Technology Adoption and Integration: A Descriptive Study of a Higher Education Institution in a Developing Nation

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Abstract

New electronic technologies like computers and the Internet continue to spread to all parts of the world. Developing nations like Malawi have experienced this thrust in the area of electronic technologies. Mzuzu University, a relatively new university in the Malawian education system has made tremendous efforts in providing computers and the internet to faculty members of the University. It was however not clear if such efforts had resulted in corresponding application and integration of the technologies in teaching and learning. This study ventured to investigate prevailing levels of utilization of the computer technology and the Internet in teaching and learning at the university and uncover factors that facilitate or hinder use and integration of the technologies in teaching and learning. Results of the study revealed that while most faculty members actively engaged with electronic technologies, such engagements often excluded instructional use. Where electronic technologies have been used for instructional purposes, it has been mainly for accessing information for teaching. Factors that affect utilization and integration of electronic technologies comprise limited availability of the technologies; unreliability of the available technologies due to related issues like power outages and poor reception; lack of training; lack of technical, pedagogical and administrative support; and lack of faculty involvement in decision making relating to electronic technologies.

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Chapter 1: Introduction

The use of technology in education is growing in all parts of the world (Anderson & Kanuka, 2003). While it may be expected that technology availability would result in corresponding utilization, technology integration in instruction is a response to the demands that society has placed on universities in general and faculty in particular (Nicolle, 2005). Universities and other educational institutions are therefore expected to equip students with skills relevant to meet these demands. In response, administrators of universities have invested in computer technology and the Internet with the hope that easy accessibility of such technologies will prompt faculty members to not only use the technologies, but also integrate them in teaching and learning. Yet this does not seem to be the case.

Evidence exists that illuminates that investing in technologies does not always result in utilization and integration in teaching and learning. As a matter of fact, it has been further found that universities are lagging behind as far as in-class use of instructional technologies is concerned. While developed countries are decades away from their developing counterparts in regards to technology availability and accessibility, results of studies regarding technology integration have tended to cut across cultures and borders. In the technologically rich environments, despite high accessibility of up-to-date technology and equipment, technology integration in teaching and learning is still an issue. This shows that there must be other factors which interact to influence the probability of technology adoption and integration.

Developing countries have lagged not just economically and socially, but more recently, technologically as well. Despite problems universities in these environments meet to balance basic needs of running the universities and the technological needs, immense efforts are underway to provide electronic technologies to faculty as a step towards enabling them use and

apply the technologies in their teaching. Technology permeation into developing nations such as Malawi is a welcome development which is likely to help bridge the information barrier between developed and developing nations. However, improved access to technology does not seem to result in improved utilization for instructional purposes.

Although it would be expected that universities and more specifically, university faculty would take a major role in modeling the use of technology for teaching and learning, the reality on the ground does not seem to be so (Bryant, 2000; Green, 2001; International Society for technology in Education, 2000; Keengwe, 2007). According to Nicole (2005) “University faculty members have been among the last educators to experience the educational thrust toward technology integration” (p. 36).

This study responds to the need to establish the current practices of faculty members in a developing nation in relation to technology use for teaching and learning following investments made to boost technology availability in the university. Factors influencing their utilization of new technologies (such as computers, the Internet and the World Wide Web) have been analyzed through the lenses of several theories that have also informed similar research endeavors.

To this end, literature is replete with theories that try to explain why people adopt technology or not, how technological innovations diffuse in a social system, and factors that facilitate or impede their implementation. These theories and models range from general forms to more specific ones. Numerous research studies have been conducted that have drawn from such theories as bases. Hence this study is an extension of such studies.

In particular, the Diffusion of Innovation theory by Rogers (2003) has been a major framework informing the field of diffusion of innovation, diffusion of technological innovations and more particularly and research endeavors that have been conducted in these areas. For this

purpose, Rogers' (2003) Diffusion of Innovations theory formed a major basis for the conduct of this study.

In this regard, chapter two provides a rich literature base dealing with diffusion of innovations. It starts by describing the role of technology in teaching and learning and moves on to the theoretical underpinnings associated with diffusion of innovations. Major of the theories is Everett Rogers' Diffusion of Innovations (DOI) theory which has not only provided the framework for other diffusion and adoption theories, but has gone further to inform many studies in this area.

Discussions of theories that emanate from the DOI theory relating specifically to instructional technology have been presented to elucidate the rationale for employing DOI theories in this study. Studies associated with these instructional technology theories and models have also been highlighted. It concludes with a focus on research that has been conducted in Malawi in relation to technology and a statement of purpose for the study and associated research questions.

Chapter three provides the research design for the study and further describes mixed methods designs in general, and the survey and interview data collections in particular. The chapter also describes Phase I survey and Phase II interview methods that were used in this study. Hence an overview of survey research and interviews has been presented, a discussion of the survey instrument and interview protocols has been presented and implementation of the Phase I survey and Phase II interviews has been described. A discussion of how issues of trustworthiness were tackled has been provided followed by a discussion on the data analysis process employed. The chapter concludes with a presentation of researcher reflexivity.

Chapter four presents analyses of the survey and interview findings. It starts by describing participants of the study, electronic technology use for teaching and learning and analyzing the degree of electronic technology development at the university. It further provides analyses of quality of efforts being done regarding electronic technology; barriers and enablers of electronic technology and the importance of such enablers in improving electronic technology implementation.

Chapter five presents discussions of both Phase I survey and Phase II interviews. It starts by providing limitations of the two data collection methods, presenting cross-analysis conclusions and further presents summaries and discussions of the findings. The chapter ends with recommendations and suggested areas for further study.

Chapter 2: Review of Literature

Technology has proliferated to all parts of the world. This proliferation has affected all sectors of life including higher education. There are fears though, that educational use of the technology has lagged behind all other uses (Murray, 2008; National Science Foundation, 2008). A number of research studies have thus been conducted to investigate factors that influence this low use of technology for educational purposes (Bauer & Kenton, 2005; Brzycki & Dudt, 2001; Cuban, Kirkpatrick & Peck, 2001; Gander, 2003; Levin & Wadmany, 2008; Nichols, 2008; Rogers, 2000; Sahin & Thompson, 2007; Surry, 1997). Such studies have shown that providing technologically superior tools neither result in guaranteed use nor assure integration in teaching and learning. Other factors interact to determine whether technology is adopted and finally integrated into teaching and learning.

Rogers (2003) presents a theory called *diffusion of innovations* which explicates why certain innovations are adopted while others are not. Through this theory, a number of other theories have emerged which have provided framework for the conduct of studies in the area of instructional technology (Surry, 2005; Ely, 1999). This review of literature discusses these major theories and present studies that have been conducted based on these theories upon which this study will be also based. It starts by exploring literature on technology for learning and widens the scope by discussing the diffusion of innovations (DOI) theory by Rogers (2003). Instructional technology theories and models that build upon the DOI theory are presented later followed by technology diffusion and implementation in developing nations. It culminates in a presentation of research questions which informed the study.

Technology for Teaching and Learning

Technology has been viewed as an agent of change in developed as well as developing countries. Reiser (2001) defined instructional technology to include "(a) the use of media for instructional purposes and (b) the use of systematic instructional design procedures (often simply called instructional design)" (p. 54). Instructional technology has the potential of transforming the way faculty members and students operate (Fillion, Limayem, Laferriere & Mantha, 2009; Girod & Gavanaugh, 2001). Stakeholders in education such as parents, administrators, and politicians have expressed the need for educators to use and integrate educational technology in the classroom (Keengwe, 2007). This has been against the backdrop that administrators have pumped large amounts of money and other resources in a bid to increase its availability to educational and corporate organizations. These developments have placed a lot of pressure on educators to transform school through technology (Becker, 2001; Brush et al., 2003; Brzycki & Dudt, 2005; Mehlinger, 1995; Sheingold & Hadley, 1990). Teachers and students are under pressure to not only meet these demands but also to keep pace with the latest changes and modifications intended to make teaching and learning better (Brush et al., 2003; Brzycki & Dudt, 2005).Unfortunately, there still seems to be a gap between technology presence and its effective integration in higher academic institutions (Bryant, 2000; Eteokleous, 2008; Oncu, Delialioglu & Brown, 2008; Keengwe, Onchwari & Wachira, 2008). Nicolle concurs with this notion when she asserts: "University faculty members have been among the last educators to experience the educational thrust toward technology integration" (Del Favero & Hinson, 2007; Nicolle, 2005, p. 36). Despite increased availability and access to instructional computer use in higher education classrooms (Green, 2002); few faculty members have effectively and efficiently integrated computer technology in their classroom (Zayim, Yildrin & Saka, 2006)

A number of barriers seem to stand in the way of faculty members' successful integration of educational technology in their teaching such as lack of hardware and software, lack of time, lack of funding, inadequate facilities and lack of support services, (Baltaci, Goktalay & Huguet, 2008; Del Favero & Hinson, 2007; Fulford, 2008; Keengwe, Onchwari, Wachira, 2008; Main-Anakalea & Boulay; Morrison & Osborn, 2005; Moser, 2007; Nicolle, 2005). Other scholars have identified aversion to risk and attitudes as critical barriers experienced by non-adopters (Alamhaboub, 2000; Hagner & Schneebeck, 2001; Mehlinger & Powers, 2002; Nicolle, 2005). While professional development and training, faculty support, curriculum design and modification have been identified in numerous studies as being central to adoption and integration prospects (Nicolle, 2005; Watson, 2007), teacher perceptions of teaching with technology in the classroom also impacts integration (Knezek & Christensen, 2002). In a study that investigated technology adoption into teaching and learning by university faculty, Nicolle (2005) found the link between effective teaching and the use of technology to be critical in helping faculty through the process of integration. University faculty members are concerned with effective teaching. Hence if they perceive technology as having a positive impact towards this effort, they are likely to get motivated to integrate it in their teaching (Baia, 2009).

Diffusion of innovations literature by Rogers (2003) illuminates factors that interact to determine whether technological innovations are adopted or not. The following sections therefore describe and discuss diffusion and adoption of innovations as seen from both the general stand point and from instructional technology perspective specifically.

General Diffusion Theory

The work of Everett M. Rogers in relation to diffusion of innovations has informed most of the research studies in the field (Burkman, 1987; Carr Jr., 1999; Ellsworth, 2000; Surry &

Brennan, 1998; Surry & Farquhar, 1997) in the past century. His book *Diffusion of innovations*, now in fifth edition (2003), provides an ample overview of diffusion of innovations theory and an excellent framework which has informed a number of research activities in the area of innovation diffusion and adoption. While a number of fields have built upon Rogers' theories, the foundation that he laid has remained an unparalleled cornerstone over time as far as diffusion studies are concerned (Fichman, 2000).

The following section discusses the general diffusion theory by analyzing the definition which Rogers (2003) offers, the elements of diffusion of innovations and theories that were developed. Similar view points as provided by other prominent authors will be discussed to substantiate the great applicability of Rogers's (2003) views and also provide alternative views to his assertions. Related research that has been conducted employing Rogers' ideas- be they as simple as elements of diffusion of innovations or indeed the theories that he proposes will be highlighted so as to provide the reader with cases in point in regards to Rogers' propositions.

Elements of Diffusion of Innovations

Diffusion of innovations means different things to different sets of scholars (Greenhalgh, Robert, Bate, Macfarlane & Kyriakidou, 2005). As set out by Rogers (2003), classical diffusion of innovation research "is a body of knowledge built upon empirical work that demonstrated a consistent pattern of adoption of new ideas over time by people in a social system" (Greenhalgh et al., 2005, p. 20). Rogers (1995) defines "diffusion" as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (p.5). Rogers (1995) qualifies this type of communication as special in that messages being transmitted concern a new idea. Once members of the social system hear about the innovation, they may adopt or reject it in the long run. From this definition of innovation, Rogers (2003) identifies four

elements in the analysis of diffusion of innovations: the innovation, its communication from one individual to another, the social system and the length of time taken by the diffusion process. These four elements are reflected in most research activities that deal with diffusion of innovations and form the basis for Rogers' (2003) four theories of innovation namely the adoption decision process, the individual innovativeness, the perceived attributes theory and the rate of adoption theory. Most diffusion research explores how these elements and many other factors interact to facilitate or hinder the adoption of specific products or practices in a social system (Surry, 1997).

The Innovation

"An innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers, 2003, p.11). This definition reflects the notion that the individual or social system's perception in question determines whether an idea is deemed new or not new. To be called an innovation, an idea does not have to be necessarily newly invented (Rogers, 1962, 1995; Van de Ven, 1986). It is also important to note that "newness" in an innovation may not be a factor in the diffusion and adoption of innovations as an individual may have already heard about the innovation, but did not get persuaded enough to adopt it (Rogers, 2003).

Communication

According to Rogers (2003), communication is "the process by which participants create and share information with one another in order to reach a mutual understanding" (p. 18). Interaction among humans is a very important factor in the diffusion process. The diffusion process involves person X who knows about the innovation transmitting information to person Y who knows

nothing about the innovation. “A communication channel is the means by which messages get from one individual to another” (Rogers, 2003, p.18). The kind of information-exchange relationship at work between these two individuals dictates, to a large extent, the conditions under which X will communicate to Y about the new idea (Rogers, 1962).

Rogers (2003) divides communication channels into two main types, mass media and interpersonal. Mass media channels are the most quick and efficient ways to create awareness about an innovation to potential adopters. These channels involve the use of mass media in transmitting messages like the radio, newspaper and the Internet. On the other hand, “interpersonal channels involve a face-to-face exchange between two or more individuals” (Rogers, 1995, p. 18).While mass media remains effective in communicating information to large populations; the latter is particularly effective in influencing individuals decide whether to adopt an innovation (Rogers, 2003; Rogers & Scott, 1997; Ryan & Gross, 1943). It is therefore noteworthy that most people are influenced by word of the mouth from others who have adopted the innovation when making innovation decisions rather than statistics (Rogers, 2003). In recent years, web-based interactions such as emails, chat rooms, discussion boards and blogs have influenced adoption of an innovation (Watson, 2007).

Homophily and Heterophily

Rogers (1995) uses the terms homophily and heterophily to explicate matters related to the transfer of ideas from one individual to another. “Homophily is the degree to which two or more individuals who interact are similar in certain attributes, such as beliefs, education, social status, and the like”(p. 19).The interpersonal channels of any diffusion process are intertwined to the social system through which an innovation diffuses. People who belong to the same groups, live or work together, and share similar interests are said to be homophilous. When individuals

share common language and meaning and are similar in some respects, they are more likely to understand each other easily and will most likely form positive attitudes towards each other and hence adopt a new idea more easily (Rogers, 2003).

Rogers (2003) bemoans the fact that diffusion of innovations mostly involves participants that are heterophilous. While it is a requirement that innovations diffuse from an area of high concentration (e.g., a change agent) to that of low concentration (e.g., clients), the problem is that when different participants are involved, they may not talk the same language or if they do, social barriers may prevent them from being open in the way they interact. In alluding to this idea, Rogers (1995) posits that "the very nature of diffusion demands that at least some degree of heterophily be present between two participants" (p. 19). Unfortunately though, the two individuals are more likely to be heterophilous not only regarding the innovation, but also on other variables such as education and social status since knowledge and experience with an innovation may go with social status and education.

Time

The third element in Rogers' diffusion of innovations is time. The time element is fused into the diffusion process in the following three ways: first, the innovation-decision process which an individual goes through from awareness through confirmation of the innovation adoption takes time. Second, the rate of adoption of an innovation in a system which is measured in terms of number of individuals in a system who adopt a particular innovation in a given period of time. Third, innovativeness of an individual or unit of adoption which is measured based on when an individual adopts an innovation compared with other members of the social system (Rogers, 2003).

Innovation-Decision Process

One of the central theories discussed by Rogers (2003) is the Innovation-Decision process. As the name suggests, the adoption of an innovation is not a single act, but rather a process occurring over time (Surry, 1993). Rogers (2003) describes the innovation decision process in the following manner:

> The innovation-decision process is a process through which an individual or other decision-making unit passes from first knowledge of an innovation to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation and use of the new idea, and to confirmation of this decision (p. 20).

Rogers and Scot (1997) conceptualize this process as an information-seeking and information-processing activity in which the goal is to minimize feelings of uncertainty regarding the innovation. According to Rogers (2003), an individual or social unit passes through five distinctive stages towards adopting an innovation: knowledge stage, persuasion stage, decision stage, implementation stage, and confirmation stage.

The knowledge stage occurs when potential adopters are exposed to information about existence of an innovation and gain some basic understanding of what it is and how it works (Rogers, 2003). Early theorists like Fourt and Woodlock (1960), and Hassinger (1959), contend that this stage is characterized by passive individuals who are affected by external forces. It is said that through this passive discovery, individuals may identify a need for which the innovation is the solution (Rogers, 2003). However, sometimes individuals may ably articulate their need and actively seek ways for meeting that felt need (Rogers, 2003).

During the persuasion stage, an individual or other decision-making unit "forms a favorable or unfavorable attitude toward the innovation" (Rogers, 1995, p.20). Rather than just

the general awareness developed in the first stage, in the persuasion stage, the individual or the social unit gets personally involved in the process by actively seeking information and forming attitudes towards the innovation (Rogers, 2003). The individual tries to look for advantages and disadvantages of the innovation in relation to his or her own situation. At this point, peer interaction and other interpersonal networks play a crucial role in influencing an individual's attitude formation (Rogers, 2003). The kind of attitude formed at this stage whether positive or negative determines, to a large extent, whether an individual will decide to adopt an innovation or not. Persuasion results in some display of overt behavior in line with the kind of attitude held by an individual (Rogers, 2003).

In the decision stage, "…an individual (or other decision-making unit) engages in activities that lead to a choice to adopt or reject the innovation" (Rogers, 1995, p. 169). "Adoption is a decision to make full use of an innovation as the best course of action available" (Rogers, 1995, p. 171). Individuals may try the innovation on a small scale to establish the usefulness of the innovation in their own situations. There are other innovations however, which cannot be tried on a small scale because of the way they are. Such innovations, according to Rogers, are less likely to be adopted as a step to try is often an important step towards a decision to adopt it. Offering free samples for trial has proven helpful in influencing potential adopters in deciding to adopt an innovation (Rogers, 2003).

Rejection on the other hand "is a decision not to adopt an innovation" (Rogers, 2003, p. 171). Active rejection takes place when individuals have had time to learn about the innovation, consider it and upon further review, decide that it is not the best course of action to take. Individuals can reject an innovation passively when they do not go through the persuasion stage (Rogers, 2003).

The fourth stage, implementation, occurs "When an individual (or other decision-making unit) puts a new idea into use" (Rogers, 2003, p. 179). At this stage, the individual exhibits overt behaviors that speak to his or her decision to adopt or not. A number of issues may crop up at this stage. Mostly these issues have to do with where to obtain the innovation, how to use it, how it works, and operational problems associated with the innovation and how to solve them (Rogers, 2003). Problems associated with implementation stage are more apparent when the adopting unit is an organization. In an organization, different individuals are involved both at decision stage and implementation stage. Although administrators may decide to adopt a certain innovation, implementers of that innovation are mostly different individuals who, themselves might have different perceptions and drives regarding the innovation (Rogers, 1995).

In the confirmation stage, "an individual seeks reinforcement of an innovation-decision already made or reverses a previous decision to adopt or reject the innovation if exposed to conflicting messages about the innovation" (Rogers, 1995, p. 181). This may result from experience with the innovation or from actively seeking information about the innovation that may lead to either continuance or discontinuance of the innovation usage.

Rate of Adoption

Another important idea that Rogers (1995) describes is the rate of adoption. According to Rogers (1995):

> Rate of adoption is the relative speed with which an innovation is adopted by members of a social system. It is generally measured as the number of individuals who adopt a new idea in a specified period, such as a year. So the rate of adoption is a numerical indicator of the steepness of the adoption curve for an innovation (p. 221).

In this theory, the adoption process of an innovation is viewed as taking an S-curve on a graph. The theory holds that at the beginning, the adoption of an innovation will be slow and gradual. After a certain time period, it will grow rapidly and become stable and eventually decline (Rogers, 1995). According to Rogers (2003), each innovation has characteristics which when judged by the individual or social unit, determines the possibility of adoption taking place (Rogers, 2003). The following section outlines the theory of perceived attributes.

Theory of Perceived Attributes

"The perceived attributes of an innovation are one important explanation of the rate of adoption of an innovation" (Rogers, 1995, p. 206).The theory of perceived attributes holds that individuals or a social unit will adopt an innovation if they perceive it to have particular attributes. Although some researchers have identified as many as 25 perceived attributes (Kearns, 1992); it is obvious that these attributes can be subsumed in Rogers' five perceived attributes.

Rogers (2003) identifies *relative advantage*, payoffs associated with the innovation; *compatibility*, the ease with which it fits current ways of doing things; *complexity*, the ease or difficulty associated with learning the innovation; *trialability*, the ease or difficulty associated with trying it out; and *observability*, the extent to which results of adopting the innovation are visible to others, as the characteristics which when judged by potential adopters, will differentiate easily adopted innovations from those that fail to be adopted.

"Relative advantage is the degree to which an innovation is perceived as being better than the idea it supersedes" (Rogers, 2003, p.229). Relative advantage is often expressed in terms of economic gains, social prestige, and other benefits. While the type of the innovation influences the particular relative advantage that is important to the potential adopters, the characteristics of

the potential adopters also determines what particular elements of relative advantage are important (Rogers, 1995).

"Compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (Rogers, 2003, p. 240).There is evidence that suggests that compatibility, just like relative advantage, correlates positively to a potential adopter's adoption rate (Liao& Lu, 2008; Rogers, 2003). Innovations that are attuned to potential adopters' values, norms and perceived needs have higher chances of being adopted (Greenhalgh et al., 2005). The more compatible an innovation is, the less uncertainty it brings to the potential adopter, the more consistent it is with the individual's present situation. At organizational level, the more compatible an innovation is with the organizations norms and values, the more easily it will be assimilated. Hence, customs, beliefs, religion, personal and political factors are likely to influence an individual or a social system's likelihood of adopting an innovation irrespective of it being a needed innovation (Rogers, 2003).

Complexity, the extent to which an innovation is considered difficult to learn and utilize, (Rogers, 2003) is negatively correlated to an innovation's rate of adoption (Tornatzky & Klein, 1982). Innovations that are perceived as simple by potential adopters will be more easily adopted (Greenhalgh, et al., 2005). It is suggested that demonstrations, breaking the innovation into manageable parts and adopting it bit by bit will facilitate its adoption (Rogers, 2003).

Trialability is "the degree to which an innovation may be experimented with on a limited basis" (Rogers, 2003, p. 258). Innovations that intended users can experiment with on a trial basis are more easily adopted and assimilated because an innovation that is trialable presents less uncertainty to the potential adopter than does the innovation that is not divisible (Rogers & Scott, 1997) by affording the individual an opportunity to learn by doing. This has been noted to be

particularly true for early adopters who may lack models to imitate and hence require hands-on experience with the innovation before adopting it. For late adopters, trialing may take the form of observing and monitoring experiences of the early adopters (Rogers, 2003).

Observability is "the degree to which the results of an innovation are visible to others" (Rogers, 2003, p.258). If potential adopters can see the benefits of an innovation, they will easily adopt it. Sometimes, observability refers to the ease with which the innovation is communicated to potential adopters (Rogers, 2003; Tornatzky & Klein, 1982). Hence observability might be dependent on the other attributes like relative advantage and compatibility (Tornatzky & Klein, 1982). For instance, if an individual observes others using an innovation and perceive it as being compatible with their values and norms, they are likely to adopt it.

King and Rollins (1995) categorized these five perceived attributes as conceived by Rogers (1995) as falling under two major groups. Relative advantage and observability of innovation have to do with both immediate and long term socio-economic benefits associated with the use of a new idea. Compatibility, complexity, and trialability on the other hand, involve the ease with which individuals learn and use an innovation (King & Rollins, 1995).

In summary, innovations that have more relative advantage, compatibility, complexity, trialability, and observability as perceived by potential adopters have more likelihood of being adopted more rapidly. Of these five characteristics, relative advantage, compatibility and complexity seem to be the most relevant in determining decision making by adopting individuals (Dayton, 2006; Kwon & Zmud, 1987; Rogers, 2003; Sultan & Chang, 2000; Tornatzky & Fleischer, 1990).

Individual Innovativeness

Another important and influential theory put forward by Rogers (2003) is the individual innovativeness concept. It is based on who adopts the innovation and when. Employing a bell-shaped curve, this theory states that for any given innovation, a certain percentage of the population will most likely adopt it while others are less likely to adopt it. “Innovativeness is the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than other members of a social system”(Rogers, 2003, p.22). Individuals in a social system vary in the time of innovation adoption. Rogers (2003) used this variation to classify individuals into different adopter categories basing on who first begins using an idea.

Rogers (2003) identifies the first category of adopters as innovators (2.5%). These individuals are pioneers and lead the way in adopting an innovation. Rogers and Scott (1997) analyze innovators and identify characteristics that distinguish them from the rest of the population. They posit that innovators are venturesome and tend to engage in more cosmopolite social relationships. Innovators have a number of prerequisites that enable them to respond to new innovations earlier than their peers. They control substantial financial resources; they have an ability to understand and apply complex technical knowledge; they have an ability to cope with high levels of uncertainty about the innovation when adopting it (Rogers & Scott, 1997, Rogers, 2003).

The second category, the early adopters, who make up 13.5% of the individuals in a social system, join the innovators early enough to help spread information about the innovation to others (Rogers, 2003). While innovators may not be respected members of their society, early adopters have the highest level of opinion leadership in most systems (Rogers, 2003). According to Rogers (1995); “opinion leadership is the degree to which an individual can informally

influence other individuals' attitudes or overt behavior in a desired way with relative frequency" (p. 354). Because of the respect held for early adopters, potential adopters consult them for advice and information concerning an innovation. Since they are not overly different from the average individual in the social system, they are sought as role models for many members of the social system (Rogers, 2003).

The early majority comprises 34% of the adopting population and are followed by the late majority who also comprise 34% of the adopting population. While respect and opinion leadership dwindles for this category of adopters, the time they take to adopt an innovation increases substantially (Rogers, 2003). Unlike the early adopters who serve as role models to their near-peers, the early majority often serve to apply peer pressure. This category of adopters is more deliberate than early adopters before adopting an innovation. Being between early adopters and late majority makes them a particularly important link in the diffusion process (Rogers & Scott, 1997).

The late majority wait longer before deciding that the innovation will help meet their needs. They "adopt new ideas just after the average member of a system" (Rogers, 1995, p. 265). They are one of the two largest adopter categories with a percentage of 34% of the members of a social system. The late majority act upon peer pressure applied by the early majority in adopting an innovation. Their financial resource base is generally low implying that any decision to adopt must be made after careful analysis of the cost involved and possible risks (Rogers, 2003).

Laggards, who comprise about 16% of the population are highly skeptical and will most likely resist and never adopt the innovation (Rogers, 2003). Rarely holding any opinion leadership, laggards are near isolates whose point of reference is the past and who if they must interact, do so with others who also hold traditional values (Rogers & Scott, 1997). They base

their decisions on what was done previously and hence are suspicious of any new innovations and change agents. Due to their limited financial resource base, they are exceedingly careful and hence must be assured of an innovation working before plunging themselves into it (Rogers, 2003).

A number of studies have been conducted that have employed adopter innovativeness as variables. Yi, Fiedler and Park (2006) surveyed 412 individuals to compare "the role of individual innovativeness as a direct determinant of innovation characteristics versus as a moderator of the relationships between the innovation characteristics and usage intentions" (p. 396). Results portrayed individual innovativeness as a direct determinant of the innovation characteristics. These results depict individual innovativeness as being important in determining an individual's perception in regards to usefulness, ease of use and compatibility of an innovation. The more innovative an individual is, the more likely they will perceive an innovation as being important, less complex and compatible with their existing situations because of their innate innovativeness (Yi, Fiedler, & Park, 2006). This observation by Yi et al. is consistent with Rogers' (2003) adopter characteristics of innovators and early adopters.

In general, it has been noted that administrators tend to emulate the mindset of early majority in regards to need-based decisions to adopt innovations (Geoghegan, 1994). Hence while innovators and early adopters may pave the way for adoption, it is the early majority who not only influence the administrators' role in the diffusion process, but share similar views as pragmatists. It goes without saying therefore, that targeting the needs of this group of adopters not only provides fertile ground for adoption by late adopters and laggards, but more so, guarantees buy in by administrators.

Diffusion of Innovations Summarized

In summary, diffusion of innovations revolves around four main elements which are not only integral to the definition as provided by Rogers (2003) but more importantly, are reflected in the different models that he formulated: innovation-decision process, individual innovativeness, and theory of perceived attribute and rate of adoption. The elements as provided by Rogers (2003) are the innovation itself, communication channels, time and the social system. The innovation decision process, which according to Rogers (2003) has five stages: knowledge, persuasion, decision, implementation, and confirmation stages, can be affected by variables such as potential adopters' role in the decision-making process, the nature of pressures within the social system, effectiveness of communication channels, and the extent of need for the innovation.

Researchers have since utilized Rogers' (2003) perceived attributes model which postulates that potential adopters' perceptions of an innovation in regards to *relative advantage,* payoffs associated with the innovation; *compatibility,* the ease with which it fits current ways of doing things; *complexity,* the ease or difficulty associated with learning the innovation; *triability,* the ease or difficulty associated with trying it out; *and observability,* the extent to which results of adopting the innovation are visible to others; are pivotal in determining the potential adopters' decisions to adopt an innovation thereby speeding the rate of adoption.

Dissecting any social system, for any particular innovation, one identifies groups of individuals that will either adopt the innovation early enough to form a class of potential models to the rest or indeed those that will lag behind and adopt after everyone else if at all. He therefore distinguishes five adopter categories of innovativeness that are based on variations in innovativeness levels: innovators, early adopters, early majority, and laggards. Although

innovators (as Rogers (2003) calls them) are the earliest to adopt, they may not necessarily be part of those that clients would hold in high esteem (Rogers, 2003). Opinion leadership, on the other hand rests sorely in the eyes of the clients.

Criticisms of Diffusion of Innovations Theory

While Rogers' (2003) adopter categories have received wide acceptance and application in research studies due to their ease of use, comparability and generalizability of results among others, critics have based their argument on the assumption that Rogers makes that all new products follow a normal distribution. For instance, Peterson (1973) asserts that in most marketing situations non-normal adopter distributions are exhibited. Second, critics question Rogers' lack of empirical rationale for suggesting that the size of the adopter categories should be the same for every new innovation (Mahajan, Muller & Srivastava, 1990). A number of critiques of Rogers' work disagree with the notion that diffusion results are as generalizable as portrayed by Rogers (Charters & Pellegrin, 1972; Cohen & Bredo, 1975; Downs & Mohr, 1976). In a similar vein, Brown (1981) criticizes the view of adoption as primarily the result of a communications process. He argues that this standpoint puts an emphasis on demand for an innovation, thereby assuming that individuals have similar opportunities to adopt it except for their innovativeness. He suggests that research should go beyond individual innovativeness and also focus on institutional and market structures that are responsible for getting technologies to individuals. Despite these criticisms, Rogers' (2003) DOI theory remains an unprecedented major framework that has informed research work in the study of not just innovations in general but also instructional technology in particular and forms the basis for the study being reported here.

Instructional Technology Diffusion Theories, Models, and Related Research

Just like any other innovation, instructional technology can be subjected to scrutiny using Rogers' (2003) diffusion of innovations theory (Schnitman, 2008). Literature is replete on the adoption of instructional technology innovations especially as it relates to technology transfer and human-computer interaction. By definition, technology has two faces: the hardware and the information associated with it which may often or may not be presented as software (Greenhalgh et al., 1988). In this section, Rogers' (2003) *diffusion of innovations* theory has been applied to the field of instructional technology and alternative theories have been described.

Surry (1997) alludes to the importance of applying Rogers' (1995) DOI theory in studying instructional technologies. In agreement, Burkman (1987) states that studying the adoption, diffusion, implementation, and institutionalization of innovations is essential to the field of educational technology because the field has experienced extensive rejection of technology. One major reason for this rejection is that educational technologists have focused on developing instructionally sound and technically superior products more than other issues (Surry, 1997).

A combination of social, economic, technical, organizational, and individual factors influence which technologies are adopted (Segal, 1994). Hence, whilst technical superiority is a factor that may determine the extent to which an innovation is adopted, it is not the only factor and probably not important one for that matter (Pool, 1997). Exploring why people use educational technology and why they do not is central to understanding the process (Surry, 1997).

"A number of researchers have attempted to use the general theories of diffusion to develop diffusion theories specific to the field of instructional technology" (Surry, 1997, p.4). Surry (1997) classifies instructional technology theories into two major categories each having distinct goals: macro and micro theories. The focus of macro theories is on educational

institutions' reform and restructuring. Research in this category, deals with the development of theories of organizational change in which technology is a key player (Surry, 1997). According to Surry (1997) these theories are mostly called systemic change theories since they "…involve the adoption of a wide range of innovative technologies and practices" (p. 4).

The second category, the micro-level IT diffusion theories, focus on adoption and utilization of instructional products. Research in this category is aimed at development of technology adoption theories that provide guidance on improved IT innovations' diffusion (Surry, 1997). A number of writers have employed and/or developed product adoption and utilization theories. (e.g., Burkman, 1987; Tessmer, 1990; Farquhar & Surry, 1994; Jost & Schneberger, 1994). As a direct opposite of the macro category, the focus of these theories is on specific innovations as applied in specific environments. This present literature review will focus on the micro theories or product utilization theories.

Surry (1997) posits that technological views range from technological determinism (developer) on the one side, to technological instrumentalism (adopter) on the other end of the continuum. The major issues at stake in philosophical debate between these fronts are autonomy and continuity. Unlike technological determinists who view technology as being beyond the control of humans, (Chandler, 1995); instrumentalists view technology as being within human control where "…social conditions and human aspirations are the primary causes of change" (Surry, 1997, p. 5). Whereas determinists view technology expansion as a discontinuous, revolutionary process (McCormack, 1994); instrumentalists view it as a continuous, gradual and evolutionary process (Surry, 1997).

Developer-based theories of instructional technology, which are a direct derivative of the determinist perspective, base their rationale on the assumption that creation of products that are

superior to existing ones will bring about educational change (Surry, 1997). However, literature regarding diffusion and adoption of innovations agrees that technological superiority alone may not result in adoption and may not even be the necessary condition (e.g., Arias & Clark, 2004).

Whereas developer-based approaches focus on technological superiority, adopter-based theories' focus is on human and interpersonal facets of the diffusion of innovation (Surry, 1997). The end-user of the innovation is regarded as the key to change. Central to developer-based theories is the role of environmental factors at play in the context of use.

Farquhar and Surry (1994) identified and analyzed factors related to the adoption of instructional technologies within organizations using diffusion theory. They identified user characteristics, perceived attributes, physical environment, and support environment as categories of factors that affect adoption. Burkman (1987), Stockdill and Morehouse (1992), and Farquhar and Surry (1994), through their models, speak to the importance of focusing on the user in deciding upon intervention points for technological innovation adoption and implementation.

Another model that developed from the general diffusion model is the RIPPLES model. Developed by Surry, Ensminger and Jones (2003), this model comprises seven major elements namely *Resources, Infrastructure, People*, *Policies, Learning*, *Evaluation,* and *Support.* Although this model has not been tested yet, and probably requires more refinement, it is one of the very few models that specifically address barriers associated with the integration of instructional technology into higher education.

The Concerns Based Adoption Model (CBAM), developed by Hall and Hord (1987) describes the process that people go through as they learn about an innovation. Their focus is on the role of people in organizations in facilitating change. CBAM elements that have received a lot of attention are "stages of concern" and "levels of use". The model applies to anyone

experiencing change be they policy makers, teachers, and students (Hall & Hord, 1987; Hord, Rutherford, Huling-Austin, & Hall, 1987).

Apple Inc. sponsored a continuing research program called the Apple Classroom of Tomorrow (ACOT) between 1980 and 1990 in which a number of American schools were given computers and other associated resources. This was followed by a number of research studies so commissioned to investigate the effects of the technology on teaching and learning. Apple researchers (Dwyer, Ringstaff, & Sandholtz, 1991) derived five general phases of implementation from across the ACOT projects described as follows:

1. *Entry phase*: In the initial phase, teachers had problems getting started with the school year and the challenges of integrating the computers into their normal ways of doing things.
2. *Adoption phase*: After the initial shock, teachers started to integrate the technology in their traditional classroom but using traditional lecture and textbook methods. Despite positive attitudes by students reported by teachers, there was little or no change as far as student achievement was concerned.
3. *Adaptation phase*: While traditional teaching methods were still at work, word processing, database, some basic graphics, and computer-based instruction tended to characterize instruction at this phase. The major change associated with this phase was an increase in productivity and efficiency.
4. *Appropriation phase*: “The change hinged on each teacher’s personal mastery… of the technology” (p. 48). More innovative instructional strategies were employed due to increased confidence in the technology and time with the

technology. Team-teaching, interdisciplinary project-based instruction, and self-paced instruction characterized this phase.

5. *Invention phase*: Although not actually a phase, this stage involved willingness on the part of the teachers to experiment and change.

In a related endeavor, Sherry, Billig, Tavalin and Gibson (2000) determined through an evaluation study they conducted of several large-scale technology projects that teachers progress through five distinct stages as they develop expertise using the Internet and the World Wide Web. Their model- Integrated technology Adoption and Diffusion model, describes a process in which teachers advance first as *learners*, *adopters of technology*, *co-learners with students*, *reaffirmer* or *rejecter* and finally teacher as *leader* Sherry (1998). "Different strategies appeal to these teachers at different stages" (Sherry et al., 2000, p. 45). Some conditions as suggested by Ely (1999) may work well for teachers who are passing through the *teacher as an adopter* stage while others would work well for teachers at the *teacher as a reaffirmer stage*.

In conclusion, a number of different stage models have been provided by different theorists that relate to technology adoption and implementation. Generally, these models begin with information gathering and attitude formation; then to decisions to use or not use the technology and finally to implementation and integration of new practice into traditional ways of doing things (Wilson et al., 2000). Other models have employed stages that adopters evolve through and have developed implementation strategies that capitalize on those stages to better target prospective adopters and implementers passing through various stages. While these models seem to differ in their focus, they either address the potential adopter or the adoption or implementation process.

Implementation

As the diffusion and adoption progresses, it becomes necessary to also focus on how the innovation is being implemented. In this regard, there seems to be a trend recently for innovation research to shift from diffusion and adoption to implementation and institutionalization (Surry & Ely, 2002).

Klein and Knight (2005) refer to successful implementation as one in which targets organizational members use the new idea regularly, in a consistent and committed manner. It is during implementation that issues relating to the use of the innovation arise (Rogers, 2003). Failure to implement the innovation successfully has been the major reason for failure to derive optimal gains from the innovation rather than the innovation itself as it is mostly construed (Klein & Sorra, 1996).

According to Surry and Ely (2002) different types of resistances exist which could be classified as cultural, social, organizational and psychological. They posit that this implementation approach's success hinges on development of strategies that target specific points of resistance (Surry & Ely, 2002). On the other hand, research studies have been conducted that have explored or employed reasons for successful programs. This approach, though less common (Surry & Ely, 2002), seeks to identify factors that facilitated the adoption and implementation process of successful innovations. It also attempts to identify consistencies among those facilitating factors among varied innovations and contexts. Ely (1999) seems to provide a major framework for this kind of approach.

Ely's Conditions for Implementation

A series of studies conducted specifically to investigate facilitating factors for successful implementation of innovations helped uncover eight conditions that facilitate implementation of

innovations (Ely, 1999). "…there seems to be another set of conditions that facilitate the implementation of innovations in general and computers specifically. The opposite of the facilitating conditions are hindrances (or barriers) that prevent implementation…" (Ely, 1993, p. 56). In addressing this issue, Ely (1976, 1990a, 1999) identified conditions that when present, or introduced in the environment where the in innovation is implemented, facilitate its adoption and implementation. Following are the conditions identified by Ely (1993) with a brief description of each condition (Ellsworth, 2000; Ely, 1990a, 1993, 1999).

1. Dissatisfaction with the status quo: Dissatisfaction is an emotional discomfort arising from an individual's or system's perception of the current situation as being problematic or ineffective. People accept a change when they perceive the need to change the environment.
2. Existence of knowledge and skills: individuals who are expected to implement the innovation need to have certain knowledge and skills to be able to execute the job proficiently. Lack of necessary knowledge and skills result in the extinction of the innovation. Training is integral to most successful innovations (Surry & Ely, 2002).
3. Resource availability: Resources are the ingredients that must be present if implementation is to work at all. An innovation that is not supported by resources such as hardware, software, money and personnel can not take off let alone be successful.
4. Availability of time: The implementers need time to learn, adapt, integrate and reflect on their actions to be able to understand and be capable to adapt the innovation to suit their situation.
5. Rewards or incentives: When people expect rewards, they are stimulated to act. Rewards may help implementers to have something to look forward to and hence facilitate

successful implementation of the innovation. This condition is consistent with Dick and Carey's (1990) view that for transfer to take place, rewards and incentives should be present in the transfer context to encourage execution of the learned behavior.

6. Participation: Authentic participation where implementers are not just involved in the mechanics of implementation but more importantly, in decisions related to planning and design of the innovation serves to enhance communication and inculcate a sense of ownership in all concerned parties.
7. Commitment: There is need for those involved in the implementation to be committed by visibly demonstrating firm and continued support for the innovation.
8. Leadership is evident: Active involvement by immediate supervisors or project leaders in helping implementers' activities is vital for the success of the implementation of the innovation. Leaders' expectations and commitment which translate into availability and provision of support to implementers have significant influence on the successful implementation of the innovation.

According to Ely (1990b), these conditions are important for change to be implemented following diffusion and adoption of an innovation. If all these conditions were present, there would be high probability of sustained implementation. Conversely, if only few of these conditions are present, there would be low probability of sustained implementation. Although the conditions are listed independent of the others, they are interrelated and may support or undermine one another (Nawawi, Ayub, Ali, Yunus, & Tarmiz, 2005). For example availability of resources may be a reflection of the commitment of the leadership of the organization to support the implementation of the innovation. Similarly, provision of incentives and rewards to

individuals that are utilizing the innovation reflects the willingness of the leadership of the organization to motivate the individuals that have committed to utilize the innovation.

A number of research studies have been conducted that employ the eight conditions as a basis in studying technological innovations' implementation. These studies have been conducted in varied educational settings and cultures and results have shown that Ely's conditions cut across institutional and cultural boundaries (e.g., Ensminger, & Haab, 2005; Ensminger, & Surry, 2008; Ensminger & Surry, 2002; Ensminger, Surry, Porter & Wright, 2004; Martins, Steil, Andrea & Todesco, 2004; Varden, 2002; Surry, & Ensminger, 2003).

Ensminger and Surry (2002), examined faculty perceptions of the eight conditions that facilitate technology implementation as they relate to an on-line degree program implementation. Their results were in agreement with Ely's findings and emphasized the need for taking into account people's perceptions within the organizations. These findings agree with observations of number of several other scholars (e.g., Sharan & Shachar, 1994).

The study by Varden (2002) identified as facilitating conditions dissatisfaction with status quo, presence of knowledge and skills, participation, commitment, and leadership in the US high school teachers' adoption and integration of laptop computers.

Nawawi et al. (2005) built on the above studies and went further to not only investigate the presence of Ely's facilitating conditions but also analyzed the conditions to determine interactions among the conditions. Their findings revealed that all of Ely's facilitating conditions to the use of computer-based technology were present but in varying degrees. Commitment by those involved was perceived as being the most present, seconded by *leadership is evident.* *Availability of time* and *rewards or incentives* perceived as being least present. In terms of

correlation analyses, *knowledge and skills* and *knowledge is expected and encouraged* were strongly correlated. This finding is also in support of Bauder's (1993) work. They also found strong positive relationships between *commitment* and *participation*; and *commitment* and *leadership*.

Building upon Ely's (1999) eight conditions is the RIPPLES model developed by Surry, Ensminger and Jones (2003). The RIPPLES model was developed based on results of a survey which was conducted with college deans to determine the deans' opinions regarding factors that affect integration of technology. The results of the "Dean's questionnaire" and a review of diffusion literature were used to develop the RIPPLES model –which is a model for integrating instructional technology into higher education (Surry, 2002). Following is a detailed description of the seven components of the RIPPLES model:

Resources

To implement any endeavor, technology integration inclusive, resources are needed. Resources are the financial resources required in developing and using technology for teaching and learning.

Infrastructure

Infrastructure is the second component of the model. It refers to the organizational technological capabilities, like hardware, software, facilities, and network capabilities within the college (Surry, Ensminger, & Jones, 2005). They identify five elements of infrastructure: teaching element, production component, communication element, student element and administrative element.

People

The *people* component refers to the role played by people in an organization, as they try to integrate technology, in teaching and learning (Surry, 2002). The needs, values, experiences and hopes of those involved are vital in deciding to integrate and technology in teaching and learning.

Policies

The *policies* component of the model refers to the need written or unwritten rules, practices and regulations that govern the organization, required to facilitate integration efforts (Surry, 2002). According to Surry, since most policies were made long before technology became a part of the organization, many of them may work to prevent or inhibit successful technology integration. Policies regarding retention, tenure and promotion could be used to boost up the integration of technology in teaching and learning.

Learning

The *learning* component refers to role played by technology in advancing education goals of an educational institution (Surry, 2002). According to Surry, technology can enhance instructional goals through pedagogical benefits by allowing teachers and students interact in ways that facilitate cognitive or motivational outcomes.

Evaluation

The *evaluation* component refers to the assessment of technology in relation to learning goals, technology, technology plans, and costs and benefits of implementing technology (Surry, 2002).

Support

The *support* component deals with the need for a support system for those involved in integrating technology in teaching and learning (Surry, 2002). Surry identifies four aspects of support faculty, staff and students may get to help them in the integration efforts: training support, technical support, pedagogical support and administrative leadership.

The study employed the instructional technology user-oriented diffusion models and the RIPPLES model and aspects of Ely's facilitating conditions to elicit information in regards to adoption, diffusion and utilization of educational technology in the form of computers, the Internets and the World Wide Web at a university in a developing nation. For this purpose issues related to the adoption of technology in developing nations will be presented.

Adoption and Utilization of Technology for Teaching and Learning in Developing Nations

Developing countries are those countries that are economically underdeveloped (Perkins, 2003) characterized by high birth rates, poverty, and reliance on worthy countries. Developing countries comprise countries of Asia, Africa, Oceania and Latin America. These countries generally have weak human resources, low per capita gross domestic product (GDP) and low economic diversification levels among other things (United Nations Conference on Trade and Development, 2001). Of the 49 least developed countries, about 35 are African countries (Tam, 1999).

Developing countries are struggling to get their people out of poverty (Arias & Clark, 2004). Education has been seen as the best way to solve these problems. Even so, developing countries are facing immense problems in areas of education and training. This is against the backdrop of monumental world population growth placing a lot of pressure on teacher training demands as well as infrastructure (Arias & Clark, 2004). According to Arias and Clark (2004),

implementation of instructional technology initiatives seems to respond to some of these problems.

Despite possibilities of benefiting from the technology advancement, many developing countries have not derived the necessary gains from these information and communications technologies (ICTs). Many developing countries lack the economy, infrastructure, and expertise needed to introduce and take advantage of ICT (Adeya, 2001). Schachter, Pence, Zuckernick and Roberts (2005), concur with Adeya (2001) by remarking that the main hindrances facing African education system are lack of infrastructure, lack of networking, high telephone and internet costs, limited expertise and skills and lack of enabling national policies.

Statistics show that developing countries are still lagging far behind in terms of accessibility to computers and the Internet (Donner, 2007). In 2002, the number of people with Internet facilities was close to a world total of 99 per 1000. In developed countries 450 people per 1000 had access to the Internet but in developing countries only 2.8 persons per 1000 had internet access (Arias & Clark, 2004).

Although introducing and implementing technology initiatives in a developing country is difficult (Arias & Clark, 2007; Donner,2007; Obuobi, Adrion, & Watts; 2006; Rajesh, 2003), "education leaders and practitioners throughout the developing world are increasingly integrating Information Communication Technologies (ICTs) into the process of teaching and learning to improve access to education, or to implement educational reform" (Arias & Dickelman, 2005, p. 1).

Among the challenges associated with the implementation of technology in developing countries, social factors, economic factors, cultural factors, technological factors stand out (Arias & Clark, 2007; Rajesh, 2003). These challenges are felt by policy makers as well as the

implementers (Rajesh, 2003). Rajesh identifies three major categories of the challenges in the application of new information and communication technology: people, software and hardware. Of these three factors, the human aspect is deemed the most difficult to address. Surry and Farquhar (1996) concur with this notion when they write: "the design, development, adoption, utilization, and diffusion of technology are inherently social processes" (p. 61). The social factors influence the development, implementation, and spread of technology (Segal, 1994; Surry & Farquhar, 1996). Rogers' (2003) Diffusion of Innovations theory highlights the significance of social factors in technology adoption. The following section will consequently focus on research conducted in developing countries regarding adoption of information and communication technologies (ICTs).

Studies on Instructional Technology Implementation in Developing Nations

In a study that was conducted to explore the diffusion of *Information and Learning Technology* (ILT) among career and technical educators in Malaysia, results indicated that although many faculty members appreciated the significance of ILT as a vital tool in teaching, only few faculty members used it in actual teaching (Rashid & Gloeckner, 2008). Institutional support was identified as a significant factor in the adoption of ILT. This finding is in line with assertions made by some other scholars (e.g., Ely, 1999; Lynch, 2002; Butler & Sellbom, 2002). Additionally, familiarity with technologies played an important role in facilitating faculty members' usage of those technologies (Rashid & Gloecker, 2008). Familiarity may well be linked to some of the perceived attributes outlined by Rogers (2003) such as complexity and compatibility.

In a study conducted to analyze problems associated with ICT adaptability in India by Rajesh (2003), results revealed that accessibility issues, cost-effectiveness, user-friendliness and

pedagogic value of the technology determine the extent of adoption and integration in teaching. Political issues, administrative factors and economic factors were also seen to greatly impact the diffusion rate and possibilities of integration.

In a study conducted in Thailand by (Intaganok & Waterworth, 2008) to determine the relationship between the attitudes of higher education staff and their skill development in ICT, results showed that low levels of skills in ICT were associated with higher levels of anxiety regarding ICT use. Access to computers and the Internet both at home and office was found to be significantly linked to ICT competence levels which in turn influenced anxiety levels. The findings specifically indicated that ICT competence of staff was greatest in creation and manipulation of files and folders; saving, deleting and printing documents. However, they exhibited weaknesses in use of multimedia, spreadsheets and databases (Intaganok & Waterworth, 2008).

The Case of Malawi

Malawi faces human and financial resource constraints as it pursues to develop the ICT sector (Isaacs, 2007). According to Isaacs, such constraints include underdeveloped ICT inftrastructure, high cost of telecommunications and unstable and reliable power. Similar results have been found in studies conducted elsewhere in Africa (E.g., Farrell, Glen & Isaacs, 2007; Kalanda & De Villiers, 2008)

Despite these constraints, efforts are underway to improve the ICT sector. This is evidenced by development of policies, legislation and program that provides an enabling environment for further progress in this area. For instance, the Communications Act, the Science and technology Act, establishment of SchoolNet Malawi, the removal of import duty on computers and printers and the adoption of a national ICT for development policy are some cases

in point pointing to the fact that efforts are being made to improve the status of ICT in Malawi (Isaacs, 2007). Based on Rogers (2003) *rate of adoption* theory, while these adoption levels as far as ICT is concerned are still low, the established programs and policies will most likely see ICT reaching high adoption levels after some time (Tondeur, van Keer, van Braak, Valcke, 2008).

To this end, universities in Malawi and probably elsewhere in Africa have made a concerted effort to provide computers and internet facilities to staff including faculty members amidst overstretched resource bases (Farrell, Glen & Isaacs, 2007). It remains to be investigated whether these technologies have been integrated in teaching and learning in these universities.

Kadzera (2006) investigated the use of instructional technologies in teacher training colleges in Malawi. He surveyed tutors from Karonga, Lilongwe, St Joseph's, Blantyre, and Montfort Teacher Training Colleges and a snapshot of faculty of Domasi College of Education. The findings of the study showed that there was a low use of the higher order instructional technologies such as overhead projectors, videos and computers. This low level of use was attributable to lack of training, unavailability of the technologies, and lack of maintenance. In regards to computer use, Kadzera (2006) had this to say: "Despite many lecturers being able to use computers in a variety of ways, very little has been done that engages the students in work on the computers" (p. 97). Kadzera proposes that a study be conducted that elucidates what it would take for faculty members to increase integration of computers in lesson delivery. He further proposes the need for case studies to also be conducted at Mzuzu University, Chancellor College and other institutions of higher learning in Malawi, to determine how faculty members at these institutions integrate technology in instruction.

Rogers (2003) provides a framework for studying diffusion and adoption of instructional technology. Through his DOI theory, he explicates how innovations spread in a social system, factors that determine whether an innovation is adopted or not and the rate at which such innovations may be expected to spread. Prominent scholars in the area of instructional technology (e.g., Ely, 1999; Surry, 1997) have applied Rogers (1995) theory to come up with theories that are relevant to the field of instructional technology. Surry (1997) offers three reasons why the study of diffusion theory is valuable to the instructional technology (IT) field. First, he posits that instructional technologists need to know factors that influence adoption of innovations and apply that knowledge to explain, predict and account for factors that limit or enhance their diffusion. Second, he emphasizes the need for instructional technologists to be knowledgeable in innovation processes and theories of innovation so as to be able to work effectively with clients and possible adopters. Third, he posits that knowledge about diffusion theory would aid instructional technologists to come up with systematic and prescriptive diffusion and adoption models that would culminate in innovations that are effective and pedagogically appropriate.

It was therefore necessary to use Rogers' (2003) theory as a framework; Surry's (2005) RIPPLES model; and Ely's (1999) facilitating conditions to investigate whether technology permeation into a developing country like Malawi, had brought with corresponding utilization of such technology by faculty members. The results of this research would therefore provide relevant information to administrators of University in Malawi to help make informed decisions regarding technology access and use among faculty members. While the results may not be generalized to the rest of the universities in Malawi and developing nations in general, this is a step forward for further studies in this area.

Summary

Technology proliferation to all parts of the world and to institutions of higher education has resulted in pressure for faculty members to integrate technology in teaching and learning. While investments have been made in supplying computers, the Internet and other electronic equipment to such institutions, there still seems to be a gap between this level of technology availability and instructional use (Murray, 2008; National Science Foundation, 2008). Studies conducted to investigate factors that influence this low use of technology for educational purposes indicate that providing technologically superior tools neither results in guaranteed use nor assure integration in teaching and learning. (Bauer & Kenton, 2005; Brzycki & Dudt, 2001; Cuban, Kirkpatrick & Peck, 2001; Gander, 2003; Levin & Wadmany, 2008; Nichols, 2008; Rogers, 2000; Sahin & Thompson, 2007; Surry, 1997).

Rogers (2003), through his diffusion of innovations theory provides a framework for explaining why some innovations are adopted while others are not. Several other theories have emerged that have made applications of Rogers' DOI theory. Such theories have put a particular eye on instructional technology diffusion and adoption (Ely, 1999; Surry, 1997; Surry, 2005).

Numerous studies have been conducted based on Rogers' (2003) DOI theory as well as the instructional technology diffusion and adoption theories. This study is an extension of these studies that have employed instructional technology diffusion and adoption theories

Chapter 3: Methodology

The principal rationale of this study was to find out how members of university faculty in a developing country were utilizing technology following its diffusion to that country and determine factors associated with this level of utilization. Specifically, this study was designed to:

1. Determine level of accessibility to electronic technologies
2. Determine the extent of technology adoption.
3. Determine current utilization of technology by faculty members within the University.
4. Identify factors that facilitated or hindered the current technology adoption and diffusion level.
5. Identify the impact of technology on teaching and learning and faculty members' perceptions.

This chapter describes the research design that was employed for this study, the instrumentation that was used to address the research questions, the implementation strategies and data analysis procedures that were employed.

Research Design

The study was a descriptive study utilizing mixed methodologies in which both quantitative and qualitative methodologies were employed in data collection and analysis. The selection of this research design was based on the fact that research questions driving this study required different data collection strategies which happen to fall under different research methodologies also. The use of different research methodologies had additional advantages: "…triangulating and converging findings, elaborating on results, using one method to inform

another, discovering paradox or contradiction, and extending the breadth of the inquiry" (Greene, Caracelli, & Graham as cited in Creswell, 1994).

In Phase I, a survey was issued to faculty members of Mzuzu University asking them to provide information on technology accessibility, use and factors affecting usage. Information obtained from this survey helped set the stage for the Phase II interviews with selected faculty members, an administrator and a librarian, to get in-depth information concerning particular points identified in the survey.

Mixed Methods Designs

"Increasingly, researchers are using designs that combine quantitative and qualitative methods…referred to as mixed-method" (MacMillan, 2004, p. 288). Both qualitative and quantitative approaches to data collection, analysis and reporting are employed together in one study (Creswell, 2004). MacMillan identifies three types of mixed-method designs: explanatory, exploratory and triangulation design. In explanatory design, quantitative data are collected first followed by qualitative data. Qualitative data collection serves as the basis for analyzing outliers and extreme cases. Exploratory design uses the initial qualitative phase with few individuals to identify areas for consideration and inclusion in the larger scale quantitative phase. In triangulation design, qualitative and quantitative data are collected almost simultaneously to take advantage of strengths of either method and at the same time offset the weaknesses of the other (MacMillan, 2004). Based on MacMillan's categorization, this study took the form of explanatory design in which all faculty members were surveyed followed by interviews with selected faculty members and other staff members deemed to be rich information sources. Despite being done sequentially, advantages of the triangulation design still accrued in this

selected design since issues identified in the quantitative data collection were triangulated during the interview phase.

Methods for Phase I Survey and Phase II Interviews

Starting with the survey method helped the researcher get an overview of what faculty members at Mzuzu University thought about electronic technology as a tool for teaching and learning. Although the survey method was used as a method of data collection, uniquely, no sampling was conducted because the focus was not on the general population but rather on a particular entity- Mzuzu University. Hence, all faculty members of Mzuzu University were surveyed to ensure that views of as many faculty members as possible were taken aboard.

Why Survey Research?

Surveys are flexible in tackling a range of problems related to attitudes, perspectives and beliefs of participants and can employ written questionnaires or interviews (McMillan, 2004). As a data collection method, surveys are useful when one needs to collect quantitative data from a large group of people in the least expensive way as possible (Russ-Eft & Preskill, 2001). Survey was preferred as a method of data collection over others in this particular study due to the fact that many questions could be asked and it was possible to reach a large enough group within a short period of time (Fowler, 2002).

Babbie (2007) identifies two basic types of surveys: cross-sectional surveys and longitudinal surveys. Cross-sectional surveys gather information of a particular population at a distinct time. Longitudinal surveys on the other hand, collect information over a period of time. This study utilized the cross-sectional survey method to collect information concerning technology adoption and integration by faculty members.

The Survey Instrument

The survey instrument is favored by many people that do research. It affords users an inexpensive and effective data collection tool that is structured and manageable (Wilkinson & Birmingham, 2003). According to Wilkinson and Birmingham, the major advantages associated with the survey instrument are that it is usually inexpensive, minimal training is required to develop and results are easy to analyze once completed. Wilkinson and Birmingham outline why many researchers use the survey instrument as follows: first, vast amounts of data can be collected with minimal effort. Second, once data has been collected, the instrument can facilitate the identification of relationships among quantifiable data. Third, respondents' anonymity is easily protected as data can be collected without having to identify respondents. Fourth, survey instruments can be used several times for different research endeavors or with modifications. Fifth, once appropriately coded, they can facilitate extremely quick analysis of data with minimal rates of error. Sixth, it is easy for the researcher to maintain control over the direction of topic and issues for discussion. However, lack of personal contact with respondents might result in low response rates requiring the researcher to follow-up with phone calls and letters thereby expending more resources than planned (Wilkinson & Birmingham, 2003).

Purpose of the Survey

The purpose of the survey was to determine accessibility levels of electronic technologies, find out whether faculty members had adopted electronic technologies for teaching and learning, and identify factors that influenced their use of electronic technologies in the delivery of instruction. The survey was divided into three major parts. Part one dealt with demographic information of respondents. Part two sought information regarding technology use for teaching and learning. Part three dealt with what was being done regarding electronic technology for

teaching and learning by faculty and the administration, and the quality of what was being done. The last two sections of part three sought information on whether what was being done regarding electronic technologies at the university created barriers or served as enablers, and the importance respondents attached to those factors.

Interviews

Interviews have been used by researchers for a long time as a tool for collecting detailed information concerning a topic or subject (Wilkinson & Birmingham, 2003). "Much of what we cannot observe for ourselves has been or is being observed by others. The interview is the main road to multiple realities" (Stake, 1995, p. 64). According to Yates (2004, p. 156), "Interview literally means to develop a shared perspective and understanding… between two or more people". In other words, the researcher and the participant develop a common perceptive regarding the issue under discussion (Yates, 2004). Interest in understanding lived experiences of other people and the meanings they attach to those experiences forms the basis of in-depth interviews (Seidman, 2006). They enable the researcher to interact directly with participants thereby providing new insights about the issue being researched (Russ-Eft & Preskill, 2001). The use of interviews in research can reflect the importance being attached to the research (Wilkinson & Birmingham, 2003) because it is by far more resource-intensive as the researcher has to elicit information from a single respondent at a time.

There are a number of interviewing techniques but the major ones are: structured interviews- which leave little flexibility in terms of what the participant can say; semi-structured interviews- which leave some flexibility but the researcher sets some kind of agenda in regards to the flow of the discussion; and unstructured interviews with no preset agenda (Yates, 2004). Whether they are structured or unstructured, interviews aim at obtaining participants' rich and

exhaustive understanding, feelings and knowledge concerning the issue being explored (Yates, 2004).

In this study, the interview method was used to elaborate on data collected through the survey instrument and to provide alternative data that could help shed more light in some cases and present a means for triangulation to improve validity of results as suggested by Yin (2003) and Denzin (1984). A mix of all the three methods was employed. The structured interview questions were mainly used to build rapport with participants at the beginning of the interviews. Once the interviewee was comfortable enough, the interviewer moved to unstructured questions that allowed the interviewee to provide rich and in-depth information.

Tellis (1997) warns researchers not to rely on a single informant, but rather seek the same data from varied sources to substantiate it. In this study, ten participants were interviewed to ensure that multiple views regarding the topic were elicited. Selection for interviewees was done purposefully based on departments the respondents came from, in order to get certain numbers of representatives from various categories. Consequently, of the ten, one came from the library, one from administration and eight of the respondents comprised faculty members from different departments. Of the eight faculty members, three were departmental heads. Since these participants were from different departments and positions, their inclusion for the interviews provided bases for “data source triangulation” (Stake, 1995, p. 112).

Interview Protocols

Questions for the interviews were formulated by the researcher using the survey instrument as a guide. Most of the questions related to Ely’s (1999) eight facilitating conditions. Three different interview protocols were devised- for the administrative staff, librarian and faculty members.

Administrator Interview Protocol

The initial interview protocol for the administrator had a total of 15 questions. After perusing through the first lot of collected surveys, an addition of eight more questions was made making a total of 23 questions. The interview protocol comprised two main categories. The first six questions dealt with technological issues and the second category of questions dealt with integration issues and consisted of 17 questions (see Appendix E).

Librarian Interview Protocol

Initially, the interview protocol for the librarian had 15 questions. Upon review of the first lot of collected surveys, eight more questions were added in order to capture issues raised in the survey. The interview protocol had two sections. The first section sought information regarding technological issues and comprised 11 questions. The second section dealt with information regarding electronic technology integration issues and consisted of 12 questions (see appendix F).

Faculty Interview Protocol

The interview protocol for faculty members had 26 questions initially. After going through the first lot of collected surveys, an addition of seven questions was made bringing the number of questions to 33. The questions were categorized into three main sections. The first section sought information regarding technological issues and consisted of seven questions. The second section captured information regarding faculty's technological skills and related issues and comprised five questions. Finally, the third section dealt with issues relating to electronic technology integration by faculty and there were 18 questions in this category (see appendix E). Both the survey instrument and the interview protocols addressed the following research questions:

1. What is the present level of accessibility to computers, the Internet and the World Wide Web?
2. To what extent have faculty members adopted technological innovation?
3. How are faculty members utilizing technology after its diffusion in a higher education institution in Malawi?
4. What factors facilitated the present adoption level?
5. What factors inhibit adoption, diffusion, and use of technology by the faculty members?
6. How has technology diffusion affected teaching and learning at this institution?
7. How has access to technology affected the faculty members' perception on technology for teaching and learning?

In deciding and selecting the instruments for this study, research questions were delineated and analyzed to determine the theoretical underpinning they speak to. Variables linked to the specific questions were operationalized to help identify an instrument that could draw out data solicited by the question. Existing instruments were analyzed for potential applicability to this study. Contacts were made with sources from which substantial amount of relevant items were identified and requests made to utilize corresponding instruments (see Appendices J and K).

The RIPPLES model instrument developed by Dr Daniel Surry (2001) was modified for use in the Phase I survey. Besides, the items in the survey instrument and the interview protocols also find much relevance in a number of other theoretical models all of which have their origin in Rogers (2003) Diffusion of Innovations (DOI) theory. For this reason, Appendix C. provides an alignment of the research questions, operationalized variables, theoretical models, data source and instrument for collecting that data.

Implementation of Phase I Survey

Survey questionnaires were hand-delivered to all faculty members who were available during the time of the data collection exercise at the university. Although the University supposedly has one hundred and thirty five faculty members, a good percentage of the faculty members were undergoing training in other countries and institutions at the time of data collection. As such, only ninety surveys were sent out. Of these, 54 were returned representing a total return rate of 60%.

Surveys were distributed to departmental secretaries by the Education and Teaching Studies Departmental (ETS) messenger on July16th, 2009. A letter was attached to each survey requesting respondents to submit their filled surveys to their departmental secretaries. Once filled, each departmental secretary sent the completed surveys to the ETS secretary through their departmental messengers. The first batch of surveys was collected on July 25th, 2009. During this time, 31 surveys were collected.

A second attempt was made to collect the remaining surveys on August 1st, 2008. During this time, the researcher went to each office to collect the filled surveys. An additional thirteen surveys were collected during this time. A final attempt was made to collect the surveys that had still not been returned. During this third time, a total of ten surveys were collected bringing the total of collected surveys to 54. However, one of the surveys was filled by a participant who did not qualify and was therefore discarded and rendered null and void. This brought down the total accounted number of surveys to 53.

Phase II Interview Implementation

Wilkinson and Birmingham (2003) suggest that a top-down approach be used in the interview process in institutions. For instance, interviews with departmental heads should

precede those with teachers. In this study, the administrator and the librarian were first to be interviewed followed by heads of departments and faculty members.

Prospective interview respondents were notified through personal contacts that they were being contacted because the researcher thought they would provide the information sought in the study through interviews and wished to request their consent to participate in the study. Once agreed, the researcher asked each prospective interview respondent to choose the time they wanted to be interviewed and the location of the interview. Duration of the interviews was generally 30 minutes although in rare circumstances they went for about 40 minutes.

The first part of the interview was an introduction concerning the interview, its length and information concerning the fact that interviewees were free to stop the researcher if they did not feel like continuing with the interview- this information is also contained in the informed consent form (see appendix I). Interviewees were also told that if they did not have a response to a particular question, they needed to say so. Interviews were audio-taped upon agreement by the interviewee. Respondents were at liberty to stop the audio-recording of the interviews any time during the interview.

After each interview, the researcher went through the audio tape to identify areas requiring further clarifications from the interviewees and to get a general view of the responses that were obtained during the interview. The researcher then wrote some few notes as a summary of the Interview. The audio-recorded interviews were transcribed verbatim in September of 2008. The researcher used pseudonyms as a means of disguising interviewees' identity. Any information that could potentially identify particular interviewees was deleted and care was taken to disguise interviewees' identities.

Piloting of the Survey Instrument and the Interview Protocol

"When designing a questionnaire it is easy to overlook mistakes and ambiguities in question layout and construction" (Wilkinson & Birmingham, 2003, p. 19). These authors stress the need for piloting the instrument with colleagues or a small sample of participants to help identify issues that could have slipped the developer's eye. In view of this, the survey instrument was piloted with a group of people from the same context where the study was to be conducted. The piloting was done in two phases. The first phase of the piloting was done at Virginia Tech with four graduate students from Malawi, enrolled in the School of Education doctoral programs at that time. These students were not only chosen for their expertise in the Malawian University system, but more importantly because they represented the targeted respondents of the study.

Four participants took part in the first phase of the pilot study. A letter of introduction and request was attached to the survey instrument and hand delivered to each participant. Participants were requested to look for typos, grammatical errors, suitability of survey items for Malawian context and length of the survey. The participants provided very informative suggestions concerning the language use, the relevance of some of the survey items to the target respondents and issues related to the survey format. All suggestions were taken and led to the improvement of the survey items and format.

The second phase of the piloting took place in Malawi with one target respondent. During this time, the participant went through the survey instrument on her own and made comments that were deemed necessary for the improvement of the instrument. After noting all the areas that required improvement, the participant and researcher went through the instrument page by page making note of areas for improvement and providing suggestions on how the instruments could be improved. Revisions made after this second phase of piloting led to

finalization of the survey instrument which was then printed and photocopied for use by the rest of the respondents. Appendix D. provides a copy of the survey instrument that was used for the phase I data collection.

After questions for the faculty members' interview protocol were formulated, they were pilot-tested on a typical representative of the respondents to assist "...in eliminating ambiguous questions as well as generating useful feedback on the structure and flow…" (Wilkinson & Birmingham, 2003, p. 52). After the pilot test, modifications were made to the interview protocol for faculty members to integrate important aspects identified from the pilot test.

Survey Instrument and Interview Protocol Expert Review

To establish content validity, two experts in the field of instructional technology, Dr. Daniel Surry and Dr. Dawn Medlin, were asked to look at the survey instrument and the interview protocols. The two experts examined the contents of the instruments to determine the extent to which they measured or helped respond to the research questions (McMillan, 2004). Overall, they felt that the instruments were valid for the research questions.

Data Analysis

In this study, quantitative data analysis preceded the qualitative data analysis procedure. However, these two analyses were not done independent of each other. The quantitative analysis informed the qualitative analysis and conversely, the qualitative analysis elaborated on the qualitative analysis thereby providing further insights and points for triangulation (Cresswell, 2009; McMillan, 2004; Rus-eft & Preskill, 2001).

Descriptive summaries of quantitative data obtained through the survey instrument were made using means and standard deviations and were represented graphically and relevant data

tabulations. SPSS was used to run the frequencies and the associated means and standard deviations.

Qualitative data analysis involves making sense of the data by consolidating, reducing and interpreting people's views and actions (Merriam, 1998). While the lines between data collection and analysis are clear in surveys and experiments, the distinction between data collection and analysis are by far less absolute in naturalistic inquiry due to its emergent nature (Patton, 2002). According to Patton, the "ideas for making sense of data, which emerge while still in the field, constitute the beginning of data analysis" (p. 436).

This was the case for this study as well. As I interviewed people, I started to see directions for my analysis. Certain patterns started to emerge that helped me improve the rest of the interviews. This gave me the opportunity to deepen data collection by testing the authenticity of held insights and provided a platform for confirmatory data collection after the interviews were finalized (Patton, 2002).

Patton (2002) suggests using the interview questions and analytic insights that emerge during the interviews in organizing the analysis. In analyzing the data collected through the interviews, I started by looking at responses to a particular question across all the respondents at a time. Concentrating on a question a time helped me identify points of convergence and divergence on similar issues in the data. Then the insights that emerged were brought to bear as I discussed the results. As I went on looking at following questions, it was evident that certain themes recurred. These themes were identified as major discussion points during report writing.

Trustworthiness

Merriam (1998) posits that for research results to be deemed trustworthy, their validity and reliability have to be accounted for. While this assertion is valid for quantitative research

methods, the qualitative research tradition uses and advocates for different ways of assuring trustworthiness of research results. For instance, while reliability is a key issue in quantitative research, qualitative research authorities postulate that a term like reliability should not be used in qualitative studies since the way such studies are designed do not warrant reliability of results (Cresswell, 2009). Lincoln and Guba (1986), advocate for using different criteria from those used in quantitative research. They describe credibility as corresponding to internal validity, transferability as corresponding to reliability, and confirmability as corresponding to reliability. Jointly, the three criteria are viewed as tackling issues of trustworthiness (Creswell, 2003). Hence "it is more appropriate to use the word trustworthy for mixed methods studies because it applies to both quantitative and qualitative research" (Larson, 2004, p. 128).

"Qualitative inquiry, because the human being is the instrument of data collection, requires that the investigator carefully reflect on, deal with, and report potential sources of bias and error" (Patton, 2002, p. 51). Unlike quantitative research which embarks at the outset to produce objective truth, qualitative research yields subjective information observed and analyzed through the lenses of the researcher. Due to the subjective nature of the whole qualitative inquiry process therefore, issues of credibility crop in and must be tackle when reporting research findings. Patton (2002) suggests emphasizing procedures for minimizing investigator bias. This then makes it necessary for the researcher to strive to produce high quality qualitative data that are credible, trustworthy, authentic and balanced through systematic data collection procedures, multiple data sources, triangulation and external reviews (Creswell, 2009).

In this present study a number of ways were used to help reduce bias in the conduct of the study, and increase credibility and trustworthiness of the study results. Such ways included using a systematically devised process systematically in the process of data collection and processing;

and ensuring reflective reporting through provisions of self-reflexivity, and reflexivity of those studied (Patton, 2002). Employing two different data collection methods and inclusion of interviewees from different departments provided for matters of triangulation.

Researcher Reflexivity

In qualitative research, it is required for the researcher to expose inclinations, values, and experiences that are personal to the researcher that may have implications in the way the researcher perceives and interprets phenomena (Creswell, 2009; Patton, 2002). In describing my world view and experience, I will use the first person. I will start by describing my cultural background and go further discussing my educational experience and finally my work experience. I leave it to the reader to analyze how my life experiences may have affected the way I view issues targeted in this study.

I come from a background that did not expect girls to excel in school. Going to school for girls was just one of the things one needed to do as they waited to find someone to marry them. For me starting school was just a routine I had to fulfill. After all, I had seen very few girls make it as far as high school. With time, I started to see changes in the way girls excelled. This change was apparent when my family moved to Lilongwe. The new school I went to was different from my previous school. The teachers emphasized excellence from boys as well as girls. So I had to pull my socks up! Additionally, I saw girls being selected to secondary schools. I thought in my mind- “so I can also be selected to secondary school.” From that time on, I was determined to work hard and I made sure I got all straight A’s. Additionally, my father took special interest in my education. He looked at my work and was very keen at ensuring that I scored well. That also made me accountable to him on a daily basis.

I got selected to a girls' secondary school and one of the high-ranking schools in Malawi- Lilongwe Girls' Secondary School. To be selected to this secondary school meant that you were amongst the best candidates of that particular year. Being selected to such a school was such a big motivation for me.

When I first started my secondary education, my major goal was just to graduate with a good Malawi School Certificate of Education (MSCE) and equivalent of a high school diploma. I had no plans of going to university level because to get to university you had to be exceptionally good. As my first semester went on, I started to look around me to see how the other girls were doing and what I saw made me want to work harder. One particular girl talked about planning to go to the university. She had scored good grades and was the best student in our class, in the first semester of secondary school. I said to myself- "If she can do this, I can also manage." That was the last semester I came second in my class. From the second semester of my form one class I took position one in all the end of semester exams I took. I was at Lilongwe Girls' Secondary School for four years. During the fourth year (form four), I sat for Malawi School Certificate of Education (MSCE). One's success in this exam determined whether one would proceed to university or not. The competition was very stiff at this level.

When Malawi National Examinations Board (MANEB) announced my name as one of the candidates selected to Chancellor College to do a Bachelor of Education degree, it came as no surprise to me. I had worked hard for the examinations and scored very well. My only problem though had been deciding my career.

We had a career counseling team at Lilongwe Girl's Secondary School which helped students in terms of future career plans. Although my goal was to be either an accountant or a finance Manager in a corporate setting, I was advised last minute to change and indicate

"Education" as first choice. So that meant my first choice (Bachelor of Commerce) came second. I got selected to do a bachelor of education degree based on my first choice. I was happy but not as excited as I would have been if I was selected to do "Bachelor of Commerce". That was the end of my dream of becoming an accountant.

My experience with teaching had been nice so far. I worked as a secondary school teacher for a number of years. However, I still desired to do something more or something else. Not that I did not like teaching. I was an excellent Math teacher; I liked my students and my job. I was just not settled into teaching in secondary school. I started looking for other jobs after teaching for four years. I finally got a job in Community Development and Social Welfare. My job involved providing business management training and loans to disadvantaged rural women. I enjoyed this job as it combined my teaching skills and my long wanted business management skills. My new job also offered more opportunities for on-the-job training apart from the fact that it brought me close to the realities of life of most people in my country. Hence, while my university education did not provide business management skills, I was trained in Business management the first year of working as a "Women in Development Officer".

Time proved to me that while working with rural women was the best I could do, there was more I needed to be able to get a more global perspective of development issues in Malawi. I had wanted to work as a University lecturer long before I even joined Ministry of Community Development and Social welfare. Opportunities had just not presented themselves to me yet. I had even attended interviews at Chancellor College for Staff Associate position in Sociology of Education. I was so disappointed when I got the negative response to my application. This was not going to be the last time I would apply for a faculty position in a university.

When Mzuzu University opened its doors to first students, there was a need for lecturers in Education. Sociology of Education was one such area that required a lecturer. I applied and was offered the position of a "Staff Associate in Sociology of Education" pending masters level training to become a full lecture. This was a dream-come-true for me. I thought I had finally reached my goal but little did I know what was in store for me.

Barely after working for six months, I got contacted by the then Deputy Vice Chancellor that I had been nominated to do a Master's degree in the United States. I was so excited about this news but wondered what the degree would be in. I had always wanted to be a Sociology Professor and I loved teaching Sociology of Education. Diverting to another field would not help me achieve my goal. Diverting to another field is exactly what I did because my Master's degree was going to be in Instructional Technology.

Instructional Technology was a new name in my country at that time. People had heard about Information Technology and the quick conclusion was- this must be just another name for information technology. I was not the only one who thought like that. Most people at Mzuzu University thought that I was no longer going to teach in my "Education and Teaching Studies" department upon graduating from Virginia Tech. As things turned out, Instructional Technology was an educational program and while I was not going to be a Sociology professor, I would still be in the Education and Teaching Studies department.

As I went through the masters program, I noticed that instructional technology was more "educational" than it was "informational". Yet I still needed to come up with a personal definition of instructional technology. What is technology? What is instruction? How does this program find relevance in these definitions? Why can't it be something else? While I have been able to define these terms, I still find myself asking myself the question: how relevant are the

courses on offer to instructional technology? As a matter of fact, technology has evolved a lot over the six years I have been in this program world over, Virginia Tech inclusive. There has been a change in the name of the program- now Instructional Design and Technology. I agree that this is a more encompassing and therefore more relevant name than the former one.

Coming from a purely chalk and board scenario, I found it fascinating to find myself delving into a technology-related “Masters Program”. I wondered if it was possible to just delve into this program without some “bridging” courses. I had never done any typing courses, let alone come close to computers. We had a computer in our department then, but it was a Secretary’s tool. All we needed to do was write drafts of letters, examinations- you name it- and she would do the typing. So other than typing, there was no way of knowing what else one could do on the computer.

Typing assignments was the first challenge I had to overcome in my master’s program. I remember at one time, typing my four-paged assignment and not saving it. I lost it soon before submitting it. I had to start all over again!

Delving into a totally new area- instructional technology- taught me one important lesson and that is, there is no end to learning. Although this program offered some educational courses I was already acquainted with, the newer courses required that I do not only learn, but change my perspective about learning. I discovered that there is no age when you can say I am set for this path and I cannot learn material from another program. Time is the only factor that prevents us from pursuing multiple endeavors. In fact, I have come to realize that I, myself may be my own block to learning new things. What I believe about myself, about my situations and about my capabilities determine to a large extent about what I try and what I learn.

For me, this way of thinking has not come as a major discovery. It has been my driving force since primary school. I have always looked inside of me and told myself, “I can do this”. Once I do, nothing can stop me. If I determine that I cannot do something on the other hand, I will not even spend a second of my minute trying to learn about it. Fortunately, so far, I have been more open than closed to learning new things. As a case in point, if I learned to type, I could also learn PowerPoint. If I could learn PowerPoint, why not flash etc. As I continued on the learning path, I discovered that some aspects of PowerPoint were actually similar to Flash etc. So why should I fear learning new things when I can use my previous knowledge and skills in learning the so called “new phenomena”.

Summary

The primary purpose of this study was to find out how members of university faculty in a developing country were utilizing technology following its diffusion to that country and determine factors associated with this level of utilization. The study was a descriptive case study utilizing mixed methodologies in which both quantitative and qualitative methodologies were employed in data collection and analysis. A survey of all faculty members was conducted to find out how members of university faculty in a developing country were utilizing technology following its diffusion to that country and determine factors associated with this level of utilization. After the survey, interviews were conducted with eight faculty members, a librarian and an administrator. While survey data and interviews analyses were conducted sequentially, the reporting of the study findings integrated the two data collection methods.

Chapter 4: Analysis of Survey and Interview Findings

This study was conducted based on Rogers (2003) *diffusion of innovations* theory and *instructional technology diffusion* theories as presented by Surry (1997, 2005), and Ely's (1999) facilitating conditions for implementation of technological innovations. The study was conducted in two phases. Phase 1 was a survey of all faculty members of Mzuzu University to investigate their perceptions on electronic technology diffusion and adoption at the university and factors facilitating this adoption. Phase II was an interview of selected few faculty members, a librarian and an administrator to provide more in-depth information on issues raised in the survey. The next section presents a description of Mzuzu University to provide a background against which the study was conceived.

Description of Mzuzu University

Mzuzu University was established in 1997 by an Act of Parliament as Malawi's second national university (Nur-Awaleh & Mtegha, 2005) with a mission to provide complementary services that met technological, social and economic needs of Malawians (Mzuzu University Act, 1997). The university opened its doors to students in 1999.

Since its establishment, Mzuzu University has been proactive in responding to the needs of the country by introducing new courses and programs of study that target the felt needs of Malawians. Associated with this approach has been flexibility in trying out new things of which information and communication technologies (ICTs) are employed. In its early stages, Mzuzu University promised to take a leading role ICT diffusion and adoption of ICT in Malawi.

In 2005, every faculty member was given a computer. Before this development, members of faculty had to use the services of their departmental secretary for typing assistance. Additionally, until 2006, faculty and staff of Mzuzu University had to go to the university library

in order to access the Internet. Since then, internet provision has been extended to the teaching area with the results that faculty members do not have to go to the library to utilize the Internet. Wireless Internet technology installed at the university has helped improve the network speed to the level that makes downloading of materials faster than before (P. Zozie, personal communication, September, 2007). Another development has been the establishment of the Information, Communication and Technology (ICT) Department which taken a leadership role in technology initiatives, including training 60 students for diploma certificates (P. Zozie, personal communication, September, 2007). This is how a librarian at the university described the electronic technologies' progress at the university:

> From 1999 we started with a dial-up connection and we didn't have a complete local area network. Only the library had a local area network. And Internet connection was just through dial-up. We only had one computer which everyone used to access the Internet. Then from 2003 we got a leased line of 64 kbs from USAID. And that could only be accessed from the Library since we didn't have a local area network. Things improved from 2004-2005 when we extended the local area network to the administration block; and we also got a VISAT internet connection, it was then 512 KDBS downlink. And then from then from 2006, we upgraded the downlink bandwidth to one meg. And the network too has been extended to wireless to the parts which could not access the local area network. Yeah. So, so far that's the development of our technology. So that's mainly in terms of Internet provision. Yeah- for computers, in the past seven years, it's only secretaries and their bosses who had computers. Then we started getting refurbished computers from the U.K. That enabled every faculty members to have

> a PC in their office. Yeah so I think computer accessibility is not a problem. The main problem is performance of the machines- we have very old machines so people are not happy about that (Nancy).

The following is an integrated report of the results of the two data collection procedures. The first part is a presentation of the description of the respondents, followed by findings related to the research questions that guided the study.

Description of Survey Participants

In seeking to draw data that described respondents, a number of questions were asked requiring them to identify themselves as either male or female. They were also asked to indicate their age category, the highest degree they had attained and their professional rank in the university. Other descriptive information included number of years they had taught at college or university level, number of classes they taught in a week, average number of students per class teaching, department they were affiliated in and level of experience in using electronic technology. Appendix L. provides an overview of the basic descriptive information of the survey respondents.

Gender: In regards to the gender of the respondents, the majority were male. This is not very surprising for a Malawian institution since the number of females who make it to university is very low. It is expected that low enrollment levels of female students would result in fewer females being recruited for any position in the university.

Table 1. Gender of Respondents

		Frequency	Percent
Valid	Female	13	24.5
	Male	40	75.5
	Total	53	100.0

Age: Fifty three respondents provided responses to this item. Most of them (47.2%) were in the 30 to 39 age category. The rest of the respondents were distributed among the youngest age category of 20 to 29, 40 to 49, and the rest of the categories.

Table 2. Age of Respondents

		Frequency	Percent
Valid	20-29	8	15.1
	30-39	25	47.2
	40-49	9	17.0
	50-59	3	5.7
	60-69	8	15.1
	Total	53	100.0

Highest Degree Held: Fifty three respondents provided responses to this item. A majority of the respondents (50.9%) had a masters' degree. The second largest group was that of bachelor's degree holders (34%). Very few of the respondents had a doctorate degree.

Table 3. Educational Qualifications of Respondents

		Frequency	Percent
Valid	Doctorate	5	9.4
	Masters	27	50.9
	Bachelors	18	34.0
	Other please specify	3	5.7
	Total	53	100.0

Position: In regards to position held, lecturers accounted for the largest proportion of the respondents (54.7%) followed by was staff associates. Very few of the respondents held a professorial position. Most universities in Malawi have higher numbers of lecturers than professors because a master's degree is considered necessary for one to teach at a university. Once one obtains a master's degree, they earn their position as a lecturer. While one can advance to professorial level even with just a master's degree, such advancement is very rare. Additionally, it is not easy for people to attain doctoral level degrees because there are very few Ph.D. awarding institutions in Malawi. The few that do so have very limited space. Consequently, those who aspire for that level of academic achievements have to apply to universities abroad.

Table 4. Positions Held by Respondents

		Frequency	Percent
Valid	Professor	1	1.9
	Associate Professor	3	5.7
	Lecturer	29	54.7
	Adjunct Instructional faculty (Part time)	1	1.9
	Assistant lecturer	3	5.7
	staff Associate	14	26.4
	Senior lecturer	2	3.8
	Total	53	100.0

Number of Years Teaching at College/University: This item asked respondents to provide information in regards to number of years they had taught at college or university level. A total of 52 responses were obtained from this item. Respondents were generally spread evenly amongst the different years of teaching at college level. Those who had taught for two years were the most highly represented by the respondents accounting for 24.5%, followed by those who reported teaching for eight years. Respondents who had taught for six and seven years were the least represented amongst the respondents comprising.

Table 5. Years of Teaching at College or University

		Frequency	Percent
Valid	1 year	5	9.4
	2 years	13	24.5
	3 years	4	7.5
	4 years	6	11.3
	5 years	3	5.7
	6 years	2	3.8
	7 years	2	3.8
	8 years	8	15.1
	9 years	3	5.7
	10 or greater than 10 years	6	11.3
	Total	52	98.1

Number Teaching Hours per Week: Respondents were asked to indicate number of classes they were currently teaching in a week. Fifty respondents provided information to this item. Respondents were generally polarized into two major categories with about 41% teaching for four hours or less and the other 41% teaching for seven hours or more. Some respondents did not respond to this item.

Table 6. Hours of Teaching in a Week

		Frequency	Percent
Valid	Less than three per week	9	17.0
	4 hours per week	13	24.5
	5 hours per week	2	3.8
	6 hours per week	4	7.5
	7 hours or more per week	22	41.5
	Total	50	94.3
Missing	System	3	5.7
Total		53	100.0

Students per Class: Respondents were asked to indicate the average number of students they were teaching per class. A total of 51 respondents provided responses to this item. The largest proportion of the respondents had an average of 21 to 30 students in their classes followed by

respondents who had 70 students or more students. The rest of the respondents were distributed evenly among varied categories.

Table 7. Students per Class

		Frequency	Percent
Valid	10-20	6	11.3
	21-30	15	28.3
	31-40	8	15.1
	41-50	5	9.4
	51-60	6	11.3
	61-70	2	3.8
	More than 70	9	17.0
	Total	51	96.2

Department: Respondents were asked to indicate the department to which they belonged. Fifty two respondents provided responses to this item. The largest proportion of respondents indicated belonging to the Language and Literature department followed by those belonging to the Mathematics department. The least represented departments were Biomedical Science, Land Management, Hospitality Management and Forestry.

Description of Interviewees

A total of 10 respondents were interviewed. Of these, eight were faculty members, one was an administrator and the last one was a librarian. The number of years these faculty members had spent teaching ranged from five to 20 years. The longest serving faculty member had served for seven years. One of the faculty members had only served for one semester. This variation helped get a range of perspectives. Both the librarian and the administrator had served for as long as the university had been in operation.

Four of the interviewees came from the department of Education and Teaching Studies, one came from the History Department, one from the Forestry Department, one from the Information Technology and Communications (ICT) Department and the last one came from the Mathematics Department.

The following section presents findings of the study as they relate to the research questions. Hence in presenting the results, a research question will be described first followed by a presentation of the findings that respond to that particular research question. Since two methodologies were employed in this study, an integrated presentation of results from both the survey and the interview will be made.

Computer Accessibility for Faculty Members

The first research question sought to determine the current level of accessibility to computers, the Internet and the World Wide Web at Mzuzu University. The interview protocol for faculty members, questions six to nine; the interview protocol for librarian, questions three to 11; and the interview protocol for administrator questions two to six specifically addressed this research question. Appendix C. provides an overview of alignment of the research question and the corresponding items that addressed the research questions.

It was noted through observation during collection of surveys and during interviews; and from discussions with faculty members, the administrator and the librarian that most of the faculty members at this university had computers that were connected to wireless internet network.

Seven of the eight interviewed faculty members had computers in their offices. The one who did not have one had loaned it out to a colleague. According to the administrator and the librarian, there was a time when every faculty member had a computer in his or her office but with a recent increase in the number of faculty members, the university has not yet provided computers for the newer faculty members. Hence it was mostly some of the newer faculty members that did not have computers in their offices. The administrator had this to say concerning this issue:

> The expectation is that the University would provide these facilities to every faculty but because of limitations to budget and funding, they (the administration) have not been able to provide every faculty member with a computer. But in each department, there have been computers allocated. Although an initiative was made some years back to provide every faculty member with a computer, we have grown now, therefore not every one of them has a computer. And even for those who have, they have been complaining that the computers are outdated, they can't run the software that they would want to use. So even those who have, there are those problems (Ron).

The Librarian concurred with the Administrator in her view concerning computer accessibility but added that some departments had newer computers than others:

> It depends on the faculty I think. Like ICT faculty members have new computers – each one has a computer- they are good. But if you go to other faculties, where most of them are using the refurbished computers, they are not quite good. They (computers for faculty) are Pentium 3 I think most of them

Of the seven interviewees who had computers, all except one were connected to wireless Internet network. The one who was not connected had just joined the university in the previous semester and plans were still underway to get him connected.

For those who had internet connections, there was a general contention that the connectivity was very slow especially during the semester with students around. One lecturer had this to say in this regard: "It is very slow especially when the students are around, it's very slow but when students have gone home on holidays, it's faster. Because it is wireless, so it's not as fast" (Mebo). Another issue related to internet connectivity was that it was "on and off" (Josh).

They attributed this problem to the prefabricated office buildings which had metallic walls and therefore shielding the signals from time to time. This view was also shared by the Librarian:

> For the staff at the administration, they are comfortable- they are connected through a fiber-optic cable and the Internet is good but for those using wireless Internet, it depends where- some of the places- the reception is poor. The design of our wireless, I think it hasn't been good from when it was initially installed. The buildings- especially the metallic buildings- the prefab, they have an effect on the signals- so its not good… and I think the equipment that was used- some of it was not powerful enough so we need to do something about it. And we opted for wireless because some of the structures are not permanent. There are plans to build new offices so may be we will try to put up proper connections (Nancy).

Ownership of Personal Computers

Six of the eight interviewees reported having personal laptops. However, except for one who lived at the campus, the rest did not have internet access in their homes. One faculty member indicated that he planned on getting connected through the Telecom Networks Malawi (TNM). He had this to say on this matter: "I am now planning to connect it to TNM. Only that the service providers are not very serious and not very efficient. They keep telling me "come next week"- when I go they will tell me again "come next week" (Josh)." The researcher wished to know how this worked. This is what the interviewee commented: "I have a handset- a telecom handset which has a connection to my laptop. So, Telecom people are supposed to install the software and then it will be on wireless network". Once the software is installed, this faculty member would be paying 20 cents per minute which according to him would be affordable.

Despite having personal laptops, the faculty members seemed to welcome the idea of introducing a loan program to enable them to purchase personal computers- probably owing to the fact that the personal laptops were old- as the following lecturer indicated: "I have a laptop at home- an old one. It's not working satisfactorily but being the owner I know how (laughs) to manipulate it. But I have an intention of getting a new one because it is a very important tool" (Moses). One of the faculty members expressed the need for the university to offer soft loans to faculty members to enable them to purchase personal desktops:

> One of the comments I have is that you know the hardware is mostly a little expensive for most of us. And I think most of us would also like to have a desktop computer at home. Yeah but I think it's a bit expensive for one to buy. So if there was a facility for example, we would like the university to provide special loans for faculty members to buy desk top computers for home use- which can also be used for academic purposes (Moses).

Fortunately, there seemed to be plans for such a program in place, though not as close to implementation as Moses would have wanted it to be. This is what the administrator said related to this issue:

> Yeah, so far, in terms of computers, I recall that the university had budgeted a certain amount of money to be used as a special fund for academic staff to get loans for laptops because the view was that the university cannot sustain buying laptops for each academic member coming. But the sustainable way would be for them to buy their own laptops using the loan. But it has not been operational- it hasn't been used. So that is one way of trying to improve access (Ron).

It was learned that the loan facility did not take off because a committee was supposed to be formed to take care of issues related to disbursement of the loan to faculty members had not yet been formed by the time of the interview. However, if implemented, this facility would go a long way improving computer accessibility for faculty members.

Computer Accessibility for Students

All the eight interviewees stated that the computers that were designated for students were not enough. This state of affairs affected assignment submission since students had to line up, waiting for others to finish using the computer before they could have access to it. When they could not get an assignment typed in good time, the students went to their lecturers to ask for extension. The librarian made the following remark concerning this issue: "At the moment we have about 40 computers that are working in the computer lab. We open the lab at 8 am and close at 10 pm. The lab is full (of students) all the time and we have to actually send some students away. So we need more" (Nancy).

Another faculty member was specific in terms of numbers of students versus number of computers as follows:

> It's even worse for students because you are talking of roughly around 150 computers against 1500 students. There are so many computers but more than half don't function. They come as donations, so very few- like last time we received 100 computers but only 10 were working- ninety were not working. But since these are donations, there is nobody to query (Grey).

Extent of Electronic Technology Adoption

The second research question investigated whether faculty members had adopted electronic technology or not. Survey item part one, question nine; interview protocol for faculty

members, question four, 13 and 14; and the interview protocol for the administrator, questions 12 through 15 specifically addressed this research question. An overview of results from the survey and the interviews indicates that a larger proportion of the faculty members had adopted electronic technology at the university.

In soliciting data that responded to the second research question, respondents were asked to indicate their experience with electronic technologies using the descriptive range of non-user, novice, average and expert. All 53 respondents provided responses to this item. The largest proportion of the respondents (43.4%) described themselves as having average proficiency followed by those who described themselves as novices as far as electronic technology use was concerned. About one third of the respondents described themselves as having high proficiency. The least category of respondents (the non-users) comprised 13.2% of the total number of respondents. Interview results shared similarities with those obtained from the survey.

Of the eight faculty members interviewed, five reported having low to average proficiency in using the computer. Three of the respondents indicated that they had high proficiency. Mostly the less proficient interview respondents had basic computer skills like typing and some Microsoft Office applications.

> The skills of Microsoft word that's all, I also use a little bit of Excel but not much. That's why even my notes, I do not take them to my secretary to type for me, I do it alone. If I have some problems, I will just ask her "Can you tell me how to do this" and she will tell me how to do it then I go to work on my own. I am improving (Moses).

Another faculty member made the following comment in regards to his computer proficiency:

> I do not know because I have never learnt it from any where. I have taught myself. Even the software that I use, I have basically taught myself. I think I am on the okay side but not very okay. At least I can do the basics. I can do word processing, I can do spreadsheets, and other packages related to statistics and related to forestry management. Also a bit of (internet) searches (Josh).

Generally speaking, the faculty members who had a bit of proficiency in using computers got the skills either from their previous places of work or colleges. None indicated learning using computers at Mzuzu University. If they did learn from Mzuzu University, it was through personal initiative. Also, it is noteworthy that a general characteristic of those who were somewhat proficient in using computers was personal interest in technology in general, leading them to be inquisitive and seeking ways to learn despite all of the difficulties associated with electronic technology.

In regards to proficiency in using the Internet, all the interviewees indicated had some level of proficiency ranging from low to very high proficiency. The one who described himself as the least proficient happened to be same interviewee who did not have internet in his office. He made the following observation in connection to this issue:

> I use it but not as good as others do because if my computer was connected to the Internet, by this time I would have been more proficient but now since I am not connected sometimes I go to a bureau and work for one hour. But in an internet bureau you cannot learn. You should go there when you are already aware of how to do things (Moses).

Technology Utilization in Teaching and Learning

The third research question investigated how faculty members were utilizing electronic technologies after its diffusion to the university. Research question six investigated how technology diffusion affected teaching and learning in the university. Survey items from part two, numbers one through 13; and the interview protocol for faculty members, question five, 16 and 17 specifically addressed these research questions. Results obtained from the survey and the interviews reveal that faculty members were mostly using the computer for preparation teaching notes and preparing exam results. The internet was mostly being used for emails to colleagues and conducting research. Further the results indicate that while there seemed to be active engagement with computers and the Internet, such engagements mostly excluded classroom use.

In addressing the third and sixth research questions, respondents were provided 13 items on the left column of the survey requiring respondents to circle the response option that best described their frequency of use of electronic technologies in the past year. Appendix M. provides an overview of the results and the number of respondents that provided responses to the particular item. Respondents had five response options from which to select. 1 represented *never*, 2 represented *seldom*, 3 represented *occasionally*, 4 represented *often* and 5 represented *almost all the time*. Some respondents chose not to provide responses to certain questions. Hence, while a total of 53 responses were expected from each item, in certain cases the number of responses was less than that number.

A general impression from the survey and interview results is that faculty rarely used electronic technologies for teaching and learning. Hence the percentages of respondents who never used the different aspects of electronic technologies were generally higher than those who actually used the technologies often.

The first item asked respondents to indicate if they had used an online syllabus. All the 53 respondents provided responses to this item. Those who reported never creating or using an online syllabus comprised 66% of the survey respondents. Those who used an online syllabus were generally few.

The second item asked whether respondents designed Web-based lectures, notes and tutorials. Fifty three responses were obtained from this item. The largest proportion of the respondents (73.6%) reported never using. Web-based lectures, notes and tutorials. A small proportion of the respondents reported using Web-based lectures in varying degrees.

In regards to whether respondents designed Web-based tests and quizzes, 90.6% of the respondents indicated that they never used the feature. Very few respondents reported designing Web-quizzes and even amongst those who did, none of them indicated doing it often.

Table 8. Designed Web-based Tests or Quizzes

		Frequency	Percent
Valid	Never	48	90.6
	Seldom	3	5.7
	Occasionally	2	3.8
	Total	53	100.0

In response to a question that sought information on whether respondents enabled and supported student group work online, most respondents (75.5%) reported never doing it. Of the few who enabled and used student group work on line, very few reported doing it almost all the time.

The fifth item asked respondents to indicate whether they enabled and supported collaboration among students online. The largest proportion of the respondents (77.4%) never enabled and supported collaboration among students online. Few of the respondents reported doing it in varying degrees with only 1.9% indicating that they used it almost all the time.

Respondents were asked to indicate if they used Internet-based audio systems for instruction. All the 53 respondents provided responses to this item. Of these, the largest proportion (77.4%) reported never using the internet-based audio systems for instruction. The rest of the respondents who reported using it did so rarely.

In response to an item that required respondents to indicate whether they conducted academic advising online, most respondents (81.1%) reported never doing it. Those who reported conducting academic advising online did so infrequently.

In responding to an item which sought information on whether respondents used on-line chat rooms, a majority of the respondents (81.1%) reported never using them. Of the few that reported using on-line chat rooms, only a small proportion (1.9%) used them often.

Another item required respondents to indicate whether respondents provided grades online and if they did, to what extent. Results indicate that a majority of the respondents (81.1%) never provided grades online. The rest of the respondents who reported providing grades on-line did so once in a while.

When asked if they had used a computer and projector in the classroom, a larger majority of the respondents (about 58%) reported using the computers in varied degrees. The rest of the respondents reported never using them.

In regards to whether respondents exchanged student written work via the Internet, a majority of the respondents (62.3%) reported never doing it. The few respondents, who reported exchanging student written work via the Internet, did so in varying degrees- mostly occasionally.

Respondents were asked to provide information regarding their use of email as the primary source of student contact outside the classroom. In responding to this question, 50.9% reported never using email for corresponding with students. The other proportion of respondents

reported using in varying degrees. Of those who reported corresponding with students via email, more than half reported using doing so infrequently.

When asked whether they used the Internet for research or not, there was a general reversal in the trend of responses. A total of 90.6 % of the respondents reported using the tool in varied degrees. Very few respondents reported never using the Internet for research.

Table 9. Used the Internet for Research

		Frequency	Percent
Valid	Never	5	9.4
	Seldom	4	7.5
	Occasionally	7	13.2
	Often	15	28.3
	Almost all the time	22	41.5
	Total	53	100.0

Results obtained from the interviews aligned with those from the survey. All the eight faculty members interviewed indicated that they used electronic technology. Mostly, the faculty members used the computer technology to write teaching notes. The Internet was mainly used for emails and for research. This is what one faculty member shared regarding his use of electronic technology as follows:

> I use them for organizing my teaching and also occasionally when delivering my lectures and when I am doing my presentations, and also when I am doing my research, I also use the Internet quite a lot, and when conducting online searches-accessing online journals, I use the Internet for that. And also once in a while you know, for relaxing through pleasure, there is music and all that (Moses).

One aspect that emerged time and again from the interviewees was the issue that the Internet helped the faculty in supplementing textbooks, as there was a shortage of textbooks for students. To highlight this notion, one faculty member stated:

> "In most cases when I am searching for information especially we have a shortage in textbooks" (Mebo).

It was noteworthy that the university had made strides in having a learning management system installed at the university. Two of the interviewees reported using this feature in their teaching. One particular faculty member remarked:

> "Currently I mostly use the Multimedia projector for presenting my work, during lesson planning I use mostly my laptop. And, I also put some courses on the student management software that we have on our server. And the students access it using our local area network" (Sidney).

The learning management system had just been introduced during the previous semester and it was apparent that most of the faculty members interviewed did not know anything about it or what it was all about. One particular lecturer who taught in the ICT department made the following comment on this matter:

> I would love if faculty members used technology more. There is need to the e-learning center that we just started because it is in its formative years- actually it's been there for a semester but I can foresee more and more departments being interested to use the e-learning center.
>
> (The learning management system) is similar to Blackboard. Since we cannot afford to buy Blackboard, we are using open source software called Claroline to upload content. Students can actually access content, submit assignments, they can also conduct dicussions but they don't do that now because we have just started. The faculty members for the ICT department and the Library Information Science, they know about it and a few other departments. At the moment, the

> departments that are using the center are the ICT, LIS (Library Information Science) and the Mathematics department. The other faculty members may know about it but may not know how to use it- may be because of techno-phobia, so may be they may not be willing to use it. But we are planning to hold a public seminar where we can show the faculty and the rest of the university how this software works so that may be some may be interested to use it considering large classes that we are having now (Don).

From these remarks, it is clear that some departments are more proactive in embracing new technology than others. This may have to do with the nature of the courses being offered in those departments or just because the individuals in those departments are more innovative than the others.

Facilitators and Barriers of Electronic Technology Adoption and Integration

The fourth research question investigated factors that facilitated the adoption and integration of electronic technologies for teaching and learning at the university. The fifth research question investigated factors that inhibit adoption, diffusion, and integration of electronic technology by the faculty members. Survey items from 3C, one through seven; the interview protocol for faculty members, questions 20, 23 through 28; the interview protocol for the librarian, questions 12 through 23 and the interview protocol for the administrator, questions 9 through 23 specifically addressed both research questions. An overview of results from the survey and the interviews indicate that while availability of computers and the internet facilitated initial faculty members' adoption of the technologies, lack of accessibility to available equipment, lack of knowledge and skills to use the technologies, lack of involvement in decision making involving electronic technologies by faculty members, lack of infrastructure to support

the technologies, lack of technical, pedagogical and administrative support hindered the integration of the technologies in teaching and learning. Interview results aligned with the survey results. All the eight interviewed faculty members reported lack of equipment, software, lack of maintenance and lack of knowledge and skills to operate the electronic technologies as factors that discouraged them from using electronic technologies for teaching and learning. It is evident from the results that mostly, the efforts by the university, related to technology focused more on provision of the hardware- the computers and the Internet. There was little focus on the software and social aspects associated with the use of the technologies for teaching and learning.

In this section, questions were asked that required respondents to give their opinion as to whether what was being done in regards to electronic technology for teaching and learning served as enablers or created barriers. Respondents were given five response options to select from. One represented *major barrier*, 2 represented *minor barrier*, 3 represented *neutral*, 4 represented *minor enabler* and 5 represented *major enabler*. Respondents were asked to select by circling the response option that best represented their opinion to the particular question.

While 53 responses were expected from each of the seven questions, exact responses to the questions were either equal to or less than 53 because some respondents opted not to provide responses to certain questions. Appendix P. summarizes results obtained from this section.

The first question required respondents to describe the allocation of financial resources of Mzuzu University as barrier or enabler to the integration of electronic technologies in teaching and learning. Fifty two respondents provided responses to this item. A majority of the respondents (54.7%) identified financial resources as a barrier to the integration of electronic technologies in teaching and learning. Very few thought financial resource allocation facilitated the integration efforts.

Table 10. Facilitators and Barriers of Electronic Technology

		Frequency	Percent
Valid	Major barrier	25	47.2
	Minor barrier	4	7.5
	Neutral	14	26.4
	Minor enabler	6	11.3
	Major enabler	3	5.7
	Total	52	98.1
Missing	System	1	1.9
Total		53	100.0

The second question in this section solicited information regarding whether respondents viewed infrastructure of Mzuzu University as a barrier or enabler to the integration of electronic technologies for teaching and learning. Fifty two respondents provided responses to this question, a majority of whom (54.8%) described the infrastructure as a barrier and only 20.8% of the respondents described it as a factor that helped facilitate the integration of electronic technologies in teaching and learning. The rest felt that infrastructure was neither an enabler nor a barrier to technology integration. Interview results aligned with the survey results as supported by the remark below by one faculty member:

> It is difficult (to integrate technology in teaching) because we do not have enough gadgets to carry around in the classrooms and our classrooms are not equipped to use the technology which is there you know. You fail to use PowerPoint. There is only one projector and I haven't seen it. I only hear that there is a projector which we have and a laptop and the laptop, I haven't seen it and I haven't seen the projector but I just hear the department has one, I haven't seen them you know. The only thing you can use in a classroom situation is PowerPoint (Moses).

Ownership of laptops and access to LCD projectors emerged as an issue time and again:

> (I am discouraged) due to that fact that in our classrooms you have to have a laptop. If you do not have a laptop then you know you are limited in as far as you can use that so may be that's the limitation- the fact that we do not have laptops and also the fact that we do not have readily available LCDs (George).

Faculty members also described lack of appropriate software as a barrier to the integration of electronic technology for teaching and learning:

> Mainly I would I would say if you ask the administration to buy software, they would find it to be expensive, or may be say 'it is not really necessary, you can do without it'. So the support that is there is not as we would have liked. For example there is software that we ordered about one and half years ago, it hasn't been bought up to this time (Don).

The administrator concurred with views of the faculty members in regards to lack of equipment for use in teaching and learning. In his view, the problem was that the university had not provided the necessary equipment in the classrooms making it difficult, and in most instances impossible, for faculty members to integrate such technology:

> As I told you that access to these facilities has been a problem, the desire is that there should be more done to improve access to computers and the Internet as well. There is a concern that the wireless network being used by the faculty members is not as effective, the contractors who installed the network have been approached now and again to improve the system. There is room for improvement. Much bigger room (Ron).

The librarian commented that the library was a custodian of some of the electronic technology equipment and that faculty members just needed to go there and borrow the

equipment for in-class use. Yet none of the faculty members seemed aware of such arrangements. There seemed to be lack of communication between the library and the faculty members and between the administration and between faculty members. As one faculty member put it, these departments tended to assume that the other group knows what they are supposed to do, when and how.

The subsequent question required respondents to give their opinion in regards to whether shared decision making and communication acted as a barrier or an enabler to the use of electronic technologies for teaching and learning. Fifty two respondents provided responses to this item and of these; a majority of the respondents (54.8%) described the culture of the university as a barrier. Only 17% described shared decision making and communication as a factor that helped facilitate the integration of electronic technologies in teaching and learning.

Table 11. *Perceptions Regarding Shared Decision Making*

		Frequency	Percent
Valid	Major barrier	18	34.0
	Minor barrier	11	20.8
	Neutral	14	26.4
	Minor enabler	7	13.2
	Major enabler	2	3.8
	Total	52	98.1
Missing	System	1	1.9
Total		53	100.0

The fourth question required respondents to give their opinion in regards to whether the policies of Mzuzu University acted as barriers or enablers to the use of electronic technologies for teaching and learning. In response, a majority (37.7%) described the policies as a barrier to the implementation of electronic technologies for teaching and learning. One third of the survey respondents thought policies of the university were neither enablers nor barriers. The rest of the

respondents described the policies as a facilitating factor in the implementation of electronic technologies for teaching and learning.

Interview respondents alluded to the fact that some of the policies of Mzuzu University did not always reflect the core mission of the university. “They should realize that the core business is teaching and research- that’s the core business. Now they should focus more attention on that core business. Yet here the opposite is true”. (Richard)

Survey respondents were also asked to provide information as to whether Mzuzu University’s commitment to learning outcomes acted as a barrier or an enabler to the use of electronic technologies for teaching and learning. Fifty two respondents provided responses to this question. In giving their views, the largest portion of respondents (45.3%) described the university’s commitment as providing an enabling environment in the integration of electronic technologies for teaching and learning. One third of the respondents described the university’s commitment to learning outcomes as a barrier.

The sixth question asked respondents to give their views concerning the quality and quantity of evaluations in the university and their impact on the use of electronic technologies for teaching and learning. In responding to this question, a majority of the respondents (41.4%) viewed evaluations as a barrier to the integration of electronic technologies in teaching and learning. About a third of the respondents described the quality and quantity of evaluations in the university as a factor that facilitates the integration of electronic technology for teaching and learning.

Table 12. Faculty Members' Perceptions Regarding Policies of the University

		Frequency	Percent
Valid	Major barrier	7	13.2
	Minor barrier	13	24.5
	Neutral	17	32.1
	Minor enabler	11	20.8
	Major enabler	4	7.5
	Total	52	98.1
Missing	System	1	1.9
Total		53	100.0

The last question in this section required respondents to indicate whether they viewed the overall support system of the university as a barrier or enabler to the integration of electronic technologies for teaching and learning. Fifty two respondents provided responses to this question. Of these, the largest fraction of the respondents (51%) described the support system as a barrier. Few respondents believed that the overall support system of the university helped facilitate the integration of electronic technologies in teaching and learning. Results of the interview shared similarities with those from the survey.

Table 13. Perceptions Regarding Overall Support System of the University

		Frequency	Percent
Valid	Major barrier	11	20.8
	Minor barrier	16	30.2
	Neutral	13	24.5
	Minor enabler	9	17.0
	Major enabler	3	5.7
	Total	52	98.1
Missing	System	1	1.9
Total		53	100.0

Analysis of Perceived Importance of Efforts Regarding Electronic Technologies

Research question seven investigated faculty perceptions concerning electronic technology for teaching and learning and whether increased access to such technologies affected

faculty members' perception about technology for teaching and learning in the university. Results from the interviews and survey indicate that increased access to technology did very little or nothing to change faculty members' previously held perceptions about the electronic technologies for teaching and learning. If anything, it was the deeply rooted personal factors like those describes by Rogers (2003) that may have played a role in determining how the faculty members viewed electronic technologies for teaching and learning.

Generally speaking, faculty members perceived electronic technology as an important tool for teaching and learning. Further, the respondents were of the view that more could be done to improve the status of electronic technologies for teaching and learning at the University.

Seven of the eight faculty members interviewed indicated that their perceptions about electronic technologies for teaching and learning were not affected by increased access of the technologies.

Survey respondents had three sets of questions aimed at addressing this research question. The first set addressed what the university was doing regarding electronic technology, the second set concerned quality and the third section dealt with the importance of efforts being made for the successful integration of electronic technologies. Part 3A, one through four; 3B, one through seven and 3D, one through seven specifically addressed this research question.

Analysis of Electronic Technology Development Efforts

In trying to obtain data that described the extent of what the university was doing regarding electronic technologies for teaching and learning at Mzuzu University, survey respondents were asked nine questions in which they selected by circling, the response option that best represented their opinion. Four response options were presented: 1 represented *low*, 2 represented *average*, 3 represented *above average* and 4 represented *high*. The total number of

expected responses was 53. However, some respondents did not respond to some of the questions making the total number of responses less than 53 in some cases. Appendix N. provides a summary of the results including the number of respondents who provided responses to the specific questions. An overview of the results indicate that most respondents were of the opinion that little was being done in developing and improving the status of electronic technologies for teaching and learning at the university.

The first question required respondents to indicate whether they felt that sufficient financial resources were allocated for electronic technologies for teaching and learning at the university. A majority of the respondents (52.8%) indicated that insufficient financial resources were allocated for electronic technologies. Very few believed that the financial resources allotted to electronic technologies were high.

The second question drew out data regarding whether respondents thought leaders at the university considered their opinions and ideas when making decisions concerning electronic technologies for teaching and learning. In responding to this question, most respondents (64.2%) thought that the leaders at the university considered their opinions and ideas. However, of these, only a small proportion (1.9%) believed that the leaders strongly considered ideas and opinions in making decisions regarding electronic technology.

Table 14. Faculty Opinion Regarding Shared Decision Making

		Frequency	Percent
Valid	Low	16	30.2
	Average	25	47.2
	Above average	8	15.1
	High	1	1.9
	Total	50	94.3
Missing	System	3	5.7
Total		53	100.0

Interview results aligned with the survey results. Most faculty members thought that the administration did not involve them in decision making concerning electronic technologies for teaching and learning as supported by the remarks by faculty members below: “I am not involved at all. I think this is done by the administration and the Dean”. (Moses)

Another faculty member had this to say:

> I don’t think we have a formal system where may be at departmental level, faculty level or university level where we discuss what technologies we should be using for what, when- we do not have that kind of forum. So, most of the things we do them indirectly (Grey).

Only one faculty member indicated being involved in decision making concerning electronic technology. This faculty member also happened to belong to the ICT department and hence was already at an advantage in terms of computer access, internet access and access to other electronic technology equipment. He was open enough to indicate that the committee had been passive, implying that even his involvement was limited in this respect. He stated:

> Yes (I am involved in decision making regarding electronic technology). Actually I am a member of the technology committee. We have a committee which comprises representatives from various departments to look at what is actually needed in terms of technology even though I may say it hasn’t been very active in the recent past (Don).

The administrator agreed with the views of the faculty members in regards to the fact that faculty members had limited or no involvement in decision making concerning electronic technology:

> The intention is there (to involve faculty members in decision making) but it hasn't been operational because I know that there is an ICT committee which used to meet way back but it looks they were frustrated or something (laughs) because their requests were not being met so it has been dormant of late. So that has limited the participation of the academic staff.

The third question in this category sought information in regards to the extent of respondents' awareness of the policies related to electronic technology for teaching and learning at this university. Fifty two respondents provided responses to this item. A majority of the respondents (71.7%) reported having a low awareness of the existence of such policies. The rest of the respondents were distributed amongst average, above average and high awareness options. It was also noted through the interviews that most of those interviewed were not aware of electronic technology policies. One faculty member stated: "We need a deliberate policy on electronic technologies for teaching and learning. We do not have a policy related to students, staff and faculty and I would be happy if we did that". Other interviewees indicated the need for prioritizing teaching and learning as a starting point in improving the status of electronic technologies at the University. One faculty members remarked:

> Management should know the importance of technology in education and invest in equipment like computers, equipment like overhead projectors, equipment like digital cameras and even video cameras (Moses).

The fourth question asked about the fairness of policies related to electronic technologies at the university. Over half of the respondents believed that policies of the university were generally fair. The rest (43.4%) thought that the policies were not as fair as they could be.

An interview with the administrator revealed that policies of tenure and promotion mostly excluded faculty members' innovativeness in using electronic technology in teaching and learning. It was thus determined that to be promoted, one had to satisfy conditions that had very little or nothing to do with the integration of electronic technologies in teaching and learning. This therefore meant that faculty members who were integrating electronic technologies for teaching and learning were not at any better position of being considered for promotion.

Table 15. Awareness of Existing Technology Policies

		Frequency	Percent
Valid	Low	38	71.7
	Average	6	11.3
	Above average	7	13.2
	High	1	1.9
	Total	52	98.1
Missing	System	1	1.9
Total		53	100.0

In responding to a question which asked respondents whether they thought policies of Mzuzu University regarding electronic technologies were up-to-date, a majority of the respondents reported having a low and average regard concerning this notion (35.8%, 39.6% respectively). Only few thought that the policies were somehow up-to-date.

In response to a question which asked respondents to describe whether policies of the university regarding electronic technology were well known by the faculty, most of the respondents reported that they thought that the policies were not well known by the faculty (86.8%). Very few of the respondents, thought that the policies were well known.

In a related question, respondents were asked to rate their opinion concerning students' familiarity with policies of the university regarding electronic technology. In response to this question, one half of the respondents believed that students were aware and the other half

believed that the students were unaware of policies regarding electronic technologies for teaching and learning.

The last question in this category asked respondents to rate the provision of support by the university administration to help them effectively implement electronic technologies for teaching and learning. In response to this question, a majority of the respondents (45.3%) rated the university's support in relation to electronic technology implementation as average, followed by those who thought that the support provided by the university was low. Only 16% of the respondents were satisfied with the provision of support by the university in the implementation of electronic technologies for teaching and learning.

Table 16. Faculty Perceptions Regarding Administrative Support

		Frequency	Percent
Valid	Low	20	37.7
	Average	24	45.3
	Above average	7	13.2
	High	2	3.8
	Total	53	100.0

Seven of the faculty members who were interviewed generally showed discontent with what the administration was doing in support of their efforts to integrate electronic technology in teaching and learning. In some instances they indicated that they were not so sure what the role of the administration was in this regard: "I don't know- I don't know (in a whisper). I don't think they are doing anything- if anything at all, they provide the computers, that's their role I think. But the use, how to operate, I don't know" (Moses). Another faculty member stated:

> I think they are the major suppliers of technology in this university. Whenever we have the need, we approach the administration for provision of the computers and the Internet. Or whenever we have new staff joining, we ask for their assistance.

> Training- and probably training also- I am not sure. I think the library is involved in the training I am not sure (George).

This kind of uncertainty was echoed by another faculty member from a different department:

> I don't know. Very little, because most of the initiatives come from the faculty and when that initiative has arisen, the response from the administration has been lukewarm. I think most of us think that the administration hasn't been very proactive as far as helping us integrate electronic media in our teaching (Jos).

The administrator alluded to the fact that while there is a lot the administration could be doing in assisting faculty members in implementing electronic technologies for teaching and learning, that was not the case at that time because of a number of challenges facing the university administration:

> Like the plan I mentioned- that there was a plan for faculty members to get loans for purchasing personal computers but unfortunately it didn't take off. Hopefully it will be brought up this financial year but again the expectation is that the administration would put in place the facilities- resources permitting- fit the classrooms with necessary equipment that would enhance teaching and learning. That's the expectation. At the same time issues of training and motivating staff, the expectation is that the administration would take a leading role- a supportive role to train and motivate faculty members to go into the use of electronic technology in teaching (Ron).

Quality of Efforts Regarding Electronic technologies for Teaching and Learning

The survey also solicited information dealing with the quality of efforts of electronic technology for teaching and learning at Mzuzu University. A total of seven questions were asked in this section. Specifically, the questions concerned financial resources, infrastructure, shared decision making, policies, training, technical support and pedagogical support. Respondents were provided five response options from which to select: 1 represented *Nil*, 2 represented *Low*, 2 represented *Average*, 4 represented *Above average*, and 5 represented *High*.

Fifty three responses were expected from each of the seven questions in this section. However, some respondents opted not to provide responses to some questions making the number of responses less than 53 in some instances. Appendix O. provides a summary of the results obtained from this section including the number of responses obtained from each question. Generally speaking, the respondents' rating of overall quality of electronic technologies for teaching and learning was low.

The first question in this section sought information regarding how respondents rated financial resource allocation to electronic technology integration initiatives. In response to this question, a majority of the respondents (86.8%) rated the financial resources for electronic technology integration initiatives at the university as generally low or non-existent.

The second question solicited information regarding the quality of the electronic technology infrastructure of Mzuzu University. One half of the respondents thought that the quality of infrastructure was generally low or non-existent and the other half believed that the quality was average and above average.

Table 17. Faculty Perceptions Regarding Quality of Infrastructure

		Frequency	Percent
Valid	Nil	5	9.4
	Low	21	39.6
	Average	23	43.4
	Above average	3	5.7
	Total	52	98.1
Missing	System	1	1.9
Total		53	100.0

The fourth survey question in the category of quality of electronic technology required respondents to rate policies of the university, specifically related to the integration of electronic technologies in teaching and learning. Fifty respondents provided responses to this item. The largest section of the respondents (79%) thought the policies were either of low quality or non-existent. Very few respondents thought the policies were good.

The fifth question sought information regarding the support respondents received in terms of training relating to electronic technologies for teaching and learning. The majority of them described the support as either low (43.4%) or non existent (35.8%). Very few of the respondents thought that the training support they received was sufficient.

Table 18. Faculty Rating of Training Support

		Frequency	Percent
Valid	Nil	19	35.8
	Low	23	43.4
	Average	7	13.2
	Above average	2	3.8
	High	1	1.9
	Total	52	98.1
Missing	System	1	1.9
Total		53	100.0

Responses from the interviewees indicated that training was a need in order for faculty to feel confident in their use of technology for teaching and learning. Yet it was the most cited

factor that all the interviewees remarked as having an important role in their ability to integrate technology in their teaching and learning. While claims were made by the administrator that the university provided training to faculty members, interviewees had different opinions in this regard. The administrator stated:

> I recall that sometime back, there were classes lined up for faculty members to learn the use of the computer but the turn-up was very discouraging. Most academic staff members did not turn up for the training sessions. I can't explain why- but those trainings were discontinued because of low turn-up. The university Library with the staff in the library and learning resource center (conducted the training). It was introduction to computer basics- excel, PowerPoint, internet, and email. (Ron)

The librarian shared similar views with the administrator in regards to training offerings for faculty members:

> Especially in the past, we were doing it (Training) frequently like office products- word and all that. But normally, now we do it in the evenings. But we offer it not only to staff but to outsiders as well- the community- on special fees. For faculty members, I think we only do it on demand. For e-journals it's usually done this time- vacation time (Nancy).

On the other hand, all the eight faculty members interviewed seemed not aware of any such training sessions. One faculty member stated:

> There is no systematic and organized way of ensuring that faculty members are up-to-date with technological advancement you know. For example the Internet, email- we are basically teaching each other. Some of us, we were expecting that

> now that we have faculty of information science they would take a lead in things like that. I think that would be a step in the right direction. But I think at the moment it's not there (Josh)

Faculty members who had an interest in using electronic technology had mostly learned from each other. Sometimes, they would ask a technician to assist them do something they could not on their own. Thus personal initiative was a driving force for the faculty who were using electronic technology:

> The problem is that there is no formal training for the members of staff in terms of internet use. Only those who are interested you know and are very keen would learn through very funny arrangements. For instance, myself, when I want to learn something, I would call a technician to assist me. That's the only way I have learnt. Those who are timid cannot learn anything because we haven't had any formal training (Richard).

In response to a question that required respondents to rate the technical support they received concerning electronic technology for teaching and learning, only 30.1% believed that the university provided sufficient technical support to help faculty members integrate electronic technology in teaching and learning. The rest thought that technical support was non existent and where it existed, it was mostly insufficient.

The last question in this section sourced information regarding how respondents rated the pedagogical support they received in regards to electronic technology for teaching and learning. Responses to this question indicate that the majority of the respondents (79.3%) were either not satisfied with the pedagogical support they received or thought they did not get any when they

needed it. Very few expressed some form of satisfaction with the pedagogical support they received.

The librarian shared the sentiments offered by the administrator on the issue of support for faculty members:

> Even the work force- things are just (laughs) chaotic and the staff are not enough. It's like the university just depends on the Library for the IT needs- and we don't provide enough (Nancy).

Section 3D comprised questions that required respondents to indicate their perceptions concerning the importance of efforts undertaken to improve electronic technologies for teaching and learning. There were seven questions in this section. Specifically, the questions dealt with the importance of financial resources, the importance of infrastructure, the importance of shared decision making, the importance of appropriate policies, the importance of technical support, the importance of training and the importance of administrative support to the successful use of electronic technologies for teaching and learning. Respondents were given three response options to select from. One represented *Not important*, 2 represented *Moderately important*, and 3 represented *Extremely important*. The mean score was 2.9 and a mode of 3 suggesting that most of the responses were "*Extremely important*". There were a total of 53 potential responses expected from each of the seven questions. However, some respondents opted not to respond to certain questions. Hence the responses obtained varied from 50 to 51. Appendix Q. provides an overview of the results obtained in this section.

The first question in this section required respondents to rate the importance of financial resources to the successful use of technologies for teaching and learning. Fifty one respondents provided responses to this question. The majority of the respondents (84.9%) rated financial

resources as extremely important to the successful use of technologies for teaching and learning. Very few rated financial resources as moderately important.

In the second question, respondents were asked to rate the importance of infrastructure to the successful use of electronic technologies for teaching and learning. Fifty respondents provided responses to this question. Most respondents (93.5%) attached a lot of importance to infrastructure in relation to the use of electronic technologies for teaching and learning followed

The third question sought information regarding respondents' views about the importance of shared decision making and participation to the successful use of electronic technologies for teaching and learning. In response, the largest group of respondents (94.3%) thought that shared decision making and participation were vital for successful implementation of electronic technologies for teaching and learning.

The fourth question required respondents to rate the importance of appropriate policies to the successful use of electronic technologies for teaching and learning. Most respondents (94.4%) thought that appropriate policies were very central to the successful use of electronic technologies for teaching and learning.

Respondents were also asked to rate the importance of technical support to the successful use of electronic technologies for teaching and learning. In response, a majority of the respondents (96.3%) rated technical support as key to the successful use of electronic technologies for teaching and learning.

Interview respondents expressed similar sentiments in regards to provision of technical support. One faculty member remarked: "…the computers –they should do regular maintenance because these are old computers- second hand computers, yeah. They should have enough

technicians to do the repairs because sometimes you tell them “okay my computer is down”, they will come and say “Okay, we will look at it”. It takes weeks”.

The sixth question sought information regarding the importance of training to the successful use of electronic technologies for teaching and learning. In response, most respondents (94.3%) attached a lot of importance to training as a tool for ensuring success in the integration of electronic technologies for teaching and learning.

The seventh question required respondents to rate the importance of administrative support for successful integration of electronic technologies for teaching and learning. Fifty one respondents provided responses to this item. Of these, the majority (94.3%) believed that administrative support was important for successful use of electronic technologies for teaching and learning.

Summary

Technology provision at Mzuzu University has improved since its opening a decade ago. Remarkably, almost all faculty members have computers and are connected to wireless network. Other developments have been the provision of equipment needed for in-class technology use. While this is the case, a very small proportion of the faculty members have integrated technology in the classroom. A number of impediments stand in the way of faculty members’ efforts to use integrate technology in teaching and learning. These impediments range from inaccessibility of equipment, inadequate infrastructure, lack of clear logistics in loaning of equipment, lack of knowledge and skills to use the technologies, lack of up-to-date faculty development programs to help faculty members acquire the knowledge and skills and lack of overall support to aid faculty members integrate the technologies. Faculty members generally attached a lot of importance to accessibility of technologies; infrastructure; training; administrative, technical and pedagogical

support and involvement in decision making. This speaks to the reason why the absence of these factors was deemed as a barrier to the integration of the technologies in teaching and learning.

Chapter 5: Discussion

Rogers (2003) laid a very good foundation for understanding and studying diffusion and adoption of innovations. Further to Rogers (1995, 2003) work, Daniel Surry (1997) and other scholars (e.g., Ely, 1999) have endeavored to shed more light on how Rogers Diffusion of Innovations theory applies in the diffusion and adoption of instructional technologies. This study was an extension of Rogers' (2003) DOI theory and Surry's (1997) application of the DOI theory to study how members of university faculty in a developing country are utilizing technology following its diffusion to that country and sought to determine factors associated with the present level of utilization.

All faculty members of Mzuzu University were surveyed to collect information in regards to technology utilization, factors affecting this utilization and perceived importance of those factors in regards to technology integration. The survey was followed by interviews of ten faculty members, one administrator and one librarian. SPSS was used to analyze data collected through the survey by running frequencies of the data and tabulating the results to offer summaries of the results in the form of percentages, means and standard deviations. Interviews were transcribed verbatim and coded to identify common themes under which results were presented. A cross analysis of the study was done to identify similarities, differences and areas of elaboration and points for triangulation. Major themes identified in this study were: accessibility to computers, the Internet and the World Wide Web; extent of technological innovation adoption; factors facilitating the present adoption level; factors hindering adoption, diffusion, and use of technology; effect of electronic technologies on teaching and learning; and effect of electronic technology diffusion on faculty members' perception on technology for teaching and learning.

Study Limitations

The study did present a number of limitations that were either inherent to the study methodologies employed as well as some unanticipated issues. This being a two-phase study, the limitations that were common to the two data collection methodologies are presented first. Then those limitations that correspond to the specific phase have been presented by phase.

The first limitation of the study was inherent in the topic itself. Different authors tend to use different terminology to describe the concept of electronic technologies for teaching and learning. These terms are sometimes used synonymously. It is not unusual to see in one report the author using ICT and in another use instructional technology. As Kadzera (2004) observes, the term instructional technology is broad and may not therefore be fully addressed in any one particular study. Hence, the meanings that these terminologies convey to the respondents and indeed the reader may be different. In this study report, the researcher has used electronic technologies for teaching and learning. The term electronic technologies for teaching and learning was operationalized as describing the use of computers, the Internet and other associated equipment in teaching and learning. When reporting findings of other studies, the author used the terminology that was used in those particular studies.

Phase I Survey Limitations

Limited External Validity

While most surveys aim at obtaining results that can be generalized to the general population, this particular survey made no provisions for generalizations because the aim of the study was not to generalize findings to other institutions. Hence, a sampling strategy for data collection was not utilized in this study. All faculty members of a single institution were

surveyed. Therefore, findings would only apply to Mzuzu University although insights for further studies in similar institutions might accrue from findings of this particular study.

Non-return Characteristics

While efforts were made to obtain a large proportion of questionnaires from respondents, only 60% of the faculty members returned their questionnaires. Due to issues of anonymity, it was difficult to determine the characteristics of the non-returns. It may well be that had the non-returns represented a particular segment of faculty members whose opinions would have affected the overall results of the study.

Self-reported Opinions

The survey depended on self-reported opinions and perceptions of respondents. As such, responses may not be an accurate representation of how they actually felt and what they actually did. Interpretations and applications of results should therefore be done cautiously.

Phase II Interview Limitations

Interview Conditions

The interview technique relies on the willingness of the respondent to provide information that is accurate and complete (Breakwell, Hammond & FifeSchaw, 1995). Issues of power between the interviewer and the respondents may affect the respondent's position in the interview process and restrict their responses. "Interview data limitations include possibly distorted responses due to personal bias, anger, anxiety, politics, and simple lack of awareness…"(Patton, 2002, p. 306). Care was taken to establish rapport with the respondents before the interviews began. Additionally, since interviews were conducted in respondents' offices based on their choice, it was envisaged that they would feel comfortable and not feel threatened by the interviewer. Using two data collection methods and different data sources in

the interviews (librarian, administrator and faculty members), made provisions for triangulation, therefore helping "build on strengths of each type of data collection while minimizing weaknesses of any single approach" (Patton, 2002, p. 307).

Interviewer Bias

The interviewer is the sole data collection instrument in interviews. This being the case, there are possibilities of bias in questioning, recording of interview data and even reporting. To defuse possibilities of bias in collecting data, systematic data collection procedures were used systematically (Patton, 2002) by using an interview protocol, tape recording the interviews and transcribing the interviews verbatim. In reporting, effort was made to convey interviewees' views by including direct quotes from the interview transcription.

Discussion of the Findings

There is need to view how the data responded to the research questions which guided the research study. In this section, data will be discussed in response to the research questions. Results and findings of similar research questions will be discussed and compared to the results of this current research, followed by a concluding analysis.

The study aimed at determining the prevailing accessibility levels of the computers and the Internet at Mzuzu University; determine adoption levels of these technologies, determine whether faculty members were using the electronic technologies for teaching and learning and identify factors that facilitate or hamper the use and integration of the electronic technologies in teaching and learning. Both quantitative and qualitative data collection procedures yielded results that point to similar conclusions. Also, it should be noted that Mzuzu University continues to progressively make improvements in the area of electronic technologies. Hence it may even be that by the time this report is read, some of the issues described in this report might have been

addressed. Below is an outline of outcomes derived from the data collected. Findings related to each research questions will be discussed after this summary list.

1. Accessibility to computers, the Internet and the World Wide Web: Mzuzu University has taken positive steps in providing computers and the Internet to faculty members since its opening some ten years ago. Almost every faculty member has a computer in his or her office and most of those who have computers are also connected to the Internet. The most prevailing internet connection in use by faculty members is the wireless network which has been associated with intermittent connectivity issues. These issues range from slowness due to low bandwidth, to total disruption due to metallic offices in which most faculty members operate. Electricity outages have also been a major cause of Internet disruptions.
2. Extent of technological innovation adoption: Most faculty members have adopted the computer and internet technologies except for very few who reported non-use of the technologies.
3. Factors facilitating the present adoption level: A number of factors have facilitated the present adoption levels. One major factor has been the availability of the technologies. Having computers in offices that are connected to the Internet has not only introduced faculty members to these technologies, but in a number of ways caused them to seek ways of using the technologies.
4. Factors hindering adoption, diffusion, and use of technology: A number of scholars and researchers have identified factors that tend to hinder the adoption, diffusion, and the use of technology in teaching and learning (Baltaci,Goktalay & Huguet, 2008; Del Favero & Hinson, 2007; Fulford, Main-Anakalea & Boulay, 2008; Keengwe,

Onchwari, Wachira, 2008; Morrison & Osborn, 2005; Moser, 2007; Nicolle, 2005). This study identified similar factors in most cases. These factors were, lack of accessibility to available equipment, lack of knowledge and skills to use the technologies, lack of involvement in decisions making involving electronic technologies by faculty members, lack of infrastructure to support the technologies, lack of technical, pedagogical and administrative support.

5. Effect of electronic technologies on teaching and learning: Although Mzuzu University has made tremendous efforts to provide faculty members with computers and the Internet, there was generally limited reported use of the technologies in class or outside the classroom for teaching and learning. In most cases, the Internet was used for supplementing textbooks and for research purposes. Only in rare cases were the technologies utilized inside the classroom. Given this state of affairs, it can be concluded that the effect of the electronic technologies on teaching and learning must be very minimal.
6. Effect of electronic technology diffusion on faculty members' perception on technology for teaching and learning: Although the introduction of computers and the Internet has most certainly increased faculty members' engagement with these technologies, it was evident that such engagement had not necessarily changed faculty members' perceptions concerning technology for teaching and learning

Access to Technologies

Any developments in the area of electronic technologies should be seen from the overall perspective of global and more local developments. While there have been a rapid improvement in the area of networking in Africa (Adeya, 2001; Jensen, 2007; Keengwe, 2007), most African

universities face insurmountable problems in the use of ICT due to lack of computers and a lack of access to affordable high-speed internet connectivity (Farrell, Glen & Isaacs, 2007). This has caused the African countries to lag behind in this area.

It is estimated that on average, an African university has bandwidth capacity equivalent to a residential broadband connection in Europe, and pay about 50 times more than educational institutions in the rest of the world. While computers and the internet are common place in the developed countries, they are still in the early process of adoption in developing nations (Adeya, 2001; Arias & Clark, 2004; Schachter, Pence, Zuckernick &Roberts (2005). Correspondingly, the process of adoption and diffusion of ICTs is transitory (Farrell, Glen & Isaacs, 2007). Such progress, though sporadic, systematically affects and is affected by educational institutions in such nations. Incidentally, countries like South Africa and Egypt stand out as satellites of technological change in Africa, but most of the countries in the Sub-Saharan region specifically, are experiencing this change in slow fashion (Farrell, Glen & Isaacs, 2007). Yet there still exist, among such countries, technological development satellites which are making an effort in spearheading ICT development in the continent. “Interest in and use of ICTs in education appear to be growing, even in the most challenging environments in developing countries” (Trucano, 2007, p. 2). These sentiments are also shared by Arias and Clark (2004), Obuobi, Adrion and Watts (2006), Rajesh (2003). The result has been a rapid increase in the use of ICTs in educational institutions in these countries (Arias & Dickelman, 2005).

Research question one sought to determine the current level of computer and internet accessibility at Mzuzu University. Findings of the study render evidence to suggest that electronic technologies have proliferated to Malawi in general and Mzuzu University in particular despite economic challenges being felt by the country as a whole and the university in

particular. Responses provided by the administrator and the librarian and indeed the faculty members; suggest that the university has made major strides by providing computers to almost every faculty member. Some of those who had joined the University most recently had not received computers yet but plans were under way to get them computers. Most of the computers that faculty members received were refurbished computers which came as donations from the United Kingdom. However, most of them were in working order. The only problem that was echoed by faculty members was that Microsoft Office was not installed on these machines. Instead free software called Ubuntu which was not favored by most faculty members was installed.

Almost all the faculty members who had computers in their offices were connected to the Internet. The most prevalent internet connection amongst faculty members at the moment was the wireless internet. The administration and the library had a cable connection. The wireless network was said to have a number of problems, one of which was intermittent connectivity due to issues associated with low bandwidth and the type of buildings in which faculty members were located. Associated with internet connection was the issue of electricity. Power outages in the city of Mzuzu and lack of a reliable standby power generator to supply electricity to faculty members' offices during power outages posed a lot of problems and added to the existing issues related to network connectivity. This finding aligns with findings of ICT and education in Africa which was conducted by Farrell, Glen and Isaacs (2007) and observations made by several scholars (e.g., Adeya, 2001; Schachter, Pence, Zuckernick & Roberts, 2005) which echoed the issue of electricity as a major issue affecting connectivity in Africa. Despite this setback, it was evident that internet provision at the university had improved in the past five years and that the

university administration was making efforts to improve the situation despite financial constraints of a young institution.

Many faculty members had personal laptops which they used at home for school related work, as well as personal matters. However, access to the internet was mostly limited to the university campus. Once the faculty member got home, they could not use the Internet as their homes did not have internet access. There were indications that a number of faculty members might start to get connected to the Internet in the near future through developments and efforts in the telecommunications department in the city. Of particular interest is the possibility that members of staff could get connected through their cell phones using phone cards or by getting registered through a phone company.

The university had a number of computer labs which catered for students' computer and internet needs. However, the computers were insufficient as students had to line up waiting for others to get done with their work before they could have access to the computers.

The results render evidence to suggest that while Mzuzu University has progressed in the area of electronic technology, there are still areas of concern which need redress if the current situation is to be maintained at a minimum or improved. The purchasing of newer computers and associated software could help ensure sustainability of this progress. It is clear that the university, despite having an interest in electronic technologies, has not invested a great deal of resources in this area. The software being used on the donated computers is free software provided by Ubuntu network, an organization committed to assisting African countries through provision of free software and other services (Farrell, Glen & Isaacs, 2007). Also, the computers belonging to faculty members did not have up-to-date antivirus protection. As a result, most computers had viruses which made computer use difficult for faculty members.

In a nutshell, computer and internet provision at Mzuzu University has improved in the past decade despite several setbacks associated with quality of hardware, software, connectivity and power outages. Most of the faculty members had desktop computers in their offices which were connected to wireless network. Although the computers were mostly refurbished donations, they were still in working order. Internet connectivity was hampered by power outagesand low bandwidth. Problems associated with electronic technologies at Mzuzu University are common to other institutions in Malawi (Kadzera, 2006); and Africa in general (Adeya, 2001; Farrell, Glen & Isaacs, 2007; Jensen, 2007; Keengwe, 2007)

Extent of Electronic Technology Adoption and Utilization

Many scholars concur that technology availability does not always translate into in-class use or integration into the classroom (Bauer & Kenton, 2005; Cuban, Kirkpatrick & Peck, 2001). This is especially true in developed nations which have experience a major thrust in regards to technology diffusion and adoption. Studies conducted in these environments suggest that while availability of the technologies is basic to any integration effort, it is not sufficient and does not guarantee integration into the curriculum (Bauer & Kenton, 2005; Cuban, Kirkpatrick & Perk, 2001; Shamburg, 2004; Towler, Miller & Kumari, 2000).

After looking at computer and Internet accessibility at the university, it was necessary to investigate if faculty members had indeed adopted the technology. If respondents reported using the computer technology and the Internet, it was an indication that they had adopted the electronic technology. As such, the second research question involved determining the extent of electronic technology adoption among faculty members. Research question three which is closely linked to question two, sought to investigate ways in which faculty members were utilizing technology after its diffusion in the university.

In as far as adopting electronic technology is concerned, most faculty members have adopted it. The findings also reveal that the older and longer serving faculty members tended to use technology less than the newer ones. Also, the larger the class size one taught, the less they used technology. Survey results and Interviews conducted with the librarian, the administrator and indeed the faculty members revealed that the faculty members were using technology although in varied degrees. Some faculty members used electronic technology more than others. Mostly, they used the computer technology for preparing teaching notes, preparing exam results, and presenting lectures. The Internet was being used for sending emails- mostly to colleagues and friends, conducting research and supplementing textbooks; and rarely as a teaching/learning platform. As far as using technology for instructional purposes was concerned, the results indicated that mostly it was used for research than anything else.

The use of the Internet to support teaching and learning was just beginning to emerge at the university. By the time of the interviews, the university had just introduced a learning management system which promised to change the way some faculty members teach. Very few faculty members had started using it. Most of them were not even aware of its existence. It remains to be seen how the mainstream faculty members will embrace this learning management system as a tool for teaching and learning. Rogers' (2003) individual innovativeness seems to provide an explanation for this.

Innovativeness refers to the degree of how early an individual or social system adopts an innovation in relation to others (Rogers, 2003). Rogers posits that the first group of individuals to adopt innovation-called innovators comprises 2.5% of the population and lead the way in adopting an innovation. These results align with Rogers' (2003) postulation that in any social system, there are people that will adopt an innovation early enough and lead the way and those

that with either trail behind or never adopt the innovation at all. The few faculty members who are already making use of the learning management system are a good example of Rogers (2003) innovators who, despite the learning management system being new, have already adopted it while the rest of the faculty members have not even heard about it.

In a study that explored the diffusion of *information and learning technology* (ILT) among educators in Malaysia, it was shown that while faculty members appreciated the importance of ILT as vital in teaching, only few used it in actual teaching (Rashid & Gloeckner, 2008). Similarly, in the present study, although most faculty members were appreciative of the electronic technologies capability to aid in teaching and learning, their interaction with the technologies and application for classroom use were limited in most cases.

Rogers (2003) identifies four important elements inherent in any diffusion process: the innovation, time, communication and the social system. These elements rely on one another so much so that absence of one element results in failure for diffusion to take place. For example you cannot even talk of diffusion if the innovation is not there. Of the four elements, communication has been deemed central to any diffusion process (Rogers, 2003). For individuals in a social system to learn about an innovation, they need to be told about it either by word of the mouth, or other communication channels.

Organizational structures such as bureaucracy may make it even more challenging to get an innovation adopted due to the type of communication structure that exists in these organizations. Consequently, as Surry and Brennan (1998) surmise, adoption does not guarantee continued usage of the innovation. Even after adoption, gathering of information by the adopters may be significant to the continued use of the innovation (Roger, 1995).

In the study being reported here, there seemed to be lack of communication between the library section and faculty members; and the administration and faculty members. In most cases, different parties used assumptions about others. For instance, the librarian assumed that faculty members knew about the equipment the library had for use by faculty members. On the other hand, faculty members seem to have had no clue about the idea. Similarly, the administration assumed that if faculty members needed training, they would request it. Hence silence on the part of faculty members was deemed by the administration to mean that the faculty members did not need to be trained. On the other hand, faculty members did not know they were supposed to make requests in order for the trainings to be conducted. These findings align with Rogers assertions that communication is central to the diffusion and adoption of an innovation. Hence the introduction of the learning management system, if not complimented by good communication for faculty members to know about it, and how to use it, it may end up not being used optimally.

A study conducted by Durrington, Repman, and Valente (2000) investigated a group of university faculty's adoption of technology use. Results, which validated Rogers' assertion, indicate that adoption of technology use by faculty members was hampered by lack of communication between friendship networks. This speaks to the significance of communication in diffusion and adoption of innovations. The results of this study by Durrington and colleagues confirm Rogers' (2003) postulation that when individuals are similar in some ways and share common language and meaning, chances for them to understand each other are higher making it more likely for them to form positive attitudes towards each other thereby positively influencing the possibility of adopting a new idea.

Unfortunately, the very nature of technological innovation requires that the innovation diffuses from people who are highly knowledgeable and skilled to those who are not (Rogers, 2003). This may limit possibilities for adoption. This seems to explain the fact that the few individual who are in the forefront integrating technology at Mzuzu University while not necessarily being more skilled and knowledgeable, may posses certain characteristics that differentiate them from the mainstream faculty members, making them heterophilous (Rogers, 2003) and therefore, not helpful in getting the information about new technologies transmitted to the mainstream faculty members.

Facilitators and Barriers of Electronic Technology Integration

Research questions five and six sought information regarding factors that facilitated (enablers) (Surry, 2005) and hindered (barriers) (Surry, 2005) electronic technology integration among faculty members. Specifically, items in this category concerned financial resource allocation, involvement in decision making, awareness of policies, fairness of such policies, whether the policies were documented and provision of support. These items were solicited from Surry's (2005) RIPPLES model with permission. As for interview questions, Ely's (1999) facilitating conditions formed the basis for development of the questions.

While Mzuzu University has made headway in making computers and the Internet available for faculty members' use, results of the study suggest that accessibility of the technologies has not resulted in corresponding integration into the curriculum. These findings are in agreement with assertions and findings of other studies in this area (e.g., Bauer & Kenton, 2005; Eteokleous, 2008; Keengwe, Onchwari & Wachira, 2008; Cuban, Kirkpatrick & Peck, 2001; Oncu, Delialioglu & Brown, 2008). A number of other factors interact to determine whether the

available technologies are employed for classroom use. Such factors have been termed enablers and/or barriers.

Barriers to and facilitating conditions for adoption and use of technology by faculty members are like two faces of the same coin. The same factor may be a facilitating factor if it is present. Lack of that same factor may be a barrier. For example, training is expected to facilitate adoption and integration of electronic technology. Lack of training would be a barrier to integration efforts.

A number of factors have been acknowledged by a number of scholars as having an impact on technology adoption and integration: access to hardware and software (Morrison & Osborne, 2005; Nicolle, 2005), time for planning and skills development (Bauer & Kenton, 2005; Cuban, Kirkpatrick & Peck, 2001; Leggett & Persichitte, 1998; Morrison & Osborne, 2005; Nicolle, 2005; Shamburg, 2004; Towler, Miller & Kumari, 2000), technical and administrative support and resources (Schrum, 1999), professional development and expertise (Adams, 2005; Cuban, Kirkpatrick & Peck, 2001; Hughes, 2005; Nisan-Nelson, 2001; Shamburg, 2004), and vision and leadership (Ely, 1999).

While faculty members in developing nations are generally eager to embrace new technologies, just like faculty in developed nations, they have to deal with issues that limit their ability to integrate the electronic technologies in their teaching. Cost of connectivity, accessibility to reliable electricity, lack of training in ICT, lack of trained personnel to service equipment and unavailability of ICT infrastructure are major factors identified to stand in the way of successful integration of electronic technologies into the curriculum in most African countries (Adeya, 2001; Farrell, Glen & Isaacs, 2007; Schachter, Pence, Zuckernick & Roberts, 2005). Findings of this study support with those identified by Schachter and his colleagues.

Findings from the survey and the interview render evidence to suggest that financial resources, infrastructure, lack of involvement in decision making, administrative support and lack of equipment pose barriers to the integration of electronic technologies in teaching and learning at Mzuzu University.

The role played by the administration is crucial for any endeavor at any university-electronic technology implementation inclusive. Faculty members interviewed were either discontented or unsure as to what the role of the administration was as far as electronic technologies were concerned at this university. For those who were discontented, they indicated that the administration was mainly involved in purchasing and installing the electronic technologies. The administrator who was interviewed concurred with the views of the faculty members to the effect that the administrator could do more to not only provide financial resources and required equipment, but also to ensure that faculty members were given the support they needed to adopt and implement electronic technologies for teaching and learning.

Lack of support in whatever degree, be it technical or pedagogical, may affect the extent of faculty members' actual use of electronic technology in a classroom setting. If faculty members are not trained, and are not supported to use electronic technologies in the classroom, there would certainly be little motivation to use it. A similar study conducted to explore the diffusion of *Information and Learning Technology* (ILT) among career and technical educators in Malaysia, identified institutional support (Rashid & Gloeckner, 2008) as a significant factor in the adoption of ILT. This finding is in line with assertions made by some other scholars (e.g., Ely, 1999; Lynch, 2002; Butler & Sellbom, 2002). Additionally, familiarity with technologies has been identified as playing an important role in facilitating faculty members' usage of those technologies (Rashid & Gloecker, 2008). Familiarity comes with training, availability of the

technologies and technical support. If one or some of these aspects are lacking, faculty members may not have the confidence they need to go before students and use the technologies. One comment made by one of the Interviewees was “You do not want to appear stupid before students”. This postulation concurs with findings of a study that was conducted in Thailand by (Intaganok & Waterworth, 2008) to investigate the relationship between the attitudes of higher education staff and their skill development in ICT in which low levels of skills in ICT were associated with higher levels of anxiety regarding ICT use. Access to computers and the Internet both at home and office was found to be significantly linked to ICT competence levels which in turn influenced anxiety levels.

Most studies conducted have revealed that adequate professional development is deemed necessary by faculty members as vital for successful integration of technology into teaching (Adams, 2005; Cuban, Kirkpatrick & Peck, 2001; Higgins & Spitulnik, 2008; Hughes, 2005; Nisan-Nelson, 2001; Shamburg, 2004). The findings of this study align with these findings. Faculty members indicated lack of training as one of the major factors affecting their integration efforts. Most of them reported lacking even the basic proficiency required to interact with the electronic technologies at a minimum level. Those who had some basic skills in using the electronic technologies acquired them through their own personal initiative.

A survey of African countries’ ICT activities and initiatives found out that most countries had made some efforts to develop faculty’s capacity to use ICTs as a tool for teaching and learning through in-service and pre-service programs. However, such programs mostly involved the development of basic skills mostly deemed as ends in themselves and not a means for integrating the ICTs in teaching and learning (Farrell, Glen & Isaacs, 2007).

Yet, studies conducted in technology-rich environments render evidence to suggest that even faculty members with necessary proficiency in using electronic technologies find it difficult to integrate the technologies into the curriculum (Bauer & Kenton, 2005). How much more difficult must it be for those with less or no proficiency at all? For a growing institution like Mzuzu University, there is need to develop well scheduled training plans to ensure that old and new faculty members are not only introduced to electronic technologies, but are also kept abreast with changes in the technologies since technology is dynamic. Training offered should not center on using technology in isolation of the curriculum, but it should be closely connected to their situations, students and subject matter; more timely to their teaching; more collaborative with peers; and more problem-oriented and challenging (Hughes, 2005; Nisan-Nelson, 2005).

Another factor that was identified as having impact on electronic technology integration is the whole issue of involvement in decision making. Ely (1999) postulates that authentic participation where implementers are not just involved in the mechanics of implementation but more importantly, in decisions related to planning and design of the innovation serves to enhance communication and inculcate a sense of ownership in all concerned parties. He envisages that spontaneous adoption, support, advocacy and willingness to use the innovation would result from this kind of participation.

Results of the survey and the interviews both render evidence to suggest that faculty members were not involved in decision making related to electronic technologies for teaching and learning. It was noted through discussion with the administrator that lack of enthusiasm to include faculty members in decisions making processes concerning electronic technologies was partly due to discontentment the faculty members had with results of their previous involvement. It seems their requests were not being met and hence they considered it not worthwhile to take

part in decisions that would not be of benefit to them. If Ely's (1999) notion is anything to go by, Mzuzu University should make faculty members part of the decision making cadre so that they do not only appreciate the issues going on in this area of electronic technology, but make an input into the decisions made based on their experiences and challenges.

Another notable finding from this study suggests that lack of readily available equipment like projectors and fitted computers hampered in-class use of electronic technologies. Since the lecture rooms did not have fitted computers and projectors, the few faculty members who used the LCD projectors had to have personal laptops and to carry the projectors around with them. This obviously was not only inconvenient, but also meant that faculty members who did not have laptops could not use the projectors. While findings of studies from technology-rich environments elucidate that even when schools or universities are equipped with the necessary technological gadgets, there is no guarantee for integration (Bauer & Kenton, 2005; Cuban, Kirkpatrick & Peck, 2001); it can be anticipated that lack of necessary equipment is a sole basis of guaranteed non-use.

The university needs to ensure that LCD projectors are made accessible by assigning at least one per department. Logistics involved in loaning out equipment should be made clear and known to all faculty members to avoid ambiguities and wrong assumptions. Efforts should also be made to fit large lecture rooms with computers and projectors to allow faculty members' easy access to such facilities.

Rogers (2003) postulates that the perceived attributes of an innovation provide an important explanation in regards to how fast an innovation is adopted. He asserts that if an individual perceives an innovation as having particular attributes they are likely to adopt it.

Of particular relevance to this study is the attribute of relative advantage which may take the form of economic gains, social prestige or other benefits (Rogers, 2003). If faculty members view electronic technology integration as providing opportunities for promotion, recognition or helping them to teach better, they may opt to use it despite the prevailing challenges (Marx, 2005). Such was not the case in the study being reported here. Faculty promotional issues were identified as affecting the adoption and integration of technology in teaching and learning negatively.

Promotions at the university were based on overall good teaching evidenced from self reported forms that faculty members submitted to the administration and to a larger degree; and research and publication initiatives accomplished by the faculty members. There was no direct link between technology use and faculty promotion. In a university where in-class electronic technology usage is constrained by low availability and accessibility of equipment and infrastructure, it goes without saying that lack of purposeful motivation for the faculty members who are making an effort to use to it is tantamount to discouragement. There is need to attach a motivational aspect for those who have gone against all odds and pursued the use of electronic technologies for teaching and learning despite the existing setbacks. Additionally, Rogers (2003) *observability*, which is termed as the extent to which results of adopting the innovation are visible to others, would also come into play to motivate non-users to consider taking the trouble to use them. If faculty members feel that there is a reward attached to using technologies in teaching, and they observe others being rewarded for integrating the technology, it is most likely that they would consider trying to use the technologies (Ely, 1999). If on the other hand, they regard technology integration as a time waster, there is very little that would encourage them to go ahead integrate them in their teaching.

In summary, results of this present study are consistent with those of other studies conducted in the area of electronic technology integration. A milliard of factors exist that can either facilitate or inhibit the process of electronic technology use. First, the technologies must be available if they are going to be used at all. Hence, availability of computers, internet access, and infrastructure are vital for technology adoption and use. Financial resources help to facilitate the purchase and maintenance of the technologies. Once the technologies are available, efforts should be made to ensure that faculty members are aware of their existence, and how to use them. Training support develops faculty members' skills in using the technologies and boosts the faculty members' confidence to start using technology (Gulbahar, 2007; Harris, 2008). On the other hand, timely technical and pedagogical supports are necessary for continued use of electronic technologies. If electronic technologies are not available, there is no way faculty members can be expected to use them, hence, unavailability of computers, the Internet and necessary financial resources are precursors to failure to technology integration. If faculty members are not trained and lack technical and pedagogical support, chances for them to adopt and integrate electronic technologies are slim even if the technologies are available.

Role of Electronic Technology on Teaching and Learning

Many scholars of educational technology have postulated that technology has the potential to transform the way faculty members and students operate (Allesi & Trollipi, 2001; Carr, 1999; Chin, 2004; Girod & Cavanaugh, 2001; Viadero, 2004). Despite this potential, the scholars concur that technology availability has not always translated into in-class use or integration into the classroom (e.g., Bauer & Kenton, 2005; Cuban, Kirkpatrick & Peck; 2001). While availability of the technologies is basic to any integration efforts, it is not sufficient and does not guarantee integration into the curriculum. Certain conditions must be met for electronic

technologies to positively impact teaching and learning (Mehlinger & Powers, 2002; Thompson, Schmindt & Davis, 2003). The success of technology integration depends more on "human and contextual factors than on hardware or software" (Valdez, Mcnabb, Foertsch, Anderson, Hawkes & Raack, 2000, p. 4). Greenhalgh (2005) concurs with this notion by asserting that although a particular innovation may be readily adopted in one context and indeed be found to be effective, efficient, acceptable and cost-effective in one site, it does not mean that it will be adopted readily and work similarly in another site (Greenhalgh et al, 2005). Differences in the individuals delivering it and differences in sets of potential adopters will interact to cause differences in adoption rates and determine the extent of cost-effectiveness, acceptability and efficiency.

While newer electronic technologies facilitate much richer and realistic collaboration and interaction among young learners, such technologies have mainly impacted student access to information outside the classroom (National Science Foundation, 2008). Adopter-based theories of instructional technology as described by Surry (1997) seem to offer an explanation on the findings of the present study. These theories assert that creation and provision of products that are superior to existing ones is not sufficient in bringing about educational change (Surry, 1997). Hence, provision of computers and the Internet should not be expected to bring about educational change straight away (Arias & Clark, 2004; Bauer & Kenton, 2005; Clausen, Britten, Ring, 2008).

In view of this, research question six sought information in regards to how electronic technology has affected teaching and learning in the university. Results from this study agree with the instrumentalist, adopter-based perspective offered by Surry (1997) in that while the university has gone through a transformation in the last ten years of operation as far as electronic technology is concerned, the impact of this transformation on teaching and learning has at best

been minimal. Although most faculty members have adopted the technology and are in some ways actively engaged with it, findings of this study elucidate that this engagement has very little to do with teaching and learning. This is in agreement with observations made by Arias and Clark (2004), Bauer and Kenton (2005), Eteokleous, (2008) and Green (2001) that despite increased availability and access to instructional computer use in higher education classrooms, few faculty members have effectively and efficiently integrated computer technology in their classroom.

The findings of this research also align with the findings of a study conducted by Kadzera (2006) in Malawian teacher training colleges which determined that despite many lecturers ability to use computers in varied ways, very little of that use translated to students' engagement with the computers.

The findings also suggest that while the university administration has facilitated the purchase and disbursement of computers to faculty members and indeed the campus-wide internet installation at the university, there is still more that needs to be done to ensure that electronic technologies' use leaves the confines of the office and find their way to the classroom.

Effect of Technology Access on Faculty Members' Perception on Technology for Teaching and Learning

Research question seven sought to determine ways in which access to technology affected the faculty members' perception on technology for teaching and learning. Findings of the study in regards to this research question render evidence to suggest that the faculty members have more or less the same perception of technologies for teaching and learning despite the improved access to such technologies. While increased accessibility of computers and the Internet made it easy for faculty members to engage with such technologies, it did little to

change their existing inclinations as far as technology use for teaching and learning is concerned. This is indeed evidenced by the fact that some faculty members chose to do nothing with technology while others sought new ways of utilizing the existing technologies for teaching and learning. This finding leads one to the conclusion that there must be other factors- personal or otherwise- which interact to affect individuals' attitudes, perceptions and consequently whether they engage with technologies or not.

Rogers (2003) has tried to explain these factors through the *Individual Innovativeness* theory. In this theory, Rogers postulates that different individual posses different characteristics which determine how early they will adopt an innovation. He identifies five adopter categories: innovators, early adopters, early majority, late majority and laggards. The first adopter group, the innovators, comprises 2.5% of the social system. While the innovators lead the way in the diffusion and adoption processes, they do not necessarily hold high opinion leadership Rogers (2003). It is the early adopters who, apart from being early enough in the adoption process, are also held in high esteem and looked up to by the average potential adopter in the social system (Rogers, 2003). This then explains the need to get this particular group of adopters (which is larger in size than innovators) involved in the adoption process to ensure that the rest of the individuals in the social system get influenced to adopt the innovation.

For Mzuzu University, the utilization of electronic technologies for teaching and learning purposes is still under the "custody" of innovators. Provision of an enabling environment that fosters easy communication of new ideas and technology will help the early adopters (Rogers, 2003) get actively involved and in turn influence the early majority (Rogers, 2003) to also adopt the electronic technologies for teaching and learning.

A study which was conducted to explore indicators of how technology will be integrated into the classroom by Nisan-Nelson (2001), found that while environmental factors help facilitate adoption of technologies, it is the personal traits of the teacher that affect technology integration. Further, the study found that if there is a match between a teacher's learning style with the design of technology-based instructions; teachers tend to integrate technology more. Besides, Sandholtz, Ringstaff & Dweyer (2000) share this notion when they contend that beliefs faculty members hold about schooling do not only determine their pedagogical styles, but go further to influence their technology integration practices in the classroom. Hence, it is the personal and deeply entrenched factors regarding instruction and pedagogy and the role of computing in teaching and learning that play a significant role as far as technology integration is concerned (Keengwe, Onchwari, Wachira, 2008; Knezek & Christensen, 2002; Wood, Specht, Willoughby, & Mueller, 2008; Nisan-Nelson, 2001).

This view is in agreement with the technological instrumentalism perspective which considers technology as being within human control (Surry, 1997) such that provision of technically and instructionally sound products like electronic technologies is deemed insufficient in enabling faculty members integrate technology in teaching and learning (Arias & Clark, 2004; MacKenzie,1996; Pool, 1997) . If this perspective is anything to go by, it is not surprising that provision of computers and the Internet has not done much to change the mindset of faculty members at the university in regards to technology use in teaching and learning. If anything, it is the existing mindset, values, beliefs that seem to have had an influence on faculty members' use and integration or electronic technology in teaching and learning.

These findings and indeed findings of others (e.g., Bauer & Kenton, 2005; Cuban, Kirkpatrick & Perk, 2001; Schibeci, MacCallum, Cumming-Potvin, Durrant, Kissane & Miller;

2008) suggest that the administration of Mzuzu University should consider doing more than just providing the computers, the Internet and equipment. Human and interpersonal facets of the technologies should be on the priority list of the administrators if faculty members are expected to make use of the electronic technologies in their teaching and learning.

To summarize, the research question seven sought to investigate whether increased access to electronic technologies change faculty members' perceptions about technology for teaching and learning. Results of both the survey and the interview elucidate that increased access to technology did not change faculty members' perception toward technology as a tool for teaching and learning. Rather, existing beliefs and personal factors seem to have actually played a significant role in determining whether faculty members made an effort to integrate the technologies or not.

Recommendations

From the discussion of the findings, it is clear that Mzuzu University has significantly developed the technological infrastructure of the institution. Progress thus far has been mostly characterized by provision of computers to faculty members and connecting them to internet network. The following strategies are recommended to ensure that electronic technologies are integrated into teaching and learning. These recommendations can serve to provide a framework for guiding the technology integration process.

1. From faculty responses to interview questions on barriers to technology use and integration, it is necessary to prioritize up-to-date software installation on computers: Much as the university has endeavored to supply computers and network connection to almost all faculty members, it is vital that software installation be amongst the priorities in this regard. The use of free software should be viewed as a temporary measure while

the university is sourcing finances for up-to-date software installation. Additionally, the installation of up-to-date anti-virus protection should be viewed as a must and not just optional. Hence any hardware purchases made should be associated with software considerations and purchases, including anti-virus protection.

2. Results from interviews with the administrator, the librarian and faculty members indicate that different departments made assumptions in regards to issues of training and loaning out of equipment due to lack of communication amongst these departments. It is necessary therefore, to improve communication amongst departments to ensure that all involved are kept aware of any new developments in electronic technologies. To facilitate this, deliberate attempts should be made to establish information forums and communication channels aimed at boosting communication amongst the different departments.
3. Faculty members' rating of training support and faculty members' interview responses on training issues revealed that training support for faculty members was insufficient. It is therefore necessary to ensure that faculty members have the knowledge and skills to use the computers and the Internet profitably: While supplying computers and other associated equipment is a welcome idea, effort should be made to mainstream faculty development as an on-going endeavor to introduce new technologies and keep faculty members abreast of the dynamic developments in electronic technologies. As a starting point, a training needs assessment should be conducted to identify training gaps and facilitate development and delivery of training that is relevant.
4. Interview responses and survey results indicate that faculty members were not actively involved in decision making concerning electronic technologies for teaching and learning.

It is therefore important to involve faculty members in decision making concerning electronic technologies for teaching and learning: One way to keep information flow regular amongst different departments in the university is to involve faculty members in decision making forums. This would assure all involved that views of faculty members are taken aboard and at the same time avoid misconceptions and ambiguities for all involved.

5. One issue that emerged from interviews with the librarian and faculty members is the fact that despite there being equipment for loaning out to faculty members, it was unclear to faculty members what they needed to do to get the equipment. Hence there is need to make electronic equipment accessible and establish clear logistics for loaning out such equipment.
6. Interviews with the administrator, the librarian and faculty members revealed that power outages was one major issue confronting faculty members' use and integration of electronic technologies in teaching and learning. It is therefore necessary to provide a reliable stand-by generator in the academic section for use during power outages: Due to constant power outages, it would be a good idea to make provisions for reliable stand-by generators to cater for the needs of the library as well as faculty members so that power interruptions should not limit electronic technology usage by faculty members.
7. Survey results indicate that policies regarding electronic technologies were either non-existent or where they existed; they were not clear enough to be known by faculty members as well as students. It is therefore important to make policies regarding electronic technology clear and known to faculty members. Where such policies are inexistent, ensure that they are formulated and that some faculty members are involved in

the formulation process so that they can act as a bridge between the administration and other faculty members in conveying the information to others. It is also vital to ensure that policies related to faculty tenure and promotion be reformulated to include an element of technology integration as one of the criteria for tenure and promotion.

Areas for Further Study

Electronic Technologies continue to diffuse to developing nations. As universities in these developing nations strive to provide faculty members with such technologies, it is obvious that such endeavors will be met with barriers and setbacks. Mzuzu University, despite and in providing faculty members with computers and the Internet, has met a number of hitches which may be local in nature and in some instances universal. A study aimed at determining the use of instructional technology was conducted by Kadzera (2004). This study was confined to Teacher Colleges in Malawi. Hence there is need to conduct studies in other educational institutions in Malawi as an extension of this present study.

While it was noted that personal factors came into play in affecting adoption and integration of the electronic technologies, it was beyond the scope of this study to indentify these factors. It would therefore be interesting to go further and study such factors and how they interact to impact faculty members' adoption and use of electronic technologies in teaching and learning. Also, a lot would be learned if Rogers' (2003) Individual Innovativeness theory was used to determine characteristics inherent in faculty members who have defied all odds and implemented electronic technologies in teaching and learning despite the existing setbacks.

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Appendix A

IRB Approval

VirginiaTech

Office of Research Compliance
Institutional Review Board
2000 Kraft Drive, Suite 2000 (0497)
Blacksburg, Virginia 24061
540/231-4991 Fax 540/231-0959
e-mail moored@vt.edu
www.irb.vt.edu
FWA00000572(expires 1/20/2010)
IRB # is IRB00000667

DATE: March 3, 2009

MEMORANDUM

TO: Barbara B. Lockee
Nertha Nyirongo

Approval date: 5/21/2008
Continuing Review Due Date:5/6/2009
Expiration Date: 5/20/2009

FROM: David M. Moore

SUBJECT: **IRB Amendment 1 Approval:** "Technology Adoption and Integration: A Descriptive Study of a Higher Education Institution in a Developing Nation" , IRB # 08-323

This memo is regarding the above referenced protocol which was previously granted approval by the IRB on May 21, 2008. You subsequently requested permission to amend your IRB application. Since the requested amendment is nonsubstantive in nature, I, as Chair of the Virginia Tech Institutional Review Board, have granted approval for requested protocol amendment, effective as of March 3, 2009. The anniversary date will remain the same as the original approval date.

As an investigator of human subjects, your responsibilities include the following:

1. Report promptly proposed changes in previously approved human subject research activities to the IRB, including changes to your study forms, procedures and investigators, regardless of how minor. The proposed changes must not be initiated without IRB review and approval, except where necessary to eliminate apparent immediate hazards to the subjects.
2. Report promptly to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.
3. Report promptly to the IRB of the study's closing (i.e., data collecting and data analysis complete at Virginia Tech). If the study is to continue past the expiration date (listed above), investigators must submit a request for continuing review prior to the continuing review due date (listed above). It is the researcher's responsibility to obtain re-approval from the IRB before the study's expiration date.
4. If re-approval is not obtained (unless the study has been reported to the IRB as closed) prior to the expiration date, all activities involving human subjects and data analysis must cease immediately, except where necessary to eliminate apparent immediate hazards to the subjects.

cc: File

Appendix B

Procedural plan for Data Collection

The following table outlines the plan for conducting the case study as suggested by Yin (1989).

Table 19. Plan for Conducting the Proposed Case Study at Mzuzu University

Communication with the Academic Registrar concerning study, purpose and duration; and participants' solicitation.	April 2008
Identification of participants by name and department.	April 2008
Hand-delivering survey instrument to participants and agreeing on submission procedures.	8-14th July, 2008
Collecting filled survey instruments from participants (phase one).	15-21 July, 2008
Initial perusal of filled survey instruments to identify areas for interview questions.	21-22 July, 2008 Soon after collection
Collecting filled survey instrument (phase two).	28-31 July, 2008
Identification of Interview participants	
Final perusal of second lot of filled survey instruments to identify and modify interview questions protocol.	4- 8 August, 2008
Piloting interview questions.	4-8 August, 2008

Sending written consent letters to interview participants and getting them signed.	
Contacting participants for interviews and notifying them about the process involved including signing of consent forms and agreement on interview date and venue.	4-8 August, 2008
Conducting Interviews	11-15 August, 2008
Transcribing interviews	From 25th August

Appendix C

Table 20. Aligning research question to theoretical model, data source and instrument

Research question	Operationalized variable	Theoretical model	Data source	Data collection instrument
What is the present level of accessibility computers, the Internet and the world wide web?	Ownership of computers by faculty, level of internet access, Network speed connectivity		Faculty members, Library staff Administrator	Interview protocol 6- 9 3-11 2- 6 Observation
To what extent have faculty members adopted ICT innovation?	Faculty members' usage of computers, the Internet and the World Wide Web	Adoption Decision process Individual Innovativeness	Members of faculty Faculty Librarian	Survey instrument Part 1: # 9 Interview Protocol 4, 13- 14 12- 15
How are faculty members utilizing ICT after its diffusion in a higher education institution in Malawi?	Ways in which the Internet, the World Wide Web and computers are used.	Perceived attributes Adopter-based models	Faculty members	Survey instrument Part 2 #s 1-13 Interview Protocol #s 5, 16
What factors facilitated the present adoption level?	Issues related to faculty members adoption of technology.	RIPPLES model Ely's facilitating conditions perceived attributes	Faculty Library staff administrative staff	Survey 3C: 1-7 Interview protocol #s 12-23 #s 9-23
What factors inhibit adoption of technology by the faculty members?	Issues related to faculty members adoption of technology.	RIPPLES Model Ely's facilitating conditions, perceived attributes,	Faculty members Faculty Library staff administrative staff	Survey 3C: 1-7 Interview protocol #s 20, 23-28 #s 12-23 #s 9-23

Research question	Operationalized variable	Theoretical model	Data source	Data collection instrument
How has technology diffusion affected teaching and learning?	Are faculty members using computers, the Internet and World Wide Web for teaching and learning?	Adopter-based models e.g., Teachers' ACOT model, CBAM, - Integrated technology Adoption and Diffusion model	Faculty members Faculty Administrator	Survey instrument Part 2 #s 1-3 Interview protocol 11, 16-18 # 7
How has access to technology affected the faculty members' perception on technology for teaching and learning?	Opinions regarding technology for teaching and learning.	Individual innovativeness, Integrated technology Adoption and Diffusion model.	Faculty members	Interview protocol: 29 - 32 Survey part 3A, 1-4 3B, 1-7; 3D 1-7

Appendix D

Survey Instrument

Technology Adoption and Integration: A Descriptive Study of a Higher Education Institution in a Developing Nation

Questionnaire

Instructions: The objective of this survey is to identify factors that influence faculty members' use of electronic technologies in the delivery of instruction. **PLEASE DO NOT IDENTIFY YOURSELF ON THIS SURVEY. ALL INDIVIDUAL RESPONSES WILL REMAIN CONFIDENTIAL. ONLY THE AGGREGATE RESULTS WILL BE REPORTED.** Thank you for participating in this survey.

FOR PURPOSES OF THIS SURVEY, ELECTRONIC TECHNOLOGY IS DEFINED AS USING A COMPUTER AND THE INTERNET AS TOOLS FOR TEACHING AND LEARNING.

This survey consists of three parts. The first part will ask you for demographic information. The rest of the parts will require you to provide your perceptions and opinions regarding electronic technology. Each part has its own instructions. Please read the instructions before providing responses. Thank you for taking time to provide answers to this survey.

PART ONE: Demographic Information

Please supply the following information regarding your experiences and background.

1. **Gender:**
   ___Male
   ___Female

2. **Age:**
   ___20 to 29
   ___30 to 39
   ___40 to 49
   ___50 to 59
   ___60 to 69
   ___70 or above

3. **Highest Degree Held:**
   ___Doctorate
   ___Masters
   ___Bachelors

___Other (Please specify) _____

4. **Professional Rank:**
___Professor
___Associate Professor
___Assistant Professor
___Lecturer
___Adjunct Instructional Faculty (Part-time, Non-Tenure Track)
___Assistant lecturer
___ Staff Associate

___Other (Please Specify) _____

5. **How many years have you taught at college/ University level? _____**

6. **How many classes do you typically teach per week? _____**

7. **How many students do you typically teach per class? _____**

8. **In which department do you teach?**
___Education & Teaching Studies
___Physics
___Humanities
___Mathematics
___Language & Literature
___Energy Studies
___ Library Info. Science
___ICT
___ Nursing
___Biomedical Science
___Land management
___Hospitality management
___Chemistry
___Biology
___Math
___Religious Studies
___Forestry
___Other specify_____

9. **What is your present level of experience in the use of electronic technology for the delivery of instruction? Please check only one response.**

___Non-user
___Novice
___Average
___Expert

PART TWO: Electronic Technology Use for Teaching and Learning

Please circle the response option that best describes the frequency of your use of electronic technologies in the last year.

Response Key:
(1 = Never; 2= Seldom; 3 = Occasionally; 4 = Often; **5 = Almost all the time)**

		(Please circle one)				
1.	Created and used an On-line Syllabus.	1	2	3	4	5
2.	Designed Web-based lectures, notes, and tutorials	1	2	3	4	5
3.	Designed Web-based tests or quizzes	1	2	3	4	5
4.	Enabled and supported student group work online	1	2	3	4	5
5.	Enabled and supported collaboration among students online	1	2	3	4	5
6.	Used Internet-based audio systems for instruction or review	1	2	3	4	5
7.	Conducted academic advising online	1	2	3	4	5
8.	Used On-line Chat rooms	1	2	3	4	5
9.	Provided grades online	1	2	3	4	5
10.	Used a Computer and projector in the classroom (e.g., PowerPoint, Excel,)	1	2	3	4	5
11.	Exchanged student written work via the Internet (e.g., email attachments, digital drop boxes, discussion forums, etc.)	1	2	3	4	5
12.	Used Email as the primary source of student contact outside the classroom	1	2	3	4	5
13.	Used the Internet for research	1	2	3	4	5

PART THREE

A. The following questions deal with what is being done and to what extent regarding electronic technologies for teaching and learning at this university.

Please select by circling the response option that best represents your opinion to the following questions.

Response key:
(1 = Low; 2 = Average; 3 = Above average; 4 = High)

		(Please circle one)
1.	To what extent do you think sufficient financial resources are allocated for electronic technology for teaching and learning at Mzuzu University?	1 2 3 4
2.	To what extent do you think the leaders of this University consider your opinions, ideas, and beliefs when making decisions regarding electronic technologies for teaching and learning?	1 2 3 4
3a.	To what extent are you aware of the existence of policies regarding electronic technology for teaching and learning at this university?	1 2 3 4
b.	To what extent do you think policies of Mzuzu University regarding electronic technologies are fair?	1 2 3 4
c.	To what extent do you think policies of Mzuzu University regarding electronic technologies are up to date?	1 2 3 4
d.	To what extent do you think policies of Mzuzu University regarding electronic technologies are documented?	1 2 3 4
e.	To what extent do you think policies of Mzuzu University regarding electronic technologies are well known by faculty members?	1 2 3 4
f.	To what extent do you think policies of Mzuzu University regarding electronic technologies are well known by students	1 2 3 4
4.	To what extent does Mzuzu University provide the support necessary for you to implement electronic technologies for teaching and learning effectively?	1 2 3 4

B. The following questions deal with the quality of what's being done regarding electronic technologies for teaching and learning at this university.

Please select by circling the response option that best represents your opinion to the following questions.

Response key:
(1 = Nil; 2 = Low; 3 = Average; 4 = Above average; 5 = High)

		(Please circle one)				
1.	How would you rate the allocation of financial resources in this University to electronic technology integration initiatives?	1	2	3	4	5
2.	How would you rate the quality of the electronic technology infrastructure of this University?	1	2	3	4	5
3.	How would you rate the amount of shared decision making in this University specifically related to electronic technologies for teaching and learning?	1	2	3	4	5
4.	How would you rate the policies of this University specifically related to the integration of electronic technologies for teaching and learning?	1	2	3	4	5
5.	How would you rate the support you receive in terms of training relating to electronic technology for teaching and learning?	1	2	3	4	5
6.	How would you rate the technical support you receive relating to electronic technology for teaching and learning?	1	2	3	4	5
7.	How would you rate the pedagogical support you receive relating to electronic technology for teaching and learning?	1	2	3	4	5

C. The following questions investigate whether what's being done regarding electronic technologies at this university create barriers or serve as enablers.

Please select by circling the response option that best represents your opinion to the following questions.

Response key:
(1 = Major barrier; 2 = Minor barrier; 3 = Neutral; 4 = Minor enabler; 5 = Major enabler)

		(Please circle one)
1.	Do you think the financial resources of this University act as a barrier or an enabler to the integration of electronic technologies?	1 2 3 4 5
2.	Do you think the infrastructure of Mzuzu University acts as a barrier or an enabler to the integration of electronic technologies for teaching and learning?	1 2 3 4 5
3.	Do you think that the culture of Mzuzu University, specifically shared decision making and communication, acts as a barrier or an enabler to the use of electronic technologies for teaching and learning?	1 2 3 4 5
4.	Do you think that the policies of Mzuzu University act as a barrier or an enabler to the use of electronic technologies for teaching and learning?	1 2 3 4 5
5.	Do you think that Mzuzu University's commitment to learning outcomes acts as a barrier or an enabler to the use of electronic technologies for teaching and learning?	1 2 3 4 5
6.	Do you think that the quality and quantity of evaluations in this University acts as a barrier or an enabler to the use of electronic technologies for teaching and learning?	1 2 3 4 5
7.	Do you think that the overall support system of Mzuzu University acts as a barrier or an enabler to the integration of electronic technologies for teaching and learning?	1 2 3 4 5

D. The following questions deal with the importance of what's being done regarding electronic technologies for teaching and learning at this university.

Please select by circling the response option that best represents your opinion to the following questions.

Response key:
(1 = Not important; 2 = Moderate important; 3 = Extremely important)

		(Please circle one)		
1.	Overall, how would you rate the importance of financial resources (money) to the successful use of electronic technology for teaching and learning?	1	2	3
2.	Overall, how would you rate the importance of infrastructure to the successful use of electronic technology for teaching and learning?	1	2	3
3.	Overall, how would you rate the importance of shared decision making and participation to the successful use of electronic technologies for teaching and learning?	1	2	3
4.	Overall, how would you rate the importance of appropriate policies to the successful use of electronic technologies for teaching and learning?	1	2	3
5.	Overall, how would you rate the importance of technical support to the successful use of electronic technologies for teaching and learning?	1	2	3
6.	Overall, how do you rate the importance of training to the successful use of electronic technologies for teaching and learning?	1	2	3
7.	Overall, how do you rate the importance of administrative support to the successful use of electronic technologies for teaching and learning?	1	2	3

End of survey

Thank you for taking your time to respond to questions in this survey.

Appendix E

Interview protocol for Faculty members

My name is Nertha Nyirongo and I am doing research on integration of electronic technology in teaching and learning. By electronic technology we mean computers and the Internet. Of particular interest in this study is to determine whether faculty members have access to computers and the Internet. If they have access to computers and the Internet, are they utilizing the technologies and how are they utilizing them. I also want to identify, if any, factors affecting the current use of electronic technologies for teaching and learning.

- Discuss issues of confidentiality and anonymity.
- Obtain signature on informed consent form.
- Ask for permission to audiotape the interview.

- Proceed with the rest of the interview

Interview protocol for Faculty members

1. How many years have you been teaching?

2. How many years have you been teaching at this University?

3. What courses do you teach?

The following questions deal with technological issues:

4. Do you ever use electronic technologies?

5. How are you using electronic technologies currently?

6. Do you have a computer in your office? If yes, is it connected to the Internet? How fast is the Internet connectivity?

7. Do you think there are enough computers for every faculty member?

8. In your opinion, are there enough computers for every student?

9. Do you have a computer at home? If yes, is it connected to the Internet? How fast is the internet connectivity?

10. Do you have any additional comments related to technological issues?

The following questions deal with faculty technological skills issues:

11. Do you use the computer at home to do teaching-related work or only at school?

12. How proficient are you in using computers in general?

13. How proficient are you in using the Internet?

14. What prior experience do you have with electronic technology? How did you learn?

15. Do you have any additional comments related to faculty technological skills?

The following questions deal with faculty integration: By faculty integration we mean the use of electronic technologies for teaching and learning.

16. What do you use the Internet for?

17. Do you use the Internet for instructional purposes? If yes, how?

18. How do you incorporate electronic technology in your teaching?

19. What is your greatest concern about using the electronic technologies for teaching and learning?

20. What factors discourage you from using the electronic technologies for teaching and learning?

21. What factors if in place do you think would help improve faculty members' use of electronic technologies for learning?

22. What changes are necessary for effective technology use?

23. Does the present Internet speed help you download instructional materials?

24. What role does the administration play in facilitating faculty's integration of electronic technology in teaching?

25. Are you satisfied with the present level of involvement by the administration to support faculty members' integration of electronic technology in teaching?

26. What would you want done by the administration to improve the status quo?

27. Are you involved in decision making concerning technology adoption and integration?

28. In what ways are you involved?

29. How did you view electronic technology as a tool for teaching and learning when the accessibility level was lower than the present level of access?

30. Is there any difference between the way you viewed technology as a tool for teaching and learning before its availability and the present access level? If yes, can you elaborate?

31. Apart from easy access, are there any other factors which have affected the way you view technology as a tool for teaching and learning? If yes, what are these factors?

32. Do you have any additional comments related to faculty technology integration issues?

Thank you for your time.

Appendix F

Interview Protocol for the Librarian

My name is Nertha Nyirongo and I am doing research on integration of electronic technology in teaching and learning. By electronic technology we mean computers and the Internet. Of particular interest in this study is to determine whether faculty members have access to computers and the Internet. If they have access to computers and the Internet, are they utilizing the technologies and how are they utilizing them. I also want to identify, if any, factors affecting the current use of electronic technologies for teaching and learning.

- Discuss issues of confidentiality and anonymity.
- Obtain signature on informed consent form.
- Ask for permission to audiotape the interview.

- Proceed with the rest of the interview

Interview Protocol for the Librarian

1. How long have you worked at this university?

2. Have you always worked at this present level?

The following questions deal with technological issues.

3. May you describe for me the process the university has gone through in introducing electronic technologies at the university?

4. How has this process impacted faculty members?

5. What is the present Internet speed?

6. Do faculty members have computers in their offices?

7. What kind of computers do they have?

8. Are these computers connected to the Internet?

9. What problems do you face in trying to cater for internet needs for faculty members?

10. How reliable is electricity supply in this city?

11. Do you have additional comments related to technology issues?

The following questions are related to faculty integration issues.

12. What is the role of the library in preparing faculty to use electronic technologies in teaching
13. Have you ever conducted trainings related to electronic technologies for faculty members? If so, what was this training about? When it was last conducted? Is it done regularly?
14. Are faculty members involved in training needs identification? How are they involved?
15. What are future training plans?
16. How is the library supporting in-class use of electronic technologies for teaching?
17. How does the library cater for individual faculty member's needs in using electronic technologies for teaching?
18. If faculty members want to use any electronic technology devices in-class, where do they go to access it? Are they located in particular classrooms? Who is in charge of loaning such devices to faculty members?
19. In your opinion, what factors influence this present usage of electronic technologies for instructional purposes?
20. What factors, if in place, would help improve the use of electronic technology for teaching and learning by faculty members?
21. Have you received any feedback from faculty regarding technology access? If so, what kind of feedback did you receive?
22. Have you received any feedback from faculty regarding technology integration? If so, what kind of feedback did you receive?
23. Do you have additional comments related to integration issues?

Thank you for your time.

Appendix G

Interview Protocol for Administrator

My name is Nertha Nyirongo and I am doing research on integration of electronic technology in teaching and learning. By electronic technology we mean computers and the Internet. Of particular interest in this study is to determine whether faculty members have access to computers and the Internet. If they have access to computers and the Internet, are they utilizing the technologies and how are they utilizing them. I also want to identify, if any, factors affecting the current use of electronic technologies for teaching and learning.

- Discuss issues of confidentiality and anonymity.
- Obtain signature on informed consent form.
- Ask for permission to audiotape the interview.

- Proceed with the rest of the interview.

1. How long have you worked at this university?

The following questions deal with technological issues

2. Can you describe the status of electronic technology at this university in terms computer and internet access by faculty members?
3. Do faculty members have computers in their offices?
4. If yes, are these computers connected to the Internet? If the computers are not connected to the Internet, where do faculty members go to access the Internet? What is the current Internet speed at this University?
5. Is electricity supply reliable? If not, do you have a back-up system in place in time of intermission? If yes, what kind of back-up is in place? What is the radius of this back-up system?
6. Do you have additional comments related to technological issues?

The following questions deal with integration issues: By integration we mean the ability of faculty members to incorporate electronic technologies in teaching and learning.

7. In your opinion, do you think faculty members are integrating electronic technology in teaching and learning? If yes, how are faculty members using electronic technology for teaching and learning?
8. Is there anyone who coordinates electronic technology integration efforts by faculty members? If yes, who are they? In what way are the coordination efforts done?
9. Are faculty members involved in decisions concerning electronic technology? How are they involved?
10. In what ways does the administration support faculty members in their use of electronic technologies?
11. Are faculty members rewarded when they integrate technology in their teaching?
12. What kinds of rewards are provided?
13. Do faculty members have time to learn and use technology?
14. How is this time incorporated in the time table scheduling?
15. Are faculty members trained in the use of electronic technology?
16. What kind of training was provided? Was this training technological, instructional or both? Do you have any documentation of the training in the form of handouts?
17. How often is this type of training offered to faculty members?
18. Is there a plan for training? If yes, what are future training plans?
19. In your opinion, are faculty members satisfied with the status quo as far as electronic technologies are concerned?
20. What factors would you consider improving to help faculty members integrate electronic technology in teaching?

21. Are there factors preventing faculty members from successfully integrating technology in teaching? What are they? How would you solve them?

22. Do you have additional comments related to faculty integration issues?

23. Do you have any general comments to add?

Thank you for your time.

Appendix H

Letter to the Registrar Mzuzu University

Virginia Polytechnic Institute and State University
120 War Memorial Hall
School of Education
Blacksburg
Virginia, 24060
U.S.A

Registrar -Academic
Mzuzu University
P/Bag 201,
Mzuzu
Att: Yonamu Ngwira
Dear Sir,

Request to Conduct Data Collection

Further to the email I sent to you on April 8th, 2008, I am writing to officially notify you that I intend to conduct data collection activities at your University. This research is in partial fulfillment of my Doctoral degree requirements which will culminate into dissertation writing. My research aims at identifying factors related to technology adoption and integration by faculty members. My purpose for writing is twofold. First, I would like to request permission to conduct the proposed study at your university. Second, I would like to solicit assistance from you to help by providing me with names of faculty members and the departments they work in. This information will help me plan for the data collection exercise which includes a survey of all faculty members and interviews with few selected staff members of varied categories ranging from administrative to faculty members.

I look forward to hearing from you soon.

Cordially,

Nertha Nyirongo

Appendix I

Consent Form

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
Informed Consent for Participants
in Research Projects Involving Human Subjects
Title of Project: Technology Adoption and Integration: A Descriptive Study of a Higher Education Institution in a Developing Nation

Investigator:

Nertha Kate Nyirongo, School of Education
Research Advisor:

Dr Barbara Lockee, School of Education

I. Purpose of this Research/Project

The purpose of this study is to solicit information regarding computer and internet adoption and use among faculty members of Mzuzu University. Also, the study seeks to elicit information regarding factors that facilitate and hamper computer and internet adoption and use among faculty members of Mzuzu University.
Results of this study will go along way establishing the current status of technology adoption and diffusion and identify factors that aid in or stand in the way for increased adoption and use. The study will among other things add to the body of knowledge regarding technology adoption and diffusion in universities in developing countries which is minimal at the moment. Also, the study will help administrators to identify areas that may require consideration and working on to change or maintain the status quo.

II. Procedures

This research will be in two phases. The first part involves administration of a survey questionnaire. The second phase involves interviews.
The questionnaire contains self-administered questions. You will be hand-delivered a questionnaire and requested to fill it at your own time and venue within a week of receiving it. Your role in this phase is therefore to fill the questionnaire and keep it until the investigator comes to pick it up.
The investigator will notify you if you have been chosen to participate in the interviews to which you will be at liberty to accept or not. If you agree to take part in the interviews, you will the investigator will discuss with you everything concerning the interview. This interview will be 30 minutes long. At your agreement, the interview will be tape-recorded. If at any time of the interview you decide that you no longer want to be audio-recorded, you will be at liberty to say so and the investigator will stop the recorder. Your role in this interview will be to suggest time and venue for the conduct of the interview, provide your opinions and ideas concerning

questions given. If at any time you no longer wish to participate in this study, you are at liberty to say so and you will be dropped.

III. Risks

There are no more than minimal risks associated with research

IV. Benefits

The study will among other things add to the body of knowledge regarding technology adoption and diffusion in universities in developing countries which is minimal at the moment. Also, the study will help administrators to identify areas that may require consideration and working on to change or maintain the status quo.
A statement must be included to the effect that -- no promise or guarantee of benefits have been made to
A summary of research results will be provided to the participants at your request.

V. Extent of Anonymity and Confidentiality

Your participation in this study will be completely anonymous, and data will be analyzed and described in aggregate form only. Further, when publishing the results of this study, the name of our university will not be included. It is possible that the Institutional Review Board (IRB) may view this study's collected data for auditing purposes; however, since this is an anonymous survey, your identity would not be compromised. The IRB is responsible for the oversight of the protection of human subjects involved in research.
In addition, the Interview

VI. Compensation

Participants will not be compensated for participating in this study.

VII. Freedom to Withdraw

You are free to withdraw from this study at any time; to do so, please quit out of your web browser. Further, you may refuse to answer any questions you don't want to answer and still remain in the study.

VIII. Subject's Responsibilities

I voluntarily agree to participate in this study. I have the following responsibilities:
• Submit this "Informed Consent" form,
• Fill out the survey that follows, and
• Submit it once complete.

IX. Subject's Permission

I have read the Consent Form and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent:
Chair, Virginia Tech Institutional Review
Board for the Protection of Human Subjects
Office of Research Compliance
2000 Kraft Drive, Suite 2000 (0497)
Blacksburg, VA 24060
_____ Date_____
Subject signature
_____ Date _____
Witness (Optional except for certain classes of subjects)

Should I have any pertinent questions about this research or its conduct, and research subjects' rights, and whom to contact in the event of a research-related injury to the subject, I may contact:

Nertha Kate Nyirongo (265) 320575 nnyirong@vt.edu
Faculty Advisor Telephone/e-mail
Dr Barbara Lockee (540) 231-9193
David M. Moore 540-231-4991/moored@vt.edu

Appendix J

Request and Acceptance to Use Instrument

----- Original Message -----
From: Nertha Kate Nyirongo
Date: Saturday, April 12, 2008 10:11 am
Subject: Request to use Instrument
To: medlinbd@appstate.edu

Dr Medlin,

I am a doctoral student at Virginia Polytechnic Institute and State University and I am in the process of preparing a data collection instrument for my research endeavor. I have just come across your instrument and I think it matches quite well with the purpose for my study. My research aims at identifying factors related to technology adoption and integration by faculty members. If accepted, I would like to use selected parts of the instrument with some minor modifications to suit the context of my study which is in a developing country. I would very much appreciate if this request meets your favorable response. Looking forward to hearing from you. Cordially,
Nertha-Kate Nyirongo

Hi Nertha-Kate,

It of course would be my pleasure for you to use my instrument and I would be interested in your findings as well. So if you would not mind sharing your findings...who knows maybe we could publish a journal article together.

My best wishes for you future degree and research endeavors.

Dawn Medlin

Dr. B. Dawn Medlin
Interim Chairperson/Associate Professor
Computer Information Systems Department
Office 2103
Appalachian State University
Boone, NC 28607
medlinbd@appstate.edu
828.262.2411

Appendix K

Request and Acceptance to Use Research Instrument

120 War Memorial Hall
Virginia Tech
Blacksburg,
VA 24061
May, 10th, 2008

Dear Dr Surry,
My Name is Nertha Nyirongo and I am a PhD Candidate at Virginia Tech in Instructional Design and Technology. I write to request you to kindly allow me to use your RIPPLES instrument for data collection purposes. My research is on the Adoption and Integration of Electronic Technologies in teaching and learning. I will conduct my study in Malawi- Africa; hence I may modify the present RIPPLES instrument to suit the study context. I hope to share my study findings with you once the study is finalized. I look forward to hearing from you soon.
Cordially,

Nertha Kate Nyirongo

MEMORANDUM

TO: NERTHA KATE NYIRONGO

FROM: DANIEL W. SURRY, ED.D.
ASSOCIATE PROFESSOR
UNIVERSITY OF SOUTH ALABAMA

SUBJECT: RIPPLES MODEL SURVEY INSTRUMENT

DATE: 5/11/2008

You have my permission to use the RIPPLES Model survey instrument for your dissertation study. Please feel free to modify the instrument as required to meet your needs.

If I can be of any other assistance in your research, now or in the future, please do not hesitate to ask. Good luck with your study!

Appendix L

Table 21. Survey Respondents' Demographic Information

			Mean	Standard Deviation
Gender		N=53	1.7547	0.43437
	Male	75.5%		
	Female	24.5%		
Age		N=53	2.58	1.26238
	20 to 29	15.1%		
	30 to 39	47.2%		
	40 to 49	17.0%		
	50 to 59	5.7%		
	60 to 69	15.1%		
Highest Degree Held		N=53	2.3585	0.73627
	Doctorate	9.4%		
	Masters	50.9%		
	Bachelors	34.0%		
	Other	5.7%		
Position		N=53	4.9057	1.69006
	Professor	1.9%		
	Associate	5.7%		
	Professor	54.7%		
	Lecturer	1.9%		
	Adjunct faculty	5.7%		
	Assistant lecturer	26.4%		
	Staff Associate	3.8%		
	Senior Lecturer			
Number of Years Teaching at College/University		N=52	4.9808	3.12793
	1 year	9.4%		
	2 years	24.5%		
	3 years	7.5%		
	4 years	11.3%		
	5 years	5.7%		
	6 years	3.8%		
	7 years	3.8%		
	8 years	15.1%		
	9 years	5.7%		
	10 or greater than 10 years	11.3%		
Number of classes/hours taught per week		N=50	3.34	1.66120
	Less than three classes per week	17.0%		
	4 classes per week	24.5%		
	5 classes per week	3.8%		
	6 classes per week	7.5%		
	7 classes or more per week	41%		
Average number of students Teaching		N=53	3.6275	2.04901
	10-20 students per class	11.3%		
	21-30 students per class	28.3%		
	31-40 students per class	15.1%		
	41-50 students per class	9.4%		
	51-60 students per	11.3%		

	class			
	61-70 students per class	3.8%		
	More than 70 students per class	17.0%		
Department teaching		N=52	7.0962	4.72482
	Education and	11.3%		
	teaching Studies	15.1%		
	Humanities	5.7%		
	Mathematics	18.9%		
	Language &	7.5%		
	Literature	9.4%		
	Library	5.7%		
	Information	1.9%		
	Science	1.9%		
	ICT	1.9%		
	Nursing	5.7%		
	Biomedical	5.7%		
	Science	3.8%		
	Land Management	1.9%		
	Hospitality	1.9%		
	management			
	Chemistry			
	Biology			
	Religious Studies			
	Forestry			
	Other			
Electronic technology skills		N=53	2.7170	0.94822
level	Non-user	13.2%		
	Novice	22.6%		
	Average	43.4%		
	Expert	20.8%		

Appendix M

Table 22. Electronic Technology Use for Teaching and Learning

Item		Percentage	Mean	Standard Deviation
Created and used an online syllabus		N=53	1.8113	1.2662
	Never	66.0%		
	Seldom	5.7%		
	Occasionally	13.2%		
	Often	11.3%		
	Almost all the time	3.8%		
Designed Web-based lectures, notes, and tutorials		N=53	1.6415	1.16189
	Never	73.6%		
	Seldom	3.8%		
	Occasionally	9.4%		
	Often	11.3%		
	Almost all the time	1.9%		
Designed Web-based tests or quizzes		N=53	1.1321	0.44018
	Never	90.6%		
	Seldom	5.7%		
	Occasionally	3.8%		
	Often	0.0%		
	Almost all the time	0.0%		
Enabled and supported student group work online		N=53	1.4717	0.97278
	Never	75.5%		
	Seldom	11.3%		
	Occasionally	5.7%		
	Often	5.7%		
	Almost all the time	1.9%		
Enabled and supported collaboration among students online		N=53	1.4151	0.88652
	Never	77.4%		
	Seldom	9.4%		
	Occasionally	9.4%		
	Often	1.9%		
	Almost all the time	1.9%		
Used Internet-based audio systems for instruction or review		N=53	1.3208	0.70092
	Never	77.4%		
	Seldom	17.0%		
	Occasionally	1.9%		
	Often	3.8%		
	Almost all the time	0.0%		
Conducted academic advising online		N=53	1.3585	0.87912
	Never	81.1%		
	Seldom	9.4%		
	Occasionally	3.8%		
	Often	3.8%		
	Almost all the time	1.9%		
Used On-line Chat rooms		N=53	1.4151	0.98905
	Never	81.1%		
	Seldom	5.7%		
	Occasionally	7.5%		
	Often	1.9%		
	Almost all the time	3.8%		

Provided grades online		N=3	1.3585	0.81085
	Never	81.1%		
	Seldom	5.7%		
	Occasionally	9.4%		
	Often	3.8%		
	Almost all the time	0.0%		
Used a Computer and projector in the classroom (e.g., PowerPoint, Excel,)		N=53	2.3774	1.44417
	Never	41.5%		
	Seldom	17.0%		
	Occasionally	15.1%		
	Often	15.1%		
	Almost all the time	11.3%		
Exchanged student written work via the Internet (e.g., email attachments, digital drop boxes, discussion forums, etc.)		N=53	1.9057	1.28996
	Never	62.3%		
	Seldom	5.7%		
	Occasionally	15.1%		
	Often	13.2%		
	Almost all the time	3.8%		
Used Email as the primary source of student contact outside the classroom		N=53	2.1321	1.42826
	Never	50.9%		
	Seldom	17.0%		
	Occasionally	11.3%		
	Often	9.4%		
	Almost all the time	11.3%		
Used the Internet for research		N=53	3.8491	1.30673
	Never	9.4%		
	Seldom	7.5%		
	Occasionally	13.2%		
	Often	28.3%		
	Almost all the time	41.5%		

Appendix N

Table 23. Extent of electronic technology development and improvement efforts

Item		Percent	Mean	Standard Deviation
To what extent do you think sufficient financial resources are allocated for electronic technology for teaching and learning at Mzuzu University?		N=52	1.6154	0.79592
	Low	52.8%		
	Average	34.0%		
	Above average	7.5%		
	High	3.8%		
To what extent do you think the leaders of this University consider your opinions, ideas, and beliefs when making decisions regarding electronic technologies for teaching and learning?		N=50	1.88	0.74615
	Low	30.2%		
	Average	47.2%		
	Above average	15.1%		
	High	1.9%		
To what extent are you aware of the existence of policies regarding electronic technology for teaching and learning at this university?		N=52	1.4423	0.80229
	Low	71.7%		
	Average	11.3%		
	Above average	13.2%		
	High	1.9%		
To what extent do you think policies of Mzuzu University regarding electronic technologies are fair?		N=51	1.7451	0.82081
	Low	43.4%		
	Average	37.7%		
	Above average	11.3%		
	High	3.8%		
To what extent do you think policies of Mzuzu University regarding electronic technologies are up to date?		N=50	1.84	0.79179
	Low	35.8%		
	Average	39.6%		
	Above average	17.0%		
	High	1.9%		
To what extent do you think policies of Mzuzu University regarding electronic technologies are documented?		N=49	1.5306	0.73886
	Low	52.8%		
	Average	34.0%		
	Above average	1.9%		
	High	3.8%		
To what extent do you think policies of Mzuzu University regarding electronic technologies are well known by faculty members?		N=52	1.5192	0.75382
	Low	60.4%		
	Average	26.4%		
	Above average	9.4%		
	High	1.9%		
To what extent do you think policies of Mzuzu University regarding electronic technologies are well known by students?		N=51	1.6275	0.77358
	Low	50.9%		
	Average	32.1%		
	Above average	11.3%		
	High	1.9%		
To what extent does Mzuzu University provide the support necessary for you to implement electronic technologies for teaching and learning effectively?		N=53	1.8302	0.80230
	Low	37.7%		
	Average	45.3%		
	Above average	13.2%		
	High	3.8%		

Appendix O

Table 24. Quality of Efforts Being Done Regarding Electronic Technology

Item		Percentage	Mean	Standard Deviation
How would you rate the allocation of financial resources in this University to electronic technology integration initiatives?		N=48	2.1667	0.72445
	Nil	13.2%		
	Low	52.8%		
	Average	20.8%		
	Above average	3.8%		
How would you rate the quality of the electronic technology infrastructure of this University?		N=52	2.4615	0.75307
	Nil	9.4%		
	Low	39.6%		
	Average	43.4%		
	Above average	5.7%		
How would you rate the amount of shared decision making in this University specifically related to electronic technologies for teaching and learning?		N=51	1.9216	0.77054
	Nil	28.3%		
	Low	50.9%		
	Average	13.2%		
	Above average	3.8%		
How would you rate the policies of this University specifically related to the integration of electronic technologies for teaching and learning?		N=50	1.9200	0.82906
	Nil	28.3%		
	Low	50.9%		
	Average	11.3%		
	Above average	1.9%		
	High	1.9%		
How would you rate the support you receive in terms of training relating to electronic technology for teaching and learning?		N=52	1.9038	0.91308
	Nil	35.8%		
	Low	43.4%		
	Average	13.2%		
	Above average	3.8%		
	High	1.9%		
How would you rate the technical support you receive relating to electronic technology for teaching and learning?		N=52	2.1346	0.88625
	Nil	24.5%		
	Low	43.4%		
	Average	22.6%		
	Above average	7.5%		
How would you rate the pedagogical support you receive relating to electronic technology for teaching and learning?		N=52	1.9231	0.90415
	Nil	34.0%		
	Low	45.3%		
	Average	13.2%		
	Above average	3.8%		
	Missing	1.9%		

Appendix P

Table 25. Barriers and Enablers of Electronic technology Integration

Item	1 = Major barrier 2= Minor barrier 3= Neutral 4 = Minor enabler 5 = Major enabler	Percentage	Mean	Standard Deviation
Do you think the financial resources of this University act as a barrier or an enabler to the integration of electronic technologies?	Major barrier Minor barrier Neutral Minor enabler Major enabler	47.2% 7.5% 26.4% 11.3% 5.7%	2.1923	1.31415
Do you think the infrastructure of Mzuzu University acts as a barrier or an enabler to the integration of electronic technologies for teaching and learning?	Major barrier Minor barrier Neutral Minor enabler Major enabler	34.0% 20.8% 22.6% 15.1% 5.7%	2.3654	1.26845
Do you think that the culture of Mzuzu University, specifically shared decision making and communication, acts as a barrier or an enabler to the use of electronic technologies for teaching and learning?	Major barrier Minor barrier Neutral Minor enabler Major enabler	34.0% 20.8% 26.4% 13.2% 3.8%	2.3077	1.19703
Do you think that the policies of Mzuzu University act as a barrier or an enabler to the use of electronic technologies for teaching and learning?	Major barrier Minor barrier Neutral Minor enabler Major enabler	13.2% 24.5% 32.1% 20.8% 7.5%	2.8462	1.14420
Do you think that Mzuzu University's commitment to learning outcomes acts as a barrier or an enabler to the use of electronic technologies for teaching and learning?	Major barrier Minor barrier Neutral Minor enabler Major enabler	11.3% 20.8% 20.8% 32.1% 13.2%	3.1538	1.24278
Do you think that the quality and quantity of evaluations in this University acts as a barrier or an enabler to the use of electronic technologies for teaching and learning?	Major barrier Minor barrier Neutral Minor enabler Major enabler	15.1% 26.4% 35.8% 15.1% 5.7%	2.6923	1.09434
Do you think that the overall support system of Mzuzu University acts as a barrier or an enabler to the integration of electronic technologies for teaching and learning?	Major barrier Minor barrier Neutral Minor enabler Major enabler	20.8% 30.2% 24.5% 17.0% 5.7%	2.5577	1.17846

Appendix Q

Table 26. Importance of What's Being Done Regarding Electronic Technology

Item	Rating	Percentage	Mean	Standard Deviation
Overall, how would you rate the importance of financial resources (money) to the successful use of electronic technology for teaching and learning?	Not important Moderately important Extremely important	N=51 0.0% 11.3% 84.9%	2.8824	0.32450
Overall, how would you rate the importance of infrastructure to the successful use of electronic technology for teaching and learning?	Not important Moderately important Extremely important	N=50 0.0% 18.9% 75.5%	2.8	0.40406
Overall, how would you rate the importance of shared decision making and participation to the successful use of electronic technologies for teaching and learning?	Not important Moderately important Extremely important	N=51 1.9% 28.3% 66.0%	2.6667	0.51640
Overall, how would you rate the importance of appropriate policies to the successful use of electronic technologies for teaching and learning?	Not important Moderately important Extremely important	N=51 1.9% 17.0% 77.4%	2.7843	0.46103
Overall, how would you rate the importance of technical support to the successful use of electronic technologies for teaching and learning?	Not important Moderately important Extremely important	N=51 0.0% 18.9% 77.4%	2.8039	0.40098
Overall, how do you rate the importance of training to the successful use of electronic technologies for teaching and learning?	Not important Moderately important Extremely important	N=51 1.9% 7.5% 86.8%	2.8824	0.38195
Overall, how do you rate the importance of administrative support to the successful use of electronic technologies for teaching and learning?	Not important Moderately important Extremely important	N=51 1.9% 13.2% 81.1%	2.8235	0.43386