often with your mobile phone?**
   Most often:_____ Second: :_____Third:_____
5. **Do you have access to a computer in your home?** ○ Yes ○ No
6. **Does your home desktop computer or laptop connect to the Internet?** ○ Yes ○ No ○ I Don't know
7. **What three things do you do most often on your computer?**
   Most often:_____ Second: :_____Third:_____
8. **Do you have access to tablet device (iPad, kindle, etc.)**
   a. ○ Yes, I own a tablet b. ○ Yes, I have a tablet that I share d. ○ No, I do not have access to a tablet e. ○ Other (please specify):_____
9. **What kind of tablet device do you have (e.g. "iPad, Galaxy, etc.)?**
   Brand (e.g. "iPad 2) _____○ I don't know

10. **How often do you do the following on your tablet device (please mark the best option below with "X")?**

		Never	1-3 times a month	Once a week	2-3 times a week	Every day
1	Access university online learning materials					
2	Access social networking sites (i.e Facebook, Twitter, etc.).					
3	Record Lectures					
4	Take notes					
5	Banking (i.e. check bank account(s), pay bills, etc.)					
6	Download songs, videos, games or ringtones					
7	Share files through Bluetooth					
8	Look for health or medical information					
9	Send and receive SMS (text messages)					
10	Research information for school assignments					
11	Send and receive email					
12	Use for time management/schedule					
13	Record video clips					

11. **What are three things you do most often on your the Tablet?**

Most often:_____ Second: :_____Third:_____

Section 3: Diffusion of mobile devices

1. **During the school term how often have you done or seen the following?**

		Never	1-3 times a month	Once a week	2-3 times a week	Every day
1	Saw a lecturer use a computer and projector in the classroom					
2-A	Used Email to contact lecturers outside the classroom					
2-B	Used Email to contact students outside the classroom					
3	Accessed a course syllabus on a mobile phone or tablet					
4-A	Received marks via SMS					
4-B	Sent marks via SMS					
5-A	Requested exam or test marks (grades) via SMS					
5-B	Received a requested for exam or test marks (grades) via SMS					
6	Used SMS as the primary source of contact with lecturers outside the classroom					
7	Sent assignments to the lecturers via SMS					
8-A	Saw a lecturer use a smartboard					
8-B	Used a smartboard					

2. **How important are the following in your decision to use (adopt) technologies at the university?**

		Not at all Important	Somewhat Unimportant	Neither Important nor Unimportant	Somewhat Important	Very Important
1	The Ministry of Education offering rewards to those using a certain technology					

2	Having the needed Physical Resources (Equipment/Software) readily available					
3	Rewards from the University for using a technology					
4	Seeing my mentors/role model use a technology					
5	University makes it compulsory to have/use a certain technology					
6	Classmates/Fellow Students					
7	Seeing friends use a technology					

3. **How much do you agree or disagree with the following statements (please tick the appropriate box)?**

		Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
1	There is pressure from the community outside the University to use mobile phones in education.					
2	Mobile phones can help with learning tasks, such as writing, analyzing data, or solving problems.					
3	The lecturer (lecturer/professor) is the most important person in the classroom					
4	The Ministry of Education has policies that support the use of mobile phones and tablets in education.					
5	University administration encourages the use of devices in education (e.g. phones, mp3 players, tablets etc.)					
6	Learning is a partnership between the lecturer, student, and learning materials					
7	A mobile phone is for socializing not for education.					
8	It is easy to access learning materials through my Mobile phone					
9	Mobile phones and tablets are too complicated to understand & use.					
10	Most students use mobile devices for learning.					
11	Technology is a distraction to learners in the classroom.					
13	Mobile devices are not appropriate for university teaching and learning.					
14	There are too few training opportunities for lecturers to learn new technology knowledge and skills.					
15	I do not know how mobile devices such as phones or tablets can be effectively included into teaching and learning.					
16	Professors/Lecturers are not interested in using technology in their teaching.					
17	Students learn best when the lecturer is at the front of the classroom, teaching and asking questions					

18	There are too few training opportunities for students to gain new technology knowledge and skills.					
19	There will be less control over classroom if mobile devices such as tablets and phones are used.					
20	Mobile devices minimize the authority of the lecturer					
21	Students get excited about the subjects in which they use mobile devices					
22	Most lecturers put learning materials on line for students to access					
23	There is no enough information showing that using technology improves learning.					
24	Other Universities are using mobile devices in education while our university is not.					
25	Mobile devices are easier to use than traditional computers (i.e. laptops or desktop computers)					
26	Requiring lecturers to allow student to use mobile devices in class would cause stress & confusion within the University.					

4. **Please list any barriers that you feel may prevent the use of mobile devices in teaching and learning:**

_____

_____

5. **Please answer the questions below by ticking the appropriate box with an "X"**

		Yes	No
1	I have seen students using mobile devices for teaching & learning		
2	I have read about using mobile devices in education from books, journals, magazines, newspapers, etc.		
3	I have had conversations about mobile devices in education with my friends		
4	I have heard about lecturers using mobile devices in their classes here at the university		
5	I am willing to attend training sessions on teaching & learning with mobile phones.		
6	I would like to try using mobile devices in education in a module/section of my class		

6. **What do you think are the advantages of using mobile devices for learning over other technologies?**

_____

_____

If you have any comments/feedback on this survey, please write them below

_____

_____

SECTION 4: ENTER A DRAWING

If you would like to be entered into a draw for a phone recharge card for P100 /N$100, please provide your contact information below:

Email:_____

Which mobile provider do you regularly use?_____

Thank you for your participation. If you have any comments or concerns about this survey please contact:

Tutaleni I. Asino

(tutaleni@psu.edu)

Learning Design & Technology & Comparative and International Education

The Pennsylvania State University

314 Keller Building - University Park, PA 1680, USA

Appendix B

Botswana Research Permits Application Packet

UNIVERSITY OF BOTSWANA

Office of the Deputy Vice Chancellor (Academic Affairs)

Office of Research and Development

Corner of Notwane and Mobuto Road, Gaborone, Botswana
Pvt Bag 00708 Gaborone, Botswana
Tel: [267] 355 2900 Fax: [267] 395 7573 E-mail: research@mopipi.ub.bw

Ref: UBR/IRB/ 086
X-REF: UB/RES/ETHI/07

20 February, 2014

To: Mr. Tutaleni I. Asino
Learning, Design, and Technology
Penn State University, College of Education
314 Keller Building, University Park, PA 16801, USA

RE: "PERMISSION TO CONDUCT RESEARCH WITHIN UB

Project Title : **FACTORS THAT INFLUENCE DIFFUSION OF MOBILE DEVICES IN HIGHER EDUCATION IN BOTSWANA AND NAMIBIA.**
Researcher(s) : **MR. TUTALENI I. ASINO**

I am glad to advise that approval has been granted for the above study to be conducted at the University of Botswana. Since the study is to be conducted within the confines of UB, the study has accordingly been exempted from Government Research Permit requirements. In reaching the above decisions, it was noted that the above study involves minimal risk. Before proceeding with the study, the researcher is required to ensure the following:

- **The study will only be conducted within the confines of UB following the approved proposal version.**
- **No interviews will be conducted with any official or individual outside UB as part of the study.**
- **Permission will be sought from UB authorities as necessary.**
- **APPROVAL DATE** :19th February, 2014
- **EXPIRATION DATE** :This approval expires on 18th February, 2015
  After this date, this project may only continue upon renewal. For purposes of renewal, a progress report should be submitted to ORD one month before the expiration date.
- **REPORTING OF SERIOUS ADVERSE EVENTS:** All serious adverse events impacting on study quality and progress (whether expected or unexpected) must be reported to ORD within 10 days.
- **MODIFICATIONS:** Prior approval is required before implementing any significant changes to the protocol.
- **TERMINATION OF STUDY:** On termination of this study, a report has to be submitted to ORD.
- **QUESTIONS:** Please contact ORD ext 2911 or 2900
- **Other:**

The researcher may accordingly proceed with the above study after fulfilling the above requirements.

Kind regards.

For
Dr. BMB SEKHWELA (Acting Director, Office of Research and Development)

PENNSTATE

01 February 2014

The Permanent Secretary
Ministry of Education
Republic of Botswana
Private Bag 005
Gaborone, Botswana

Dear Sir or Madame:

Please accept this letter and enclosed supporting documents as application to conduct research in Botswana from 22 February to 03 March 2014.

My Name is Tutaleni I. Asino and I am Dual-title doctoral degree candidate in Learning, Design, and Technology program within the Learning and Performance Systems department and the Comparative and International Education Program in the Policy Studies department at Penn State University, in the USA. I am a Namibian citizen whose research investigates the use, adoption, and diffusion of mobile devices (tablets and phones) in higher education in Botswana and Namibia. I have collected my data at the University of Namibia and would like to travel in February 2014 to collect data at the University of Botswana for a comparative study.

Included in this packet are the following:

- ✓ Completed government research permit application form
- ✓ Research study hosting and support letter
- ✓ Detailed proposal (including Budget & Timeline)
- ✓ Proof of IRB approval from Penn State University
- ✓ Informed consent document
- ✓ Data collection tools (survey)
- ✓ Letter of support from the supervisor
- ✓ CV of the researcher
- ✓ Copy of Research Funding Proposal
- ✓ Copy of Research Funding Proposal Support Letter

I graciously ask that you examine my application and respond to my request at your earliest convenience.

Sincerely,

Tutaleni I. Asino
Researcher & PhD Dual-Title Degree Candidate
Learning, Design & Technology, Department of Learning and Performance Systems
& Comparative and International Education Program, Department of Ed. Policy Studies
The Pennsylvania State University
2502 Plaza Drive, State College, PA 16801
tutaleni@psu.edu | 412.720.7917

REPUBLIC OF BOTSWANA

Research Permit Application Form

Two copies of this form should be completed and signed by the applicant who wishes to obtain a permit for conducting research in the Republic of Botswana, and sent to the Permanent Secretary of the relevant Ministry

(See guidelines for addresses). These forms should not be submitted unless the Guidelines for the Research have been carefully studied. A copy of any project proposal submitted to funding agencies must accompany this application. Please refer to annexure I attached to this application form.

Fill this form in full.

Description of the Proposal

1. **Title of Research**…… FACTORS THAT INFLUENCE DIFFUSION OF MOBILE DEVICES IN HIGHER EDUCATION IN BOTSWANA AND NAMIBIA……

2. **Name and Address of Applicant**

   Title: Mr. / Mrs. / Miss/ Dr. / Prof:

   …Mr. Tutaleni I. Asino…….
   … Learning, Design, and Technology……..
   … Penn State University, College of Education ……..
   …314 Keller Building, University Park, PA 16801, USA……..
   Telephone: …***.***.****…….Mobile …***.***.****……..
   Fax: …….
   E-mail …tutaleni@psu.edu…….

3. **Name and address of home institutions (if any) which you are affiliated**
   …Penn State University, College of Education ……..
   …314 Keller Building, University Park, PA 16801, USA
   ……..

4. **Name and address of supervisor of research in home country or responsible referee:**
   …Dr. Simon Hooper, Professor of Education……
   …Learning, Design, & Technology, College of Education, Penn State University
   …310C Keller Building, University Park, PA 16802……

   …Dr. Ladislaus M. Semali, Professor of Education…….……
   …Adult Education & Comparative & International Education, Penn State University
   …307 Keller Building, University Park, PA 16802…….……

Research plans

5. **a) Main aims (general)**

…The aim of this research is to study the diffusion of innovation in Botswana and Namibia. Specifically, I am interested in learning how mobile devices are adopted and diffused with in the two countries using the higher education as a context……

Objective: detailed description of issues/problems and/or topics to be investigated, relevance of the research; hypothesis etc. (attach a separate sheet if necessary).

……PLEASE SEE ATTACHED RESEARCH PROPOSAL..……

c) **Methods or techniques**

…This study utilizes a survey instrument to collect data. The method of collecting data consists of requesting permission from lecturers at the University of Botswana to access their classes so that the survey can be administers. Once a lecturer gives permission and a time a time and day is agreed upon, the researcher will visit the classroom and ask for permission from the students. The survey takes 15 – 20 minutes to complete and maintains the anonymity of the participants because it does not require personal identifiable information.

6. Budget for the costs in Botswana (give detailed breakdown of research costs such as subsistence, traveling, local staff, secretarial service, seminar, printing etc). Please state the amount in Pula

…Airfare: 12658 (U$ 1,400.00) ……
…Lodging: 14466 (U$ 1,600.00) ……
…Local transport: 4520 (U$ 500.00) ……

7. Name and address of financial sponsor(s) of the research (if appropriate)

…… Africana Research Center……
…… The Pennsylvania State University……
…… 217 Willard Building, University Park, PA 16802……
…… E-mail: africanacenter@la.psu.edu……
…… Tel: 814-865-6482……Fax: 814-865-6145……
…… www.arc.psu.edu……

8. Has funding already been obtained? (Yes/No)

a) If yes, please state the total amount granted, and the name and address of the funding agency:

……Awarded $2000……
……Africana Research Center……
…… The Pennsylvania State University, 217 Willard Building,
…… University Park, PA 16802……

b) If no, what steps are being taken to ensure sufficient funding?

…The researcher will self-fund the portion not covered by the grant from personal resources

9. If you have previously done research in Botswana please give details of the research.
……N/A……

10. Name and address of institution in Botswana to which the researcher is to be affiliated

……University of Botswana……
……Physical Address: 4775 Notwane Rd. Gaborone, Botswana……..
……Postal Address: Private Bag UB 0022, Gaborone, Botswana……

11. Details of Botswana – based personnel that will be involved (names, functions, qualifications).

… Dr. Tshiamo Motshegwa …….…….
…Private Bag UB 00704……
…Computer Science Department……
…Faculty of Science……
…University of Botswana……
…Gaborone, Botswana……

12. Places in Botswana where the research is to be undertaken

……University of Botswana Gaborone…….

13. Proposed time – schedule for the research

……24^{th} February to 3^{rd} March 2014……..

14. Plans for dissemination of research findings

……completed copy of the research will be forwarded to the host institution ……

15. How are the research findings going to be used in the home country?

……Broadly, this research will contribute to an understanding of how emerging technologies are adopted by higher educational institutions in Southern Africa. This research will also serve as an integral component of my dissertation and will be used towards the completion of my degree.……...

16. Any other information

……..

17. Signature of applicant:

18. Date ……01 February 2014……..

For Official Use Only

Action taken:

……

……..

……..

Action Officer: …….. Date: …….

Permit: Granted/ Deferred/ Rejected ……..

ANNEXURE 1

i) Submit the following passport particulars:

Name : …Tutaleni I. Asino .....

Date of Birth : …********** .....

Nationality : …********** .....

Passport Number : …********** .....

Place of Issue : …********** .....

Date of Issue : …********** .....

Date of Expiry : …********** .....

ii) Submit of Research Proposal

iii) Attach an up to date Curriculum Vitae

iv) Applicants from foreign countries are advised not to leave for Botswana before obtaining a research permit from the relevant Ministry

v) Statutory deposit of resulting publications:

Resulting publications should be directly deposited with the following institutions and any other departments as may be specified in the permit.

1. Permanent Secretary Ministry of Education Private Bag 005 Gaborone, Botswana
2. Director, Botswana National Library Services,
   Private Bag 0036 Gaborone, Botswana
3. Director, Botswana Archives and Records Services,
   P O Box 239 Gaborone, Botswana
4. User Ministry and/or affiliating body.
5. Director, Research and Development Office, Private Bag 0022, Gaborone, Botswana

vi) For any correspondence pertaining to research permit issued, always quote the permit reference number.

PENNSTATE

Department of Education
Policy Studies

The Pennsylvania State University
300 Rackley Building
University Park, PA 16802-3201

Fax: (814) 865-3480
http://www.ed.psu.edu/epsy

February 8, 2014

The Permanent Secretary
Ministry of Education
Private Bag 005
Gaborone, Botswana

Dear Sir / Madame:

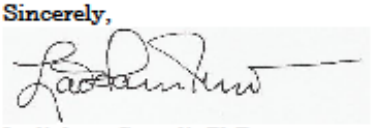
It is an honor to write this support letter for Mr. Tutaleni Asino who has informed me he is applying for a permit to conduct doctoral research in Botswana. I support this effort without hesitation because Mr. Asino needs this opportunity to collect dissertation research data in order to complete his doctoral studies at the Pennsylvania State University. I have known Tutaleni since he enrolled in the Learning, Design, and Technology (LTD) Program at Penn State University, where I serve as his academic advisor. During the past three years, as doctoral candidate, Mr. Asino was enrolled in several graduate level courses under my supervision. In addition, he was my Research Assistant, a role he played superbly well and exceeded reasonable expectations. By the way, this work led to several publications.

In the next phase, Tutaleni must produce a dissertation thesis to graduate from Penn State. Since he is enrolled in the Dual-title Degree program in Comparative and International Education and LTD, Mr. Asino needs comparative data for the thesis. It is for this reason I'm requesting you to grant him permission to visit Botswana and involve colleagues in the process to collect the needed comparative research data.

In the previous year Mr. Asino received a small grant to conduct a pilot study in which he assessed the capability for mobile learning in Namibia. This effort complimented his anticipated dissertation research, tentatively titled: "Factors that Influence Diffusion of Mobile Devices in Higher Education in Botswana and Namibia." Positively, this line of research will illuminate teachers, instructors, and designers to grasp the nature of emerging technologies and address the needs of learners in Africa.

Because of these considerations, I wholeheartedly support Mr. Asino's application for a permit to conduct dissertation research in Botswana. If you need additional information about Mr. Asino, please do not hesitate to contact me at the above address.

Sincerely,



Ladislaus Semali, PhD
Professor of Education
lms11@psu.edu

PENNSTATE

Africana Research Center | The Pennsylvania State University, 217 Willard Building, University Park, PA 16802 | 814-865-6482, 814-865-6145 – Fax, E-mail: africanacenter@la.psu.edu, www.arc.psu.edu

January 20, 2014

Tutaleni Asino
Penn State University
314 Keller Building
University Park, PA 16802
tutaleni@psu.edu

Dear Mr. Asino:

Congratulations. The ARC has decided to fund your research project, **"Factors That Influence Diffusion of Mobile Devices in Higher Education in Botswana and Namibia"** in the amount of $2,000. **If your research involves human subjects, you will need to provide the requisite IRB certification, or proof from IRB that certification is not required, before the agreement can be signed. For more information on the IRB, visit** http://www.research.psu.edu/orp/humans. You have 60 days from the above date in which to provide us with a copy of your IRB certification letter, make an appointment with Dawn Noren (814-865-6144) to review and agree to abide by ARC grant guidelines, and sign the award agreement. You will then have 18 months to use your ARC funds. Please do not begin spending ARC funds before the agreement is signed, as we will not reimburse for expenses incurred before the grant period.

In return for sponsoring your project, we ask that you acknowledge the ARC in written and oral form as a funding source, and that you agree to present on your funded research project at a future ARC-sponsored event or by contributing to the ARC Travel Blog. By accepting the ARC research funds, you agree to provide us with a copy of your finished research product (e.g., dissertation, book, journal article, external proposal, etc.) immediately following your project's completion. We were very impressed with your proposal's potential to yield quality research, and we are pleased to support your efforts.

Sincerely,

Lovalerie King
Director, Africana Research Center

Appendix C: Advantages Themes

Table 5-3 Frequency of advantages codes in the sample

Code	University of Botswana	University of Namibia	Total
Portability	168	61	229
Easier to use	65	57	122
Anytime-Anywhere Learning	70	25	95
Faster	50	45	95
Less expensive/They're cheap	30	40	70
Easily Accessible	42	13	55
Everyone owns or has access to one	29	19	48
Saves Time	19	26	45
Enhances Learning	14	30	44
Convenient to use	38	3	41
Provide/improve Access information anytime-anywhere	20	19	39
Accessibility	23	14	37
Captures student interest/attention	21	11	32
Makes Learning Easier	17	14	31
easier to access material	16	13	29
Faster access to information	19	10	29
Improves communication between lecturer & students	16	12	28
Mobility	9	9	18
Up-to-date information	8	9	17
Easy access to Learning Materials	12	4	16
always in hand/pocket	10	5	15
Fun	10	5	15
Effective for learning	9	5	14
efficient for learning	9	5	14
No advantages	7	7	14
Improved student success	8	5	13
Learner autonomy	8	5	13
Accessible all the time-anywhere	8	3	11
Acceptable	2	8	10
helps with research	5	4	9
inappropriate	4	5	9
User Friendly	7	2	9
Improves teaching & learning	2	6	8
Instant access to information	2	6	8
Makes Work Easy	4	4	8
Provide/improve access to internet anytime-anywhere	5	3	8
Readily available	7	1	8
collaborative learning	2	4	6
connect globally	2	4	6
Flexibility	4	2	6
less waste	5	0	5
more reliable	4	1	5
Provide Interactive learning	1	4	5
access to learning applications	3	1	4
Comfortability	3	1	4

it is compatible	4	0	4
multipurpose	1	3	4
Storage capacity	3	1	4
useful for teaching & learning	3	1	4
Access diverse information	1	2	3
Convenient during power outages	2	1	3
easy to take notes	1	2	3
hard to steal	3	0	3
helps shortage of computers/lab congestion	3	0	3
Saves time	2	1	3
Social networks	3	0	3
Useful	0	3	3
don't know	1	1	2
instant feedback	2	0	2
makes life easy	2	0	2
Not distracting	2	0	2
cannot tell	1	0	1
mass teaching	0	1	1
meet deadlines	1	0	1
networked learning	1	0	1
Networked learning	0	1	1
No disadvantages	1	0	1
not really important	0	1	1
opportunity for further learning	0	1	1
Practical	0	1	1
Precise	1	0	1
provides knowledge	0	1	1
Replaceable	1	0	1
saves time	1	0	1
social factors	0	1	1
They're advanced	0	1	1
Total	857	553.00	1410.00

Appendix D: Barriers Themes

Table 5-4: Frequency of barriers code in sample

Code	University of Botswana	University of Namibia	Total
Distraction/Disturb	127	93	220
Affordability	67	66	133
Infrastructure	65	24	89
Distraction from social media	55	14	69
Conflict with values	25	27	52
Technology	28	24	52
Lack of Knowledge & Skills	25	13	38
Lecturers	7	11	18
None	7	9	16
lack of Knowledge	8	5	13
Academic Dishonesty	7	3	10
Theft	10	0	10
Lack of Technology Skills	7	2	9
Fear	6	2	8
Government	5	3	8
Lack of Skills	2	6	8
University Administration	3	5	8
Lack of control	2	3	5
Lack of Knowledge & Skills by Lecturers	2	6	8
Lack of Knowledge & Skills by Students	2	2	4
Lack of Interest	1	2	3
Lack of Resources	2	1	3
Poverty and Corruption	0	3	3
lack of control	1	1	2
Parents	2	0	2
Security Concerns	1	1	2
Access	0	1	1
Assessment	1	0	1
Attitude	1	0	1
Beliefs/Myths	0	1	1
Community attitudes	1	0	1
Culture	1	0	1
Digital Divide	1	0	1
Lack of knowledge by students	1	0	1
Language	1	0	1
Screen size	1	0	1
Socio-Economic	1	0	1
Time	0	1	1
Too complicated	0	1	1
Too personal	1	0	1
Total	477	330	807

Table 5-5 6. Thematic coding for 'advantages of using mobile devices for learning over other technologies'

Code	• Easy To Take Notes • Makes Work Easy • Makes Life Easy • Easy Access To Learning Materials • Easier To Access Material • Makes Learning Easier • Easier To Use • Mass Teaching	• Access Diverse Information • Instant Access To Information • Access To Learning Applications • Faster Access To Information • Accessibilit y • Everyone Owns Or Has Access To One • Easily Accessible • Provides Up-To-Date Information • Readily Available	• Accessible All The Time-Anywhere • Anytime-Anywhere Learning • Provide/ Improve Access Information Anytime-Anywhere	• Collaborative Learning • Networked Learning • Provide Interactive Learning • Effective For Learning • Efficient For Learning • Enhances Learning • Improves Teaching & Learning • Useful For Teaching & Learning • Acceptable For Learning • Helps With Research • Improves Communication Between Lecturer & Students • Opportunity For Further Learning	• Captures Student Interest/ Attention • Improved Student Success • Learner Autonomy	• Convenient During Power Outages • Comfortability • Not Distracting • More Reliable • Storage Capacity • Less Expensive /They're Cheap • Convenient To Use • User Friendly • It Is Compatible • Always In Hand/Pocket • Hard To Steal • Multipurpose • Connect Globally • Meet Deadlines • Social Networks • Fun • Helps Shortage Of Computers/Lab Congestion • Instant Feedback • Flexibility • Precise • Replaceable • Less Waste • Faster • Saves Time • They're Advanced • Practical	• Portability • Mobility
Sub Category	Ease Of Use	Easy, Instant Access To Information	Anytime-Anywhere Access	Improves Teaching & Learning	Empowers Students	Convenient And Multipurpose	Portability & Mobility
Category	Easy To Use And Provide	Easily Accessible Information					
Theme	*Mobile devices are easier to use and provide for access to information and anytime anywhere*			*Mobile devices empower students and improve teaching and learning*		*Mobile devices are more convenient, portable and multipurpose than other learning technologies*	

Appendix E: Thematic coding for advantages of mobile devices

Code	Distraction/Disturb (220)	Access (1)	Digital Divide (1)	Government (8)	Academic Dishonesty (10)	Assessment (1)
	Distraction from social media (69)	Affordability (133)	Infrastructure (89)	Lecturers (18)	Attitude (1)	Lack of Interest (3)
	Lack of control (7)	Socio-Economic (1)	Screen size (1)	University Administration (8)	Beliefs/Myths (1)	Lack of Knowledge & Skills (38)
			Security Concerns (2)		Community attitudes (1)	Lack of Knowledge & Skills by Lecturers (8)
			Technology (52)		Conflict with values (52)	Lack of Knowledge & Skills by Students (5)
			Too complicated (1)		Culture (1)	lack of Knowledge (13)
					Fear (8)	Lack of Resources (3)
					Language (1)	Lack of Technology Skills (17)
					Parents (2)	Time (1)
					Poverty and Corruption (3)	
					Theft (10)	
					Too personal (1)	
Sub-Category	Distraction	Socio-Economic factors	Technology	Stakeholders	Community environment	Lack of knowledge & skills
Category						
Theme	Mobile devices are seen as disruptive to the teaching and learning experiences	The cost of mobile devices, the technology and infrastructure form a barrier to mobiles in education		The environment is currently not supportive of using mobiles in education		There is a lack of knowledge and skills by lecturers and students for how to integrate mobile into teaching and learning

Appendix F: Mobile Phones Thematic Coding Example

Code	Access Computer Science School Website (1) Dictionary (1) Download Notes (1) Record Lectures (1) Save Notes From The Internet (1) School Assignment (1) Surf The Internet For School Work (1) Take Notes (1) Browse Internet For School Work (1) Google For Information For Assignments (3) Access University Lms (5) Research On The Internet (7)	Google Hangouts (1) Instagram (1) Twitter (1) Whatsapp (32) Facebooking (67) Access Social Networking Sites (75) Change Profiles (1)	Check & Send Emails (16) Communication (7) Make & Receive Phone Calls (268) Send & Receive SMS (459) Send 'Please Call Me Backs' (1)	Browse The Internet (3) Search For Information (7) Access Internet (18) Check Soccer Updates (1) Read News (2) Read Scripture (1)	Download & Play Music (1) Play Media (1) Use The Media Player (1) Downloading (2) Listen To Radio (2) Youtube (1) Watch Videos (1) Listen To Music (47) Play Games (2)	Time Management (15) Take Photos (2)	
Sub-Category	*School Access*	Social Networking	Communicate	Consume Information	Consume Media	*Personal Management*	
Category		*Communication*		*Consumption Of Content*			
Theme		**Mobile Devices Are Used For Communication**		**Mobile Devices Are Used To Consume Content**		**Mobile Devices Are Used For Personal Management**	Mobile devices are used to create content

Appendix G: Tablets Thematic Coding Example

Table 5-6 Tablets use thematic coding

Code	Academic Research (1)	Access Social Networking sites (18)	Make and Receive Calls (6)	Browse Internet (3)	Listen to Music (1)	entertainment (1)	Take photos (3)
	ACCESS UB ONLINE LEARNING MATERIALS (1)		send and receive email (2)	Download/Read Books (2)	Play Games (3)	RESEARCH ONLINE (1)	
	reading lecture notes (1)		SEND AND RECEIVE SMS (1)		Watch Videos (4)	Take Notes (1)	
	School Assignments (10)					Time Management (2)	
Frequency	13	18	9	5	8	5	3
Sub-Category	*School Access*	Social Networking	Communicate	Consume Information	Consume Media	*Personal Management*	Create
Category		*Communication*		*Consumption of content*			
Theme	**Tablet devices are used for academic purposes**	**Tablet devices are used for communication**		**Tablet devices are used to consume content**		**Tablet devices are used for personal management**	**Tablet** devices are used to create content
	21.31%	29.51%	14.75%	8.20%	13.11%	8.20%	4.92%

Appendix H: Computer use thematic coding

Code	Access University Online Learning Material (Blackboard, Moodle) (3) Emails & Class Discussion (1) Learn Some Basic Things In The Computer (1) School Assignments (Research, Type, Read Lecture Notes./Slides) (124)	Access Social Networking Sites (39)	Check Emails (9)	Browse Internet (22) Online News (1) Read (Ebooks, Pdfs) (5) Search Fashion Trends (1)	Browse Through Photos (4) Download Content (Videos, Movies, Games, Music) (20) Listen To Music (60) Play Games (22) Take Photos (5) Watch Videos & Movies (107)	Download Pdf's (1) Guitar (1) Keep Records Of My Files (1) Format Documents (1) Listen To Christian Teachings (1) Look For Health Or Medical Information (2) Personal Stuff (2) Programming (2) Read Material On Personal Development (1) Read Notes And E-Books (1) Read Stored Data On Discs And Flash Drives (1) Reading Any Information Saved On External Drives Relevant To Assignments (1) Reading Downloaded Pdf (1) Rugby (1) Shopping (1) Transferring/Exchanging Data (1) Typing Assignments & Personal Stuff (1) 20	Mix Via Virtual DJ (1) Record and Produce Music (1)
Frequencies	129	39	9	29	218	20	2
Sub - Category	*School Access*	Social Networking	Communi cate	Consume Information	Consume Media	*Personal Management*	
Category		*Communication*		*Consumption of content*			Create
Theme	**Computers are used for academic purposes**	**Computers are used for communication**		**Computers are used to consume content**		**Computers are used for personal management**	**Computers are used to create content**
	28.92%	10.76%		55.38%		4.48%	0.45%

Table 5-7 6. Thematic coding for 'advantages of using mobile devices for learning over other technologies'

Code	• Easy To Take Notes • Makes Work Easy • Makes Life Easy • Easy Access To Learning Materials • Easier To Access Material • Makes Learning Easier • Easier To Use • Mass Teaching	• Access Diverse Information • Instant Access To Information • Access To Learning Applications • Faster Access To Information • Accessibilit y • Everyone Owns Or Has Access To One • Easily Accessible • Provides Up-To-Date Information • Readily Available	• Accessible All The Time-Anywhere • Anytime-Anywhere Learning • Provide/ Improve Access Information Anytime-Anywhere	• Collaborative Learning • Networked Learning • Provide Interactive Learning • Effective For Learning • Efficient For Learning • Enhances Learning • Improves Teaching & Learning • Useful For Teaching & Learning • Acceptable For Learning • Helps With Research • Improves Communication Between Lecturer & Students • Opportunity For Further Learning	• Captures Student Interest/ Attention • Improved Student Success • Learner Autonomy	• Convenient During Power Outages • Comfortability • Not Distracting • More Reliable • Storage Capacity • Less Expensive /They're Cheap • Convenient To Use • User Friendly • It Is Compatible • Always In Hand/Pocket • Hard To Steal • Multipurpose • Connect Globally • Meet Deadlines • Social Networks • Fun • Helps Shortage Of Computers/Lab Congestion • Instant Feedback • Flexibility • Precise • Replaceable • Less Waste • Faster • Saves Time • They're Advanced • Practical	• Portability • Mobility
Sub Category	Ease Of Use	Easy, Instant Access To Information	Anytime-Anywhere Access	Improves Teaching & Learning	Empowers Students	Convenient And Multipurpose	Portability & Mobility
Category	Easy To Use And Provide	Easily Accessible Information					
Theme	*Mobile devices are easier to use and provide for access to information and anytime anywhere*			*Mobile devices empower students and improve teaching and learning*		*Mobile devices are more convenient, portable and multipurpose than other learning technologies*	

VITA

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EDUCATION

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Penn State University, University Park, PA
Master of Science, Instructional Systems and Technology, May 2008
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WORK EXPERIENCE

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- Teaching Assistant, College of Information Sciences and Technology (Spring 2015)
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AWARDS

2013 – Association for Educational Communications & Technology (AECT and National Science Foundation Early Career Symposium Award
2012 - Cochran Intern - Association for Educational Communications and Technology (AECT)
2011 - Presidential Award - Awarded by Dr. Barbara Lockee, president of the Association for Educational Communications and Technology (AECT) for service to the organisation
2011 - R.W. "Buddy" Burniske" Award by the International Division of the Association for Educational Communications and Technology (AECT)
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MEMBERSHIP IN PROFESSIONAL ASSOCIATIONS

Association for Educational Communications and Technology (AECT), 2009 – present
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