Implementation of Technology Integration in Higher Education: A Case Study of the University of Dar-es-Salaam in Tanzania

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Abstract

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The use of technology in education is one of the major trends in educational reforms all over the world. Integrating technology into the learning and teaching processes is widely perceived as a great assert in those reforms. However, the implementation process of technology integration has been surrounded by skepticism concerning its effectiveness. Challenges to and gaps in technology integration have been identified and discussed by scholars based on different contexts. In the context of higher education in developing countries, despite notable progress, many challenges loom concerning the use of technology.

The purpose of the study was to investigate and evaluate the nature of technology implementation at the University of Dar-es-Salaam in Tanzania. The study examined the classroom practices and what surrounded the learning and teaching processes using technology from the perspective of teachers and students. It also evaluated the use of technology at the University based on four of Ely's eight conditions for adoption of innovations and ACOT's stages of development of technology integration. Two research strategies were used: Interviews and document analysis. Twenty-four students, ten faculty

members, one head of a department, and one faculty dean were interviewed. They were selected from the Faculty of Science and Faculty of Education.

The findings revealed that although there were significant efforts and positive attitudes toward the use of computers in learning and teaching, the process of technology integration at the university faced impediments that affected its effectiveness. The impediments included lack of enough computers, absence of sound computer knowledge and skills of teachers and students so as to effectively integrate technology into learning and teaching, absence of adequate and effective teachers' professional development programs on technology, and lack of effective technology planning and technology plans.

The result of this study indicated that the four Ely's conditions of diffusion of innovations were not effectively met at the university and that the university's technology integration process was leveled at entry and adoption stages of ACOT's Stages of Development. The following recommendations were made: 1) more priority and emphasis on teacher training on computer knowledge and skills, 2) creation of technology plans at different levels and divisions, the process that should involve teaching staff, 3) creation of technology a committee to oversee all aspects of the use of technology, and 4) an establishment of partnership with local people and organizations to diversify sources of funds for acquisition of technology equipment and services.

Approved: _____

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Chapter One: Introduction

In this era of technological advancement, we have witnessed tremendous change in information technology such that now we are an information society, and that has greatly influenced our education. According to Al-Oteawi (2002), information technology has become the backbone of a global society. Furthermore, “Information technology is changing every institution, every business and every individual in a profound way” (Tuller & Oblinger, 1997, p. 33). One of the major trends of educational reform is geared towards acquiring and using information technology. The general impression is that integrating technology in learning and teaching is a very valuable asset in the process of learning, appealing to many aspects of students’ learning, and hence, a vital necessity for adoption in education. This impression has been echoed by many scholars and studies. For example, one of the benchmarks of research studies indicating how technology has benefited the process of education in America is the 1997 nationwide survey of teachers and school superintendents by Jostens Learning Corporation. In the survey, 74% of the general public and 95% of educators indicated that computers had improved the quality of education, teaching, and learning (Earle, 2002). In that regard, technology integration in education poses as one of the crucial elements in educational endeavors nowadays and suggests that it is almost inevitable that governments and institutions strive to adopt and integrate technology in their educational curricula. Nevertheless, the effectiveness of integrating technology into education has been questioned, and challenges have been pointed out by various scholars. Baron, Orwig, Ivers, and Lilavois (2002) argue that integrating technology into education is not easy

because it is still difficult for schools to afford enough resources to meet the demands. Shuldman (2004), states that the most troubling gap is classroom teachers' lack of integration understanding. He says that this is because technology's greatest impact on student learning appears only after teachers have sufficient skills, coupled with an understanding of how various technologies can be used as cognitive tools, and are able to weave technology experiences into their daily practice. The other major challenge that has been indicated by scholars concerning technology integration in schools is the achievement of the process itself (Edyburn, 1998; Katz & Rudy, 1999; Shuldman, 2004). The key question is whether the teachers have really integrated technology in learning or not, and if they have, to what extent they have done so; or, if not, what is the essence of the problem of not doing so? Amy, Baylor, and Ritchie (2002) argue that the way in which technology is used in the classroom is a critical measure of its success. They state that it is becoming increasingly clear that technology, in and of itself, does not directly change teaching or learning. Rather, the critical element is how technology is incorporated into instruction. I believe that these and other perceived challenges of technology integration by different scholars raise questions on the nature of technology integration processes in institutions and hence a need for formatively evaluating them so that the benefits of technology in education are maximally realized.

Tanzania, as it is in many countries in the world, has been swept by the wave of adopting modern technology in education. According to the United Republic of Tanzania-- Ministry of Communications and Transport (2003),there have been moves to adopting technologies in many schools, more significantly in higher education

institutions (Tanzania National ICT Policy of 2003). Some of these institutions of higher learning have introduced new technology, especially computer science and information technology, into their curriculum. For example, in 1995, the University of Dar-es-Salaam approved an Information and Communication Technology (ICT) policy plan, which was geared to overseeing and implementing ICT programs in improving technology use at the university. According to the university website (http://www.udsm.ac.tz/), all academic buildings were networked and this enabled all teaching staff to have access to computers**.** To facilitate the implementation of ICT in carrying out its primary activities of teaching, learning, research, and service to the community, the Instructional Technology Resource Unit (ITRU) was established from a project proposal submitted to the Carnegie Corporation for funding in 2001. This plus other moves in different faculties and institutes at the university suggest that there are efforts to put technology integration in place (http://www.tufts.edu/talloiresnetwork/downloads/UniversityofDaresSalaam.pdf)

However, challenges in the use of technology, specifically in the context of higher education in developing countries, have been identified. For example, Sife, Lwoga, and Sanga (2007) argue that the ICTs have not permeated to a great extent in many higher learning institutions, not only in Tanzania but in many developing countries, due to many socioeconomic and technological circumstances. In their article, they observe that despite the achievements that the institutions of higher education in Tanzania have accomplished, they still face many challenges in undertaking the ICT integration process. The challenges include lack of a system approach to learning, awareness and attitudes towards

ICTs, administrative and technical support, staff development, lack of ownership, inadequate funds, and transforming higher education.

It has been more than 12 years since the University of Dar-es-Salaam approved an ICT policy and, as stated above, the policy was geared to overseeing and implementing ICT programs in improving technology at the university. At the same time there has not been enough literature and comprehensive research focused on technology integration in Tanzania. For the University of Dar-es-salaam, there haven't been many studies focusing on evaluating the effectiveness of technology integration practices and/or policy implementation at the university even after the enactment of the Tanzania Development Vision 2025 in 1999. The Vision was meant to provide the development philosophy of the country and the general objectives and guidelines for implementation of development activities.

This qualitative evaluation case study was aimed at determining, through interviews and document analysis, whether the process of technology integration in classrooms at the University of Dar-es-Salaam in Tanzania has been effective in view of four of Ely's (1999) eight conditions for effective implementation of innovation, planning and the presence of technology plans, and the ACOT Stages of Development model. Ely's three conditions in this study were: availability of resources, presence of sufficient knowledge and skills, and availability of time. The findings will inform stakeholders of the status and trends of technology integration at the University of Dar-es-Salaam and the implications for the Tanzania Development Vision 2025.

Background of the Study

The United Republic of Tanzania is a country in East Africa. It was founded in 1964 after the union of Tanganyika and Zanzibar. Tanganyika was under British rule until 1961 when it gained its political independence while Zanzibar was under Arab rule until 1963 after the 'Revolution'. According to the CIA's World Fact Book, the population of Tanzania is approximately 36,766,356 people (2005 estimate) with an area of 945,087 sq. km., which is slightly larger than twice the size of California in the United States or nearly one-half of the area of Western Europe. Tanzania is a relatively poor Third World country with a dependent economy. After independence, the country adopted the socialist ideologies from the Eastern bloc (led by Russia and China). In implementing these policies, most of the social services were provided free by the government. For example, education was provided free at all levels including the university level with the government funding the entire education system. Basically, this was a large burden to the government and resulted in a poor quality of education (Mwakikagile, 2004). To curb such a situation in all sectors, Tanzania launched a couple of structural adjustments to motivate its economy and improve its social services. In education, among other adjustments to improve the quality of education was one that introduced the idea of the integration of technology into education. One of the initial efforts was in 1990, when the government established the Ministry of Science, Technology and Higher Education, as an offshoot of the Ministry of Education. The main objective of establishing this ministry was to create an opportunity to accelerate the promotion of science and technology initiated through higher education. By pushing the

acquisition and use of science and technology in higher education, a pivotal point for disseminating development to other economical and social sectors would be created. In that regard, according to the website of the Ministry of Higher Education, Science and Technology (MHEST) (http://www.tanzania.go.tz/science.htm) its vision was 'to evolve a well-educated gender-equitable society that could cope with development and effective utilization and application of science and technology regionally and internationally'(1990, para 1). The mission of MHEST is 'to facilitate the provision of quality gender equity technical and higher education to the Tanzanian community and to promote development in application of science and technology in collaboration with all Stakeholders' (1990, para 2). The implication is that the major responsibility for technological development was given to higher education in Tanzania.

In order to emphasize on the need for technology in Tanzanian long-term development plans through education, the Tanzania Development Vision issued in 1999 by the Planning Commission of Tanzania indicates that Tanzania's goal is to graduate from the least developed country in the world to a middle-income country with a high level of human development by the year 2025. The commission's report prescribes that education is a strategic change agent and should be restructured and transformed qualitatively with a focus on promoting creativity and problem solving (p. 3-4). In the foreword to the Vision 2025 report, Benjamin Mkapa, the then President of Tanzania, asserted:

> We are standing at the threshold of the 21st Century, a Century that will be characterized by competition. It is clear, therefore, that it will be a century

> dominated by those with advanced technological capacity, high productivity, modern and efficient transport and communication infrastructure and, above all, highly skilled manpower imbued with initiative. If we are to be active participants in the global developments of the twenty-first century we must, as a Nation, find ways of improving and strengthening ourselves in all these areas. (p. v)

From that perspective, the country sees technology as a strong base for its development and philosophically believes that this is possible through education. The Vision sees education as a precondition for development and determining the course of action. The Vision 2025 contends:

> Tanzania would brace itself to attain creativity, innovativeness, and a high level of quality education in order to respond to development challenges and effectively compete regionally and internationally (p. 4).

Furthermore, the Vision 2025 specifies the kind of educational output that would be realized in terms of human resource. It contends:

> To this effect, Tanzania should be a nation with high level of education at all levels; a nation that produces the quantity and quality educated people sufficiently equipped with requisite knowledge to solve society's problems, meet the challenges of development and attain competitiveness of regional and global level. (p. 5).

These perspectives are reflected in the current general trends of various schools and institutions acquiring and integrating modern technology in educational practices, most prominently, acquiring computer technology. Institutions are using their technology

availability to attract applicants to join their institutions. With all these good intentions, the emerging question is whether these technologies are really integrated and/or integrated appropriately into learning and teaching.

Nonetheless, the idea of integrating technology in education is generally not new in Tanzania. Senzige and Sarukesi (2003), discussing the introduction of technology in schools, point out that in the 1960s and 1970s, primary and secondary schools were provided with radios to enable them to follow the educational programs designed by the Ministry of Education in collaboration with Radio Tanzania Dare-es-Salaam (RTD). Sometime in the 1970's these programs stopped and since then there have hardly been any significant efforts to promote the use of technology in schools, not even after the spread of television technology in Tanzania, which started in 1994. There were only sporadic implementations and efforts in educational policies and curricular practices, which did not indicate serious strategies for technology integration. The current nature of technology as contained in the Vision 2025 focuses more on the new direction of electronic and digital technology. This new direction is the mission of the country, which reflects the global trend of technological revolution, more prominently known as Information Technology (IT).

Al-Oteawi (2002) contends that IT has become a backbone of our global society, a society in which the ability to increase productivity, implement time-saving efforts, and improve job quality has caused rapid expansion of IT. Every institution in society is profoundly changing due to technology. Such changes have been evident in Tanzania, which unfortunately implemented IT not too long ago. For example, according to Mgaya

(1994), the first computer in Tanzania was installed in 1965 in the Ministry of Finance, and by 1974 there were only seven computers in the country**.** He reports that there were pertinent problems with the adoption computers in the country, including lack of a national informatics policy. That problem led to a slow pace of adoption of computer technology. In recent years, there have been efforts by the government to adopt computer technology on a large scale. These efforts include the establishment of the Commission for Science and Technology (COSTECH) in 1986, and the establishment of the Ministry of Science and Technology and Higher Education in 1985. In 2003, National Information and Communication Technology Policy was enacted. These efforts have had a bearing on establishing reforms to introduce digital technology in education.

In the eighties, there were insignificant efforts to introduce electronic media into education by the government. Most schools and even institutions of higher learning had hardly even one computer or television. Some significant efforts to use electronic media in delivering educational instruction were made in some privately owned schools and nongovernmental institutions. In 1990, High Precision Center (HPC) used videocassettes to teach subjects, but with a focus on religion. This does not imply that the government did not realize the importance of using technology in education; rather, the slow pace of diffusion of technology was due to economic reasons and most likely planning reasons. The National Information and Communication Technology policy contends that the lack of overall policy and poor harmonization of initiatives has led to random adoption of technology systems and standards. For example, in 1977 the Ministry of Education issued

a syllabus for computer studies for secondary schools. Its implementation was elusive. This syllabus was revised in 2002, but still its implementation is obscure.

In broader perspective, the idea of integrating technology in higher education is more urgent because of the nature and the role of higher education institutions to the society. Falk and Carson (1995), analyzing the context of higher education, point out that higher education is closely linked with the needs of a productive workforce, continuing education for those who had no opportunities to do so through distance learning, and that higher education is more diversified in terms of skills provided and cultural background of students.

Higher education in Tanzania, which is under the Ministry of Science, Technology and Higher Education, constitutes universities, colleges, and institutions that offer advanced diplomas. Currently, there are 19 universities and two university colleges under the ministry. The prominent ones include University of Dar-es-Salaam (UDSM), Sokoine University of Agriculture (SUA), Open University of Tanzania (OUT), University College of Lands and Architectural Studies (UCLAS), and Muhimbili College of Healthy Sciences.

There are also institutions such as the National Council for Technical Education (NACTE), Tanzania Commission for Science and Technology (COSTECH), Higher Education Accreditation Council (HEAC), and National Radiation Commission (NRC). Under the same ministry, there are three technical colleges that offer advanced diplomas: Dar-es-Salaam Institute of Technology (DIT), Technical College Arusha (TCA), and Mbeya Technical College (MTC). There are 13 private universities mostly owned by

religious institutions. Of all these institutions, the University of Dar-es-Salaam stands out as the oldest and the largest university in the country. Some of the universities and university colleges were originally colleges or faculties of UDSM.

This study examined and evaluated the nature of technology integration at the University of Dar-es-Salaam in Tanzania, which is the home country of the researcher.

Statement of the Problem

In this era of information technology when we are witnessing that our lives are almost entirely anchored in the use of technology, the process of education stands out as a bridge to connect us to this innovative trend. Tanzania's dream of realizing the goals of Vision 2025, which strongly highlights the use of technology, will be fulfilled implementing strategies and solid plans for adopting and integrating new technology in education more effectively. As implied in the Vision 2025, the integration of technology in education is a foundation for realizing the Vision's goals. In this regard, higher education plays a prominent role in fulfilling and helping to effect changes that will take us on the path we desire. Basically, adopting and implementing technology integration into the education system is a vital choice. By establishing a ministry that incorporates science and technology and higher education, the government of Tanzania puts pressure on institutions of higher education to take the lead in transforming the society through the use of technology. There is a necessity to ensure that there are initiatives to monitor the adoption and the effective use of technology to meet the desired goals. Monitoring the effectiveness of technology in education is a necessity, given the observations of some scholars that schools have mainly concentrated on the placement of technology in

classrooms without authentic utility in the process of learning and teaching. As observed by Earle (1997) in a nationwide survey in the United States, despite the general sense that the computer revolution of the last decade has had a major impact in schools, the nature of the impact seems to be limited to access and information retrieval rather than improved teaching methods or revitalized school and classroom structures. Furthermore, monitoring may prevent the wasting of resources invested in acquisition of that technology**.** In that context, the researcher has the perception that despite the fact that the University of Dar-es-Salaam reflects efforts to adopt and use technology, the information provided about technology use does not indicate vivid details of the nature of implementation of technology integration into the university curriculum or the presence of technology plans to guide implementation. The researcher feels that there is a gap in research indicating that the University is on the right track in implementing the requirement of the Vision 2025; therefore, there is a need to conduct a study to reveal the real situation concerning the nature of implementation of technology integration at the institution. Through this research, recommendations will be made to motivate viable technology integration not only at the university, but also in higher education as a whole to enable the realization of the goals of Vision 2025.

Purpose of the Study

The purpose of this study was to investigate and evaluate the nature of technology implementation in classroom practices at the UDSM, which is the major center of higher education in Tanzania. The research looked at what technologies were available, strategies that were employed to implement the integration of technology in the

university curricula (teaching and learning processes), the stakeholders' perception of their knowledge and skills of technology use, training programs and technology plans. The research also used ACOT Stages of Development technology model to generally determine the stage of technology integration at UDSM. Finally, I offer suggestions for more effective inputs that may make technology integration more effective in achieving the desired goals of Vision 2025 in higher education in Tanzania.

The Research Questions

The researcher sought answers to the following question: What is the nature of implementation of technology integration in learning and teaching at the UDSM by faculty and students?

To answer that main question, the research sought the answers to the following sub-questions:

1. What technology is available to support teaching and learning, where is it located, and who uses it?
2. How much knowledge and skills do the stakeholders have of technology and technology use?
3. What approaches and strategies of integrating technology do teachers and students employ in learning and teaching?
4. Are there professional development programs for the teachers? How effective are they?
5. Does the university have technology plans? If so, what are the contents of those plans and to what extent are they being implemented?

6. At what stage of ACOT Stages of Development Model is the status of technology integration at the UDSM?

Significance of the Study

At these times of technologically driven lives, when countries, especially developing countries like Tanzania, are encountering the challenges of major reforms in their educational systems, it is vital to assess and monitor the strategies used to reform education systems through technology integration. The benefits of integrating technology into learning and teaching are numerous and especially at this time when the country is implementing its development Vision 2025. Any research of this nature is important in motivating and trying to streamline reform strategies. The findings of this study will contribute to the body of ideas and knowledge about better ways or strategies of implementing technology integration in higher education in Tanzania. It is undeniable that a university is the major research center for all educational levels and the gathering place of scholars and educators. In that regard, universities should be a locus of vision of any society. As indicated above, UDSM is the first university in the country and the first institution of higher education. It is the most well-established university in Tanzania. Therefore, it stands at the apex of higher education reforms in the country and mirrors the general trends of what higher education should be. In that regard, the study will inform the stakeholders (students, academic staff, administrative staff, and technical support service staff) of:

1. The status of technology availability and accessibility for teaching and learning at the university

2. The skill level of academic staff members and their assessment of the implementation of technology integration at the UDSM
3. How technology is being used by students and teachers at UDSM
4. The nature and the effectiveness of professional development programs in technology, and
5. How to make technology plans for teaching and learning, using technology.

Scope of the Study

Considering, as much as possible, the factors surrounding the requirement of this study, the researcher designed the study as a case study of one major university that was considered the a model of well-established institutions of higher education in Tanzania. The researcher chose to examine implementation of technology integration in classroom contexts as one essential element for successful technology integration.

Limitations

No research project is without limitations: “There is no such thing as a perfect designed study” (Marshall & Rossman, 1999, p. 42).The following are the limitations of the study. These are the factors that, in one way or another, may have affected the outcome of the study.

1. The researcher had planned to travel to Tanzania to be in the field, but due to unavoidable circumstances he could not do that. By being in the field, he felt that he would have obtained a clearer understanding of the nature of technology integration. For example, he would have applied the observation method to see real technology integration in process.

2. It was difficult and took time to obtain research assistants. Twice the researcher had recruited research assistants who had agreed to help. Later, after some weeks, they opted out saying they could not do the job. One of them had demanded a large sum of money to collect data but later withdrew when he learned that the money was not forthcoming. This situation caused the process of data collection to take a longer time after the research proposal was approved.

3. There were times that the other side of recording, that is, the respondent, was interrupted by the voiceover from the background of the interviewees. Also the recording was completed with the researcher's regular home phone using the speakerphone. Sometimes the quality of recording was poor because of interruptions or because voices were muffled.

4. All telephone interviews were completed by using respondents' cell phones. The phone networks were sometimes poor, and the researcher had either to struggle to comprehend what was being said by the respondents or had to hang up and call again. This hindered the flow of the interview/ideas. Sometimes he had to shout because the respondents were located at points where the reception was poor or had cell phones whose service providers were inexpensive but not very efficient.

5. The researcher could not identify many studies that have been conducted on ICT in Tanzania. There were many studies covering Tanzania within the

context of Africa or developed countries. However, the researcher believes that there is unique information about Tanzania that could have helped in explaining the essence of the findings if these studies could have been identified.

6. Although the context of the study was the home country of the researcher, the researcher had been out of the country for more than eight years. Thus, some of the situations and aspects in the study may have been conceptualized differently by the researcher and therefore be analyzed from a different mindset or outlook.

Delimitations

This study was designed as a qualitative evaluation case study. It focused on technology integration at one institution in Tanzania. Given the breadth of technology integration and the population, the study covered only a small portion. It focused only on the evaluation of implementation of technology integration. The study results would not be sufficient to draw a representative picture of the nature of technology integration in Tanzania. They could, however, give us an impression of technology use in higher education in the country of Tanzania.

Definition of Terms

The following are the definitions of terms as used in the context of this study:

a) *Higher education*: In the context of this study, higher education referred to all those courses that are offered by institutions that are under the Ministry of Science

Technology and Higher Education in Tanzania. In the context of Tanzania, these are institutions that offer an advanced diploma and degrees.

b) *Technology in education*: Broadly, this refers to using multimedia technologies or audiovisual aids as a tool to enhance and support the teaching and learning process. In this study, technology in education referred specifically to the use of computers and Internet in education.

c) *Vision 2025*: This is an economic and social vision for Tanzania created by the Planning Commission of Tanzania in 1999 as a strategic guide for social and economic reform measures.

d) *Planning Commission*: A commission formed to assume the role of economic and social planning in Tanzania, its major role was to bring together all development plans from all ministries and departments into one major development plan and relate it to the national budget. It was formed to replace the then ministry of Economics and Planning.

e) *Technology*: Technology is a broad term that refers to the use of tools and machine systems to do tasks efficiently. This study adopts the definition of technology as given by Piacciano (2002) to refer to computers and computer- related technologies such as data communication, interactive video, and digital television.

f) *Technology Integration*: Technology integration is use of technological equipment (mainly computers) in classroom teaching and learning by students and teachers aimed at facilitating and enhancing understanding of the intended knowledge.

g) *Stakeholders*: This refers to all the people who are involved in the process of technology integration and are likely to benefit from technology projects or programs at UDSM. In this study, it refers to students, academic staff, and administrators.

h) *Teachers*: Teachers refers to all academic staff. In this study, refers to all those who are involved in the instruction process with direct contact with students. It includes lecturers, professors, and teaching assistants, and at times its use involves the heads of faculties or departments.

Organization of the Study

The study is organized into five chapters. The first chapter describes the study. It covers the context of the study, the statement of the study, the purpose and the significance of the study. It also indicates the scope, the limitations, the delimitations and the definition of terms.

Chapter 2 provides the literature review of readings that are relevant to the study. Chapter 3 covers the research methodology by describing the design of the study, including the conceptual framework. Chapter 4 covers the findings and the analysis of collected data. In Chapter 5, discussion and interpretation of the data are given. Also in chapter 5, are the conclusions followed by the recommendations for Tanzania and future studies. After those five chapters, references and attachments are provided.

Chapter Two: Literature Review

Introduction

The purpose of this study was to investigate and evaluate the nature of technology implementation in classroom practices at UDSM. The literature review highlights a body of knowledge and issues concerning the integration of technology in education from different perspectives and contexts. It examines technology implementation as an essential stage in effecting technology integration. These ideas and issues put into perspective how technology integration can be viewed in the context of Tanzanian education, with specific focus on higher education. Although some of the ideas are drawn from countries in which technology is already in an advanced stage, it may be that similar ideas apply even in less technologically advanced countries like Tanzania. This literature will help to establish a framework or guidelines for evaluating the implementation of technology integration at the UDSM, in Tanzania.

Technology in Education-Experience from Africa

As technology continues to take center stage in the educational systems in the developed world, the developing countries, such as countries in Africa, have made efforts to ensure that they are not left behind. Shrestha (2000) argues that advances in technologies have led to the creation of a great opportunity to what is now called 'leapfrog' stages of development. However, he says that this opportunity is unparalleled in history; therefore, he reports the World Bank's warning to African countries: "If African countries cannot take advantage of any information revolution and surf this wave of technological change, they may be crushed by it. In that case, "they are likely to be

even more marginalized and economically stagnant than they are today" (p. 4). The fear of being left behind is also expressed in the Tanzania National Information and Communication Technology (ICT) policy (2003). The policy says that the gap between those able and those unable to access technology, which is termed as the *digital divide,* is evident within nations, and within the developing and developed world. Therefore, the policy argues: "The current Tanzania ICT situation requires urgent steps to enable Tanzanians to participate meaningfully in the knowledge economy" (p. 2). There has been pressure to effect education reforms in many countries in Africa (Shrestha, 1999). Barnett (2000) observes that there is significant pressure in schools today to change due to economic, social, and political transformations, and in all these, he says, they need new skills and approaches to learning.

Technology integration in Tanzania can be viewed in the realm of the nature of technology in education in developing countries, especially in Sub-Saharan Africa. The National Committee for World Summit on Information Society (WSIS) for Preparation Committee (PREPCOM) II (2003) on the country report says**:**

Currently, ICT services are yet to be fully realized in most of developing countries including Tanzania due to basic factors of poor ICT infrastructure, weak and or the lack of policies and the lack of Capacity to manage and plan ICT industry. This combination has resulted in inadequate access to affordable telephones, broadcasting, computers, and the Internet. ICT has not been capitalized on enhancing livelihoods and creating new business opportunities and cross-border linkages within the continent and between the region and with global markets (there still exists a digital divide). (p. 23).

Chisholm, Irwin, and Carey (1998) observe that Africa remains the least computerized continent and that computers have yet to penetrate in many important sectors including education. This, they argue, limits success in technology adoption and development. For example, they point out that in Ghana they found that many Ghanaians lacked competence in computer skills and access, and as a result, adoption and development of technology in education was hampered. Chisholm et al. (1998) indicate that, insufficient resources in the form of well-trained computer technology personnel and the capital to train them were the impediment to technology integration in education in Ghana.

Writing about virtual institutions on the African continent, Naidoo and Schutte (1999) reveal that there are some fundamental differences in the way in which educational change toward technology is approached and implemented between more advanced countries and developing countries. They write that for developing countries, the primary emphasis is always upon acquiring infrastructure such as telecommunication infrastructure, hardware, software, and networks. They indicate that Africa continuously struggles to procure infrastructure and once obtained, there is a struggle to hold on to it and its relevant software. Then there is a struggle to provide infrastructure to more than just a small part of the population. All these challenges emanate from poor economies. In a study by Wagner, Day, and Sun (2004) on ICT in higher education in Africa, a number of barriers creating a smooth environment to make integration possible were found. Among them was acquisition of ICT as an initial foundation of technology integration. The barriers were as follows:

1. Many higher education institutions (HEI) were found to have no coordinated institutional policies or strategies for promoting ICT literacy for staff and students.
2. HEIs lacked sufficient network infrastructure, PC laboratories, and quality ICT instructors to provide most staff or students with adequate access.
3. Africa's hardware, electricity, and telephone infrastructures are inadequate to support the current growing need for ICT initiatives and possibilities.
4. Many national policy directions in the ICT domain were not sufficient or forward-looking and aggressive enough to enable public resources to be released to improve the infrastructures needed. Or if there were any, they were very slowly implemented.
5. There was a lack of coordination between governmental organizations and nongovernmental organizations (NGOs) initiatives such that even where progress could be made it becomes difficult.
6. Capacity building was at a very low level. Capacity building refers to creating human resources in Africa so that local ICT products and services (Africa for African) can be put into service. Some of the projects depend much on foreign expertise (Wagner, Day, & Sun, 2004, p. 24-33).

Saint (1999), writing about technology in Africa in implementing distance education identifies the following shortfalls:

1. In most campuses, academic and library staffs lack an awareness of what information technology can do for them.

2. Information and connectivity are generally limited.
3. A small but significant group of African university libraries have no functioning computers at all. A large group of university libraries possess a few stand-alone computers equipped with dial-up e-mail. Saint (1999) says this group, in most cases, is heavily dependent on donor assistance for maintenance and development of its technology. Consequently, these libraries' computers fall to recession when donor financing ends.
4. Only small numbers of universities (in Namibia, South Africa, Tanzania, and Zambia) are linked to local computer networks with full connectivity to Internet for sustainable ICT development.
5. Even where libraries possess some information technology, they are used unevenly (only active students are users) because technology is unreliable due to fluctuating electric supply, and poor maintenance, and lack of know-how as a result of little training of library and academic staff in the use of technology. This means very few people know how to use technologies or are able to teach others. (Saint, 1999, p. 29-34)

Nevertheless, some significant efforts are made by some countries to push for creation of a good technology integration environment. Some developing countries have taken initiatives in higher education institutions to move a step forward to reducing the problem of acquisition of technologies. For example, they have initiatives to seek help from technologically developed countries. According to the World Bank's Partnership for Higher Education in Africa (2003), initiatives include help from the World Bank, the U.K.

government through the British Council, and United States Foundations. The report says, in 2000, four United States foundations joined together to establish the Partnership for Higher Education in Africa. The foundations for this partnership include Carnegie Corporation of New York, Ford Foundation, John D. and Catherine T. McArthur Foundation, and the Rockefeller Foundation. In Tanzania the main beneficiary was UDSM which was funded to build the technology resource center.

Regarding classroom experience, computer illiteracy has been singled out as a barrier in African higher education. For example, in a paper about a new established university in Kenya, John and John (1998) pointed out that most students enrolled were largely unacquainted with computer knowledge. They indicated that only 10% had used computers on at least10 times before enrolling. Students were required to take keyboarding and introduction to computer applications in the first two semesters. Metu (1994) observed that students and teachers from developing nations had limited computer literacy. In his survey on attitudes of teachers about computers, he found that many teachers, despite their positive attitudes, would not be able to use computers in their classrooms even if the necessary hardware and software were made available. He argues that teachers need a level of familiarity with computer technology in order to transfer the knowledge to their students.

Tanzania has been involved in a number of long-term and short-term educational plans some of which involved structural adjustments. The educational reform toward ICT is the most recent, and it can be observed that it is still at the infancy stage. Literature has indicated significant developments in technology in developing countries like Tanzania.

Sife, Lwoga, and Sanga (2007*)* in discussing the challenges in higher education regarding new technologies in teaching and learning in developing countries, present the following barriers:

1. Lack of a system approach to learning. Sife et al. argue that the integration of ICTs is complex and needs to be fully conceptualized and defined from the beginning. They point out that many institutions have embraced the ICT integration process without clear plans to guide their way.
2. Awareness and attitudes towards ICTs. They argue that the stakeholders in institutions need to know the existing ICT facilities, services, and their importance in relation to specific tasks. Therefore, in institutions, there tends to be some vague knowledge about ICTs by a lot of stakeholders.
3. Administrative support. Administrative support to teachers and students is very crucial in ICT teaching and learning processes. Administrators need to be interested, committed, and competent in many issues that involve ICT in education.
4. Technical support. Sife et al. (2007) argue that in most cases support is not available and that this was a prevailing problem in developing countries where there are few experts.
5. Staff development: They argue that ICT integration does not only deal with introduction of new hardware and software, but both trainers and the students have to adopt new roles and change their ICT behaviors and ways of teaching and learning. Faculty staff members require training fundamentally in how

people learn and in instructional design so staff training is a continuous process of regular updates with the development of ICTs.

6. Inadequate funds. They observe that financial resources are a key factor in the successful implementation and integration of ICTs in education. They suggest the following strategies to the institutions to offset that financial shortage in many developing countries: adopt freeware and open source software for teaching and learning activities; continuously press for more funds from the governments; and to diversify sources of funds to have a wide financial base.

Other challenges of technology in education in Tanzania are highlighted in National ICT Policy. For example, it states that very few institutions have computer laboratories and other multimedia facilities, although there are more in private schools than public schools. It states that at universities and other institutions of higher learning, few computers are available for use by students and academic staff and therefore they do not meet the demands.

We can deduce that when assessing the nature of implementation of technology integration in Tanzania in higher education, the assessment should include a spectrum of factors that are perceived within the context of experience of technology integration in Africa, on one end, and the factors that are likely to be found in any country trying to implement technology as an educational reform in education on the other end. Nonetheless, some factors may be country specific given the unique differences, such as the political, cultural, and philosophical inclinations. For example, although Ghana does

not have a very strong economy, it has made significant headway in ICT, more so than countries with stronger economies (Wagner, Day, & Sun, 2004).

What is Technology Integration?

Different definitions of technology integration have been offered. According to the National Forum on Educational Statistics (NFES) (1998), technology integration is the incorporation of technology resources and technology-based practices into the daily routines, work, and management of schools. Technology resources include computers and specialized software, network-based communication systems, and other equipment and infrastructure. Practices include collaborative work and communication, Internet-based research, remote access to instrumentation, network-based transmission and retrieval of data, and other methods (NFES, 1998, p. 1). Weston (2005) defines technology integration as sustained and meaningful use of an application for the core function of class instruction or learning. He indicates that integration means that instruction moves from initial adoption and one-time demonstration to implementing technology as part and parcel of instruction. He states that technology covers a wide range of applications, lessons, activities, games, and tools, such as personal computers in classrooms, labs, or student homes; handheld devices and video technology. From these definitions of technology integration, becomes clear that adopting and using technology goes beyond the early efforts by schools that concentrated or focused mainly on acquisition and superficial use of technologies. The development of technology integration is changing quickly in all facets of our lives because of the advent of the World Wide Web (WWW) and Internet (Franklin & Sessoms, 2005). Schaffer and

Richardson (2004) point out that, schools are at the ‘third phase’ of technology integration-technology integration reform, focusing on technology fluency where students are able to select technology tools to help them obtain information in a timely manner, analyze, and synthesize the information, and present it in a more critical manner. Thus, technology is a primary tool for enhancing learning. Edyburn (1998) indicates that the goal of integrating technology is to link software, media, and technology tools with specific instructional objectives in ways that facilitate teaching and learning.

Mills and Tincher (1997) characterize technology integration as a developmental process that includes five stages; entry, adoption, adaptation, appropriation and invention. They elaborate that in entry stage the teacher uses text-based materials and instruction to support teacher directed activities. In adoption stage, teachers use technology for keyboarding, word-processing or drill and practice software. In adaptation, they further indicate that teachers integrate new technologies into classroom practice and students use word processors, databases, graphic programs and computer assisted instruction. The appropriation stage includes teachers' beginning to understand the usefulness of technology and students' work at computers fluently as project based instruction begin to take place. Lastly in the invention stage, Mills and Tincher (1997) suggest that learning becomes more student-centered as multidisciplinary, project-based, peer-tutoring and individual instruction occurs. Rogers (2000) argues that technology integration in education is a ‘model’ of educational reform.

From the literature above we see that the concept of technology integration is a profound concept that goes beyond just acquiring and using technology in the classroom. Rather it is the concept that mainly focuses on what goes into the process of using technology in the process of learning. Whatever the processes, the ultimate goal is to facilitate the learning process or making the learning meaningful and manageable. In the context of this study technology integration will be used to refer to the use of technological equipment (mainly computers) in classroom teaching and learning by students and teachers aimed at facilitating and enhancing understanding of the intended knowledge.

Benefits of Technology Integration in the Process of Learning and Teaching

The potential of technology to improve the quality of learning and teaching is undeniable. This potential has been indicated by numerous people. Valdez (2004) observes that technology offers many opportunities to improve learning and that it has the potential to provide people in their own homes and work settings with access to knowledge and learning resources possible until recently only in very large universities. Furthermore, he argues that technology has the potential to make everyone a producer of original knowledge that can be shared with the world at very little cost. On its effectiveness in classroom practices, Franklin (2000), as cited by Blankson (2004) observes that technology in education may promote new learning environments in which enquiry and problem solving increase student achievement.

Hansen (2003) highlights the importance of technology in teacher preparation, pointing out three benefits. First, technology can be a powerful tool for helping

individuals achieve personal and shared goals. Second, technology alleviates human suffering and promotes social justice to help people make a difference in their worlds. Third, people must have knowledge and skills to evaluate and decide appropriate courses of action when confronted with problems.

According to Barron et al. (2003), technology provides an excellent avenue for student motivation, exploration, and instruction in a multi sensory diverse world. They further argue that technology touches more aspects of our daily lives. They observe that the integration of technology into the school curriculum is no longer a luxury, rather "it is a means to survival in the future that will be driven and supported by technology" (Barron et al., 2001, p. 17).

In general, Barron et al. (2001) report the following benefits of integrating technology noting that it:

1. Promotes active learning
2. Promotes critical thinking
3. Offers diversity and self-paced learning and individual growth
4. Motivates and inspires students by making learning exciting and relevant
5. Provides flexibility for students with special needs
6. Promotes cooperative learning and increases teacher-student interaction
7. Enhances communication skills
8. Supplies information through multi sensory channels (supporting students with various learning styles and
9. Helps students to build cultural bridges. (Baron et al., 2001, P. 3-8)

In the 10 year report of the Apple Computer (1995) sponsored project called the Apple Computer Classroom of Tomorrow (ACOT), the benefits of using computers are discussed and the tremendous impacts of using technology on student learning are outlined. Independent researchers in the project found that students in ACOT classrooms not only continued to perform well on standardized tests but were developing a variety of competencies not usually measured. In summary, they reported the following abilities of students developed from using technology asserting that students**:**

1. Explored and represented information dynamically and in many forms
2. Became socially aware and more confident
3. Communicated effectively about complex processes
4. Used technology routinely and appropriately
5. Became independent learners and self-starters
6. Knew their areas of expertise and shared that expertise spontaneously (Apple Computer, 1995, p. 10)

There is no doubt that integrating technology is very valuable in the process of learning and appeals to many aspects of students' learning. In short, technology integration in education provides students with ample opportunities to benefit from and manage their learning while it facilitates the teaching process.

The benefit can be looked at from a wider perspective outside classroom situations. These are benefits to the individual and the society at large in the context of their lives. As argued by Roblyer (2003), "Technology is everywhere and therefore in

education" (p. 10); it is a profound decision in terms of learning process and the outcome of learning to adopt technology in education.

Perceptions on the Nature of Technology Integration in Education

The current rapid acquisition and diffusion of technology in our daily lives has inevitably affected the entire outlook of education in the process of learning and teaching in different parts of the world. This is due to the marked increase in the use of technology in social, economic, and political change. Technology is highly linked with improving and accelerating ways and quality of doing things. Kerr (2005) points out that using technology in education has a bearing on the perceptions of what the process of education is and how it can be fostered and leads to the determination of how schools should be organized. In a broader perspective, educational technology is grounded in promoting efficiency in learning, which in turn promotes efficiency in the functioning in our daily lives.

According to Bruess (2003), computer technology is permeating the educational arena and changing the way teachers teach and students learn. With technology, students are able to access different sources of knowledge by themselves. This trend deviates from the traditional approach of depending almost entirely on teachers or instructors. With this new trend, the process of education has taken on a new dimension which requires new approaches to the process of learning and teaching. Al-Oteawi (2002) suggests that teachers need knowledge and skills that will enable them to improve their teaching, such as integrating IT within the curriculum in order to enhance learning and allow students to learn from different sources.

Nevertheless, the concept of integration is not so straightforward one such that it is easy to practically implement it. In different environments it may be perceived differently. Different aspects need to be made clear and elaborated on when looking at technology integration in education. For instance, there is a distinction between acquiring technology and integrating technology. An institution may be well equipped technologically but poor in using that technology (quantity does not always suggest quality). This means it is not enough to acquire technology; rather, the basis lies in the use of technology. Fulton, Glenn, & Valdez, 2004) argue that Technologies can provide powerful tools for student learning, but their value depends upon how effectively teachers use them to support instruction. Expounding on technology use, scholars highlight some aspects that define technology integration in learning and teaching. In essence, they indicate that it is not just using technology in curriculum; rather, it is how meaningful the technology is integrated (the approach). Earle (2002), points out that integration is not just a mere placement and use of hardware in the classroom; rather, technology must be pedagogically sound in the learning and teaching environment. He points out that education must go beyond information retrieval to problem solving, allowing for new instructional and learning experiences not possible without computers. Kerr (2005) argues that although there is good evidence that using technology can effectively help students learn, many issues make a difference in the outcome. The issues he mentions include how easy the hardware is to use, how well it is supported in schools, how well organized are circumstances on which technology is brought to bear, how well designed is the software, how well prepared and confident a teacher is in his/her ability to work

using technology in a technology-rich environment, how student learning will be appropriately assessed, and how ready parents and community are to accept new models of learning and assessment.

Such distinctions and issues have initiated skepticism regarding the whole idea of technology integration in education. Experience of some scholars has shown that, in practice, technology integration is not as smooth as it sounds. Some literature (Baron et al., 2002; Lippincott, 1999; Whitehead, Jensen & Boschee, 2003) indicate that the experience of integrating technology in education has emerged with many challenges in institutions such that at some point some people are skeptical about whether the adoption and integration will yield the desired goals.

In some institutions, technology hardware and software have been hurriedly adopted without considering other factors that may encourage the success. Wagner (1992) argues that the educational technology that can make the biggest difference to schools and students is not the hardware but the process of designing effective instruction that incorporates computer technology and other media appropriately. In discussing the factors that make IT successful, Hogan (1998) argues that more than just resources are necessary to maximize the potential of IT to transform higher education. Careful attention to the following issues is a prerequisite for any institution wishing to change itself and prepare its students for the 21st century: planning, funding, support, and incentives. Titthasiri (2000) observes that universities must have a strategic planning process for the institution for both the administrative and pedagogical functions to help them address the challenges. In her research in Thailand, she observed that many universities in Thailand

were unable to create a strategic plan because they did not have the information and the experience to strategically plan and utilize IT.

The bottom line is that acquiring technology in the school system does not guarantee the success of that technology brings into the process of education; rather, the most basic component to success is how it is integrated into the curriculum (Cuban, 2001). According to Piacciano (2002), the major impediment to establishing successful computer-based applications in schools now is lack of careful planning. He says unless educators take time to develop clear plans for how technology will be put to work for students, new computer hardware flooding in schools in the United States may go to waste. He indicates some necessary aspects to consider in planning and implementing technology, including evaluation and feedback, and involving people who will ultimately use the technology. Whitehead et al. (2003) observe that for technology to be effective in instruction or in the process of education, its adoption and use should be carefully planned and implemented.

So, while the use of technology in education has appealed to many people in educational practices, its implementation has been clouded by challenges and skepticism about its effectiveness in implementation.

Some Perceived Gaps in Technology Integration

Research has indicated that there are gaps or barriers in the implementation of technology integration even in developed countries. Baron et al. (2002) argue that integrating technology into education is not easy because it is still difficult for schools to afford enough resources to meet the demands. This observation focuses on acquisition of

technology and it is indeed one of the issues that are in the center of the popular concept of *technology divide*. However, the other major concern that has been indicated by a large number of scholars about technology integration in schools is the achievement of the process itself (Edyburn, 1998; Katz & Rudy, 1999; Shuldman, 2004). The key question is whether the teachers have really integrated technology in learning or not and, if they have, to what extent they have done so, or, if not, what is the essence of the problem of not doing so. Amy et al. (2002) argue that the way in which technology is used in the classroom is a critical measure of its success. They state that it is becoming increasingly clear that technology, in and of itself, does not directly change teaching or learning. Rather, the critical element is how technology is incorporated into instruction. Amy, Baylor and Ritchie (2002) comment that when students and teachers perceive computers as a separate subject, unassociated with the context of the lesson or classroom, the content or concepts studied are often left fragmented in the learner's mind. They suggest that technology integration requires teachers, no longer being the sole distributor of information, must alter their teaching processes. Computers must be viewed as function rather than application, process rather than approach (Mills & Tincher, 2002).

In light of those observations, gaps in integrating technology in schools have been indicated. Shuldman (2004) has indicated that a great deal of accumulated evidence has identified obstacles that impede teachers' ability to adopt and integrate technology into their teaching. These obstacles include the lack of time, expertise, access, resources, and support. He argues that the most troubling gap is classroom teachers' lack of integration understanding. This is because technology's greatest impact on student learning appears

only after teachers have sufficient skills, coupled with an understanding of how various technologies can be used as cognitive tools, and are able to weave technology experiences into their daily practice. Edyburn (1998) points out that integration is a complex, difficult process. He says time to experiment, explore, and study innovations is essential but rare in schools. This process, which is a valuable resource in improving instruction, is not easy and not quickly accomplished. He advances the following factors, which have been observed by other scholars (Franklin, 1999):

1. Lack of teacher time
2. Limited access to hardware, software, and support
3. Insufficient leadership
4. Lack of common vision or rationale for technology use, and
5. Limited training and support to teachers. (Edyburn, 1998, p. 1)

In general, many gaps have been highlighted, indicating that technology integration has not been implemented as it is supposed to be. This has accounted for factors within the implementers themselves who are basically teachers and factors that are institutional, contextual, and even economical. Lack of understanding of what technology integration entails is one of the major factors that impede technology integration in education.

Factors for Effective Integration of Technology

Effectively integrating technology in the curriculum is a process that has to take into account various factors that surround the learner, the teachers, the school, and even the parents. In other words, one needs a clear understanding of the environment and other

components that may contribute to success. The teacher and/or the leadership will effectively implement technology integration by taking into consideration those factors. These factors range from educational philosophy of the society in which integration is to take place, to the psychological inclination of the process itself to the model of technology integration. The model suggests the steps, patterns, and components and their relationship that reflect how the process of integration should be viewed (Roblyer, 2003). In this part, the general factors that are necessary for technology integration are presented. The philosophy, psychology, and model of technology integration are discussed to create a body of knowledge that guided the evaluation of the technology integration at the university of Dar-es-Salaam.

Bettis (1998) points out the following factors to be considered by the teachers. These factors would vary depending somewhat on the context of the schools and the student/teacher:

1. Knowing and respecting the social and economic contexts within which to introduce technology. Social context involves knowing what students need of technology, what their parents and the society need. Economic context involves knowing the capability of investing in technology. Schools should operate in costs that are proportional to their capability. In other words, one should know the cost of technology and its operations. In the context of Tanzania, the teachers need to know what Tanzania's expectations of higher education are and must translate the political social ideologies into education. Technology in education has to reflect such ideologies of the society and

stakeholders (students and parents). At the same time, stakeholders must know the economic status of how much is manageable to invest in education.

2. Getting priorities straight, which involves knowing what is to be taught, how to teach it and how to evaluate it. Bettis (1998) says that selecting the most appropriate technologies to support your work should come after you have a solid program for curriculum, instruction, and assessment.
3. Establishing leadership in technology integration contexts. Teachers should stay close to the leaders so that they can easily communicate their needs for technology integration. But integration needs a committed leadership that understands the importance of technology integration.
4. Understanding that people will respond differently. Teachers need to understand that the process of technology integration will be received differently by different parties. Some of the people will resist changes. One needs to support those who resist change.
5. Being optimistic about better technology trends in the future. The process is challenging with many demands and obstacles but should not be an obstacle for implementation (Bettis, 1998).

In order for the school to be proactive regarding technology in the classroom, Williams (1998) argues that the school should have a technology plan, reviewing the curriculum to fit the technology needs in instruction and ensuring that the staff has skills. He argues for tapping school and community resources to ensure sustainable funding mechanisms.

Barron et al. (2001) report that, to effectively use technology in the classroom, one requires new understandings, new approaches, and new forms of professional growth. They offer some comprehensive suggestions for strategies for implementing technology derived from National Council for Accreditation of Teacher Education (NCATE) report (1997). They are as follows:

1. Determining your instructional goals and objectives and then locating the technology to support them. In other words, choosing the technology to fit the curriculum and not vice versa.
2. Seeking support from your administration. They suggest that your administrator should be kept informed of your instructional goals and technology needs so that it would be easier to obtain their financial and other support.
3. Forming partnerships with local businesses and universities. Partnerships can provide donation of equipment, expertise, and time -- things that are all valuable to your quest to integrate technology.
4. Acquiring technology in increments. They argue that technology is changing rapidly, especially hardware and software. Therefore, purchase what you can use and absorb it before you seek additional resources. This avoids acquiring technology that may be obsolete before used.
5. Visiting other schools and asking other educators for some advice. This will enable you to share ideas. Advances in technology are constant and overwhelming.

6. Providing in-service training sessions to meet demands for emerging technologies. They suggest that these sessions should include, among other things, lesson integration strategies.
7. Supplying training for teachers on the software and hardware available at school rather that inviting in outside experts. The training sessions should focus on the current needs of teachers.
8. Providing follow-up support and coaching. They argue that teachers should be supported after in-service training so as to produce desired changes on implementing technology in the classroom. They say ongoing support, as a model of professional development, is more likely to produce desirable results.
9. Involving students and capitalizing on their expertise. By so doing, students will be more comfortable with the technology they use. Students' expertise might be tapped to help other students. This provides valuable assistance to the teachers.
10. Exploring public domain and shareware sources. Since the educational budget is always tight, this move might help bring relief to a tight budget. For example, public domain software may be obtained and copied for free.
11. Investigating technical support and documentation. This involves access to quality documentation and technical support as a buyer. They argue to make sure the vendors are reputable and have a history of reliable service.

12. Monitoring the use of technology. This will enable technology to provide materials that are appropriate to students. They talk of filtering Internet sites and monitoring student use of chat rooms and e-mails.
13. Subscribing to magazines and journals. This move will allow access to information about the use of technology in education. This will enable teachers and students to keep up with the latest developments and releases about technology at low or no cost.
14. Balancing high tech and high touch. This means one should not be too zealous with technology at the expense of teachers. They argue that technology will not replace classroom teachers since they cannot provide teachers' compassion and ability to analyze student's learning needs, so teachers remain an essential factor for providing high touch in an increasingly high-tech world.
15. Being flexible and ready for change. They observe that we cannot force technology to fit neatly into our traditions. (Barron et al., p. 15-16).

These are some of the factors to consider when one is preparing or implementing the process or program of technology integration, but they give a very comprehensive picture that technology integration is an endeavor that requires a lot of inputs. These factors are basically very important as prerequisites and supporting fundamentals in the real process of technology integration, which is more methodological. They provide a reflection on the philosophical, theoretical, and practical considerations that would enhance the quality and effectiveness of the implementation process.

The Philosophy of Technology Integration in Education

The philosophy of technology integration involves the belief and the nature of technology integration of a person and a group of people. In other words, it represents the beliefs of the society, the institution, or even the individual on the rationale and the modes that makes technology integration in education necessary. This means that in planning to integrate technology in education, educators are trying to achieve something that stakeholders believe in and something that could be a guide in undertaking certain tasks in education. The goal is to meet the expectations of the society in which the process is operating. According to Whitehead, et al. (2003), a philosophy should reveal a general understanding of beliefs, concepts, and attitudes of a group. Integrating technology in education, therefore, is based on a society's beliefs or outlook about technology as translated into educational policies. For example, in Tanzania, the use of technology in education is reflected in Tanzania Development Vision 2025 Policy. It is narrowed down to National ICT Policy of 2003. These two policies are adopted by schools or institutions to derive their own policies. This implies that the technology practices of one institution should reflect the national policies. In these institutions, the teachers translate policy into classroom practices. From the implication of practices and the findings of different scholars (Earle, 2002), inferences can be made about the attitudes a society has concerning technology. In practice, the adoption of technology at a higher rate is a manifestation that the society sees technology as a vital aspect to learning. According to Rohrer and Moore (1997), technology is needed in education for various reasons. They argue that our students will be the users of technology and the technology

decision makers of tomorrow. They point out that as consumers; students will purchase a wide variety of technology, develop new technology, and have to deal with many problems such as suitability and reliability.

The Psychological Foundation of Technology in Education

For the process of technology integration to be effective, one needs to understand its psychological foundation. The essence of integrating technology in learning or teaching is to facilitate the process of acquisition of knowledge (Mayer, 2003). This means a link between how a person learns and how technology is used so that knowledge is acquired. It follows that when the suggestion of technology use in learning is advanced, the suggestion is in a way implying the consideration of learning theories. Roblyer (2006) states that theories describe how learning should take place and hence strategies are derived from them. Because technologies are used to carry out learning strategies, technology integration strategies have a learning theory base. In that regard, adopting technology integration initiatives and all the processes attached to them is implicitly suggesting the underpinning theory of learning that is realized by the use of the technology at hand. Theories describe conditions required to make learning happen and the kinds of problems that interfere most with learning. When a teacher prepares for teaching, he/she uses a particular method, which in turn is based on a learning theory. If he/she chooses to use technology as part of the methodology, there is an underpinning belief of what technology does to facilitate learning**.** A thorough understanding of a theory would yield a better preparation and approach to teaching. Scholars (Bates & Poole, 2003; Jacobsen & Lock, 2004; Roblyer, 2003) have tried to establish that

relationship of theories and the use of technology. Bates and Poole (2003) argue that how students learn is influenced or linked to the role of media technology in teaching, learning, planning, design, and delivery of technology-based courses. Roblyer (2003) argues that the appropriate role of technology depends on the teachers' or educators' perception of the goals of education itself and the appropriate instructional method to help students attain those goals. Verillon (2000) indicates that technology educators need an epistemological and psychological framework to derive coherent representation encompassing their field of knowledge and their students' cognitive function. Such framework, Verillon (2000) argues, helps to justify the importance of their teaching to students, parents, and teachers of other subjects. Historically, two theories of learning have dominated the use of technology in teaching: behaviorist and cognitive theories. But, the most prominent theory in contemporary education is constructivist theory, which is derived from the works of Piaget, Brunner, and Vygotsky**.**

Roblyer (2003) has analyzed the link between technology integration and the learning theories and methods of teaching and shows how each have implications for technology integration. For example, she identifies two theoretical models associated with technology integration: Direct Instructional Model (DIM) and Constructivist Instructional Model (CIM). She states that DIM is grounded in behaviorist learning theory and the information-processing branch of cognitive theory. CIM evolved from the other branches of cognitive theory. So in relation to the process of technology integration, Roblyer (2003) asserts that whereas activities like drills and tutorials are associated only

with the DIM, problem solving, multimedia production, and web-based activities can be enhanced by either direct DIM or CIM, depending on how they are used.

According to Roblyer (2003), John Dewey's social constructivism could be well illustrated by the use of the Internet. She states that the Internet can help the students to communicate with each other about their society and therefore reinforces Dewey's emphasis on cooperative learning. Technologies could be used to emphasize cooperative learning by developing group projects to be completed using technologies. Roblyer (2003) argues that many technology-using teachers feel that utilizing visual resources such as Logo and simulations can help children increase developmental level and hence have implication for Piaget's theories of cognitive development. She suggests that technologies can be used to realize discovery learning advanced by Brunner and use the use of the concept of scaffolding and the development of individual potential advanced by Vygotsky.

Nanjappa and Grant (2004) put into perspective the relationship between technology and the constructivist theory of learning, arguing that the relationship is complementary. They say that although technology refers to the designs and environment that engage learners, constructivism is a doctrine stating that learning takes place in contexts. Constructivism is a psychological approach based on social cognitivism which assumes that persons, behaviors, and environment interact in reciprocal fashion. Nanjappa and Grant (2004) argue that the focus of both technology and constructivism is on the creation of a learning environment in which knowledge building tools and the means to create and manipulate artifacts of understanding are provided. In that regard,

they suggest that this relationship has an implication for teaching. In their research, they observed that as the amount of technology available, the level of technology skills of the teacher, and the use of technology increased the use of constructivist strategies in the classroom appeared to increase. In their research article “Constructing on Constructivism: the Role of Technology”, they indicate that technology is a cognitive tool and that the central assumption of constructivism is that learning is mediated by tools and signs. They refer to Duffy and Cunningham (1996) who state that: “Technology is seen as an integral part of cognitive activity that focuses, not on an individual in isolation and what he or she knows, but on the activity in environment contextualized” (p. 187-188).

This explains one of the tenets of contemporary constructivist theory, which calls for constructing knowledge by active engagement by the learner, rather than a passive acquisition and reproduction of knowledge. In this theory, learners are able and encouraged to construct knowledge based on their experience, and skills. The work of the teacher is to find ways or approaches that will motivate learners to construct their knowledge based on prior knowledge, experience and their view of the real world. This theory rests on the assumption that knowledge is constructed by learners as they attempt to make sense of their own experiences (Driscoll, 1994). The theory suggests that students, not the teacher, are the center and controller of learning. Instead of acquiring knowledge from the teacher, the student has multiple sources of information in the process of constructing knowledge (teacher, students, library, Internet, textbooks, etc.). From the perspective of constructivist theory, the use of technology in learning becomes

more essential to fulfilling the demands of a constructivist approach. The student is able to use technology for searching, analyzing, and creating their knowledge.

Technology in education is related to Piaget's pragmatism theory. Verillon (2000) argues that pragmatism embodies the characteristic aspect of technology. He asserts that technology is concerned with making and using artifacts and that a theory of pragmatic subject would certainly be welcome for technology education.

A profound relationship evidenced by many scholars between learning theories and technology integration indicates how important technology is in the learning process. The connections indicated above, between learning and using technology reflects the importance of integrating technology in education. Teachers and educational leaders need to understand that kind of connection and hence strive to support and implement technology integration effectively (Foster & Hollowell, 1999).

However, the main aspect that is very basic for the successful integration of technology is to understand technology integration in real practice in the classroom. The key question is what the teachers need to know in order to effectively integrate technology. Wills (2006) argues that teachers should possess and draw on a rich knowledge base of content, pedagogy, and technology to provide relevant and meaningful learning experiences for all students. Therefore, he says, teachers need to identify needs, and plan, implement, and assess classroom instruction through the collaborative use of technology and other resources. Unfortunately, Wills (2006) observes, the current situation is that "most teacher candidates seeking teacher certification have little experience integrating technology into the students' learning

process and typically do not have experience using models on which to build their own visions of an integrated classroom" **(**p. 25). Roblyer (2003) believes that effective technology integration depends on a well-planned match of needs with resources and teaching strategies, along with classroom conditions that support them. She suggests an approach that reflects the effective technology integration, an approach "An Enlightened Approach to Technology Integration" (p. 36).

Models of Technology Integration

Although a good number of scholars (Bates, 2003; Bradshaw, 2002; Ertimer, 1999; & Levira, 1997) have discussed the gaps or shortfalls that occur when technology integration is not properly or effectively achieved, they have superficially demonstrated what and how it should be integrated. Edyburn (1998) observes that much literature generally overlooks an essential component of the integration process, namely, what technology integration looks like and how it is achieved. He argues that without models, principles, and strategies, the challenge of integrating technology into the curriculum can be an overwhelming task with unpredictable results. Technology integration models are frameworks for how technology may be integrated in the classroom. The models provide a guide for the teacher. The teacher selects the model by looking at various factors; among them are how it relates to the curriculum, the context of technology adoption, learners' characteristics, and the technology standards. In this part, two models that were used in the study are discussed. They are Apple Computer's ACOT Stages of Development model (1995) and Ely's (1999) eight conditions for effective adoption of innovations. Ely's "conditions of diffusion of innovations" is not actually a model but it

has been widely used such that many researchers view it in the same way as models are viewed.

These models and other factors necessary for technology integration are used as a conceptual framework for evaluating technology integration at the University of Dar-es-Salaam in Tanzania.

ACOT Stages of Development Model

A good number of technology integration models have been developed to investigate the process of implementing innovations. They have been developed in an attempt to describe the adoption process. Among them, Rogers' (1995) Diffusion of Innovations model is the most widely known and cited model as regard to adoption and diffusion, not only in education but also in other fields (Surry & Ely, 1998). This model has broader implementation and applications possibilities. The model contends that an innovation is diffused through a social structure over time. Therefore, adoption of innovation is a process and not just a one-time event. Generally, from the perspective of technology, the theory posits that the adoption of a new innovation follows a predictable pattern and that those patterns are part of the decision-making process of adaptors. The stages in Rogers' (1995) theory are knowledge, persuasion, decision, implementation, and confirmation.

ACOT Stages of Development model has the same perspective in terms of stages or patterns as Rogers' model. However, the ACOT model is more focused on technology integration in the classroom. The model was developed from a ten-year project conducted by the United States Department of Education funded by Apple Computer Inc., from

1985 to1995. The project was based on the question: What happens to students and teachers when they have access to technology whenever they need it? (Apple Computer, 1995, p. 8). The findings of the project indicated that teachers must go through the stages before they are able to fully integrate technology in their teaching. The stages are entry, adoption, appropriation, and invention.

Stage	**Examples of What Teachers Do**
Entry	Learn the basics of using new technology
Adoption	Use new technology to support traditional instruction
Adaptation	Integrate new technology into traditional classroom practice. Here, they often focus on increased student productivity and engagement by using word processors, spreadsheets, and graphics tools
Appropriation	Focus on cooperative, project-based, and interdisciplinary work-- incorporating the technology as needed and as one of many tools.
Invention	Discover new uses for technology tools, for example, developing spreadsheet macros for teaching algebra or designing projects that combine multiple technologies

Figure 1: ACOT Stages of Development. (Apple Computer, 1995, p. 16.)

The ACOT Stages of Development model explains what the teachers go through as they integrate technology into classroom teaching. The stages may strongly indicate the level of technology integration by students and the institution as a whole. They may also help as a guide for the steps to be taken by the institution to evaluate and improve on the processes of technology integration.

Ely's Eight Conditions for Implementing Educational Technology Innovations

Apart from the models, other scholars have suggested conditions that must be present if the process of using technology is likely to be successful. One of those scholars that have caught the attention of many people in the field of technology integration is Donald Ely. Ely (1999) suggested eight conditions that must exist or be made available for adoption of an educational innovation to take place. The process of technology integration is the process that involves the adoption of new innovations. According to Ely (1999), these conditions are interrelated and influence each other. This means the presence of one may not be sufficient to suggest success unless the others are also present**.** However, other conditions, according to Ely (1999) are more necessary than others. These conditions are:

1. Dissatisfaction with the status quo. This is the condition of the implementers when they feel that change is required. It is the situation that emanates from the emotional feeling of the implementers when they are dissatisfied with what is currently available. They perceive the current methods as insufficient and ineffective (Ely, 1999). Ely provides reflective phrases of those who are

dissatisfied that gives an impression of how this condition exists: “Something is not right. Things could be better. Others are moving ahead, we are standing still. There must be something we can do to improve the situation” (p. 4). He says that this emotional state may be inert or induced and it is linked to leadership. So, if we understand what causes dissatisfaction and the extent of the dissatisfaction, we can help change it, and it would be easier to communicate innovations to the adopters.

2. Presence of sufficient knowledge and skills. In order to make the implementation succeed, "the people who will ultimately implement any innovation must possess sufficient knowledge and skills to do the job" (Ely, 1999, p. 4). Ely (1999) says that it is especially evident when the innovation involves use of a certain tool or a technique. People who will be involved in the implementation of innovation must possess knowledge, technical knowledge, and skills to be able to effect change. Without enough training to use the tool or technique, the innovation will cease to exist. This condition has consistently been ranked as the most influential among the eight conditions.
3. Availability of resources. This refers to appropriate and adequate resources to be available and accessible to the users. According to Ely (1999), the resources include hardware, software, publications, audiovisual, and other teaching materials. These are required to make implementation work. This means the institutions must provide the required resources to support the use

of technology in teaching and learning. According to Ely, this condition is linked to commitment, reward and incentives, and leadership.

4. Availability of time. The adoption of the innovation takes time and is a long process that needs to diffuse at a good pace. Ely (1999) states that, "the implementers must have time to learn, adapt, integrate, and reflect on what they are doing" (p. 4). He says that time is necessary to ensure that people understand the innovation and develop the abilities to adapt the innovation. He indicates that sometimes it requires the willingness of individuals to contribute some of their own time and that the company should ensure adequate, paid time for innovation.
5. Reward or incentives. It is natural that people need to be encouraged, recognized and appreciated for their performance or use of the innovation. Ely (1999) characterizes incentive as something that serves as an expectation of reward or fear of punishment. He says that it serves as a stimulus to move an individual to action. In his study, however, he found that rewards and incentives were of less importance than other conditions.
6. Participation. Involvement instills the sense of belongingness and therefore a positive attitude of the implementer. The implementer develops a feeling that their ideas are honored. Participation, according to Ely (1999), is shared decision making and communication among all parties. It is the involvement of key stakeholders in decisions that involve planning and design of the innovation.

7. Commitment. Innovations take time and involve numerous activities. Implementers have to be ready and to expect the flexibility of adopting new innovations. According to Ely (1999), this condition is more often expressed by the primary leaders of the organization, such as a board of directors. He states that commitment is measured by the perceptions of implementers. Nawawi, Ayub, Ali, Yunus, and Tarmizi (2005) observe that there must be visible support for innovation from top management of the organization, such as principals and department heads to facilitate its acceptance potential. To Ely, commitment is linked with leadership, resources, time, and reward and incentives.
8. Leadership is evident. This condition is defined as an active involvement of the leadership in the process of innovation adoption and implementation. In other words, an active involvement by immediate supervisors in assisting the users in implementing the innovation. Ely (1999) states that this condition includes providing support and encouragement to users, as well as role modeling in the use of the innovation. He says, "Once the executive leadership is evident, then the project leadership becomes even more important because the person who can help with implementation is closer to the user" (p. 5). Surry and Ensminger (2002) say that knowing how faculty members view the importance of these eight conditions can assist an institution in successfully implementing a web-based instructional program.

In another study on the teachers' perceptions of Ely's conditions on the implementation of online programs, Ensminger and Surry (2002) found that teachers perceived availability of resources as the most important condition for implementing a new technology program. They found that adequate skills and knowledge and dissatisfaction with the status-quo were the next most important conditions.

According to Ely (1999), the presence of these conditions is necessary to implement change once an innovation has been introduced and adopted. This means if all conditions are present or deliberately created, there will be a high probability of sustained implementation. Nawawi et al. (2005) report that Ely's eight conditions were determined through studies in North America and those studies found that the conditions were true in many innovation environments. Ely's eight conditions were also determined in non-American environments and cultures and in many cases, they proved to be true. However, the extent of their existence depended on the uniqueness of different environments. Ely, however, has reservations about the existence of the conditions. He writes, "While it is difficult to generalize about the existence of these conditions, it is clear that they differ in magnitude according to the innovations being studied and the environment in which it (technology) is used" (Ely, 1999, p. 8.).

The two models discussed above may be used to examine and evaluate the status of technology integration in a particular environment. The ACOT model is more focused on the teachers. However, since the teachers are the main players in facilitating the process of education, determining the stage of development of the teachers may suggest the stage of the whole program.

Technology Planning

In the editors' note, the 1999, *Information Technology in Higher Education: Assessing its Impact and Planning for the Future* journal, Katz and Rudy (1999) argue that the story of planning and assessing information technology in higher education is a story about change. They argue that change demands clarity of vision and a campus-wide commitment to using information technologies in ways that reinforce this vision and the goals associated with it. They continue to argue that to harness this change for greatest effect; institutions will need to align their information plans closely with their goals for teaching, learning, scholarship, and service.

Looking into the nature of technology integration as a complex process, which basically involves an amalgamation of factors, components, people, and ideas, it is clear that having a plan is paramount. Technology planning is the only way that all these elements can be organized to produce effective results. One of the indications that may suggest that technology integration is on the right track is first and foremost the presence of a technology plan. In the United States, planning is conducted at different levels from the national level to the school level. Whitehead et al. (2003) write, "Planning enables the schools to meet established technology standards" (p. 30).

Rationale and Process of Technology Planning

Generally, there is a need to plan in education in order to give a focus and provides guidelines to implementation. In order to ensure that the goals of technology integration in education are achieved, the concerned party has to prepare a technology plan. Whitehead et al. (2003) argue that capable leadership and careful planning are

critical factors that are consistently interwoven within a fabric of successful school technology initiatives. Sun, Heath, Byrom, Phlegar, and Victor (1993) provide comprehensive guidelines for technology planning. They state that planning is the key to successful technology implementation and integration. They observe that technology planning and integration are both complex processes that require and take place over time. Sun et al. (1993) argue that planning is a process of moving from vision to reality and that a plan creates the big picture and provides a framework for the myriad individual strategies and actions that must take place to bring everything together successfully. On the other hand, they point out that technology is not simply about hardware, software, and connections. It is about managing people and resources for accomplishing what you have set out to do. Sun et al. (1993) highlight the planning process as to include planning to plan, gathering information, identifying resources, managing resources, providing professional development, purchasing materials, writing curriculum, and evaluating the progress.

Cradler (2004) argues that careful planning is a prerequisite for effective implementation of technology. He suggests that technology alone does not make school reform happen; in order to effectively target technology to support teaching and learning, it is necessary to engage in planning it at all levels. This is consistent with Porter's (2003) argument that a technology plan should be part of the school improvement plan and that it is needed because of unfamiliarity and high visibility of technology in schools. Moreover, he writes that planning helps everyone understand technology roles in schools and provides a unique opportunity to extend the scope of traditional school improvement

plan (Porter, 2003). Roblyer (2003) says that the mere presence of technology is not a guarantee for improved education. She says that planning is the key to addressing key concerns that have been observed as causes of failures in using technology. Bates and Poole (2003) argue that the biggest barrier to an increased use of technology is the difficulty thinking creatively and imaginatively about how technology could move department, college, or university forward in a strategic sense.

Valdez (2004) points out that if the tremendous potential of technology is to be optimized, educators and community members need to develop a comprehensive learning and technology plan long before technology equipment starts arriving. He further observes that most research studies on technology implementation show that much of the frustration with technology can be attributed to inadequate or nonexistent planning. Adequate planning may be especially lacking in how technology is used to improve learning and determining how teachers receive professional development to help enhance student learning. From these scholars, it is clear that planning is a central factor in the implementation of technology integration. Comprehensive and successful planning should address other resources and factors that are connected to technology, and mostly these are human resources and human factors.

Cradler (2004) provides a summary of beliefs in the systematic planning approach. These beliefs are examples of the guidelines to creating a technology plan and implementation of the plan. They include:

1. A rationale for the technology and related resources
2. The stakeholders' involvement in the decision-making process

3. A way to promote thinking about the most cost-effective uses of technology
4. Assurance that technology applications are aligned with the curriculum
5. Help in determining the specific training and assistance needs
6. Assurance that existing resources are used in the plan
7. A needed vehicle for procuring funding
8. A method for determining how to evaluate the impact and progress of the technology
9. A vehicle for communicating steps for others to follow in adapting the plan
10. A process for coordination with other programs and projects
11. Teaching that addresses the needs of all learners
12. Guidelines and context for the insertion of new technologies
13. Software developers with a definition of the technology needs of users. (Cradler, 2004, para 9)

There are many variables in any education system, and adopting technology in a complex system such as an education system cannot be done without anticipating and considering intervening factors. Planning can avoid many implementation obstacles. It provides us with an opportunity to choose and therefore is a guarantee of success in achieving our desired goals.

What Constitutes a Technology Plan?

Before putting up a technology plan, two questions must be addressed: What entities are to be organized, and what aspects make an effective technology plan. See (2004) discusses features of an effective technology plans as follows:

1. Effective technology plans are short term, not long term. Since technology is changing fast, See (2004) notes that a technology plan should not lock schools into old technology and applications just because it says so in the plan. Newer, more powerful, lower-cost technology may be available to replace what is specified in a three-year-old plan.
2. Effective technology plans focus on applications, not technology. In other words, See (2004) says, make your technology plan outcome-based, not input-based. Develop a plan that specifies what students, staff, and administration should be able to do with technology and let those outcomes determine the types and amount of technology requested.
3. Effective technology plans go beyond enhancing the curriculum. Don't buy technology to teach about technology. Educators should be able to do more than enhance existing instruction with new, powerful types of instructional technology.
4. Effective technology plans define technology as more than computers. See (2004) observes that many technology plans only deal with computers. He says that there are many other types of technology available that have appropriate uses in education. Include as many types of technology in a plan as possible. See (2004) says that there are many types of applications that do not get much attention in many schools.

5. Effective technology plans stress integration of technology into the curriculum. Effective technology plans help teachers answer the question, "What do I have to stop teaching to teach about the computer?"
6. Effective technology plans are tied to staff development plans. Technology plans that are not tied to long-term staff development are destined for failure. (See, 2004).

Rohrer and Moore (1997) argue that the challenge of the new technology plan is to define new teaching strategies using technology to enable educators and students to respond to academic and economic changes and to ensure that resources are available, used effectively, and equitably distributed. Therefore, in terms of process, they agree that planning for technology should do the following:

1. Maintain focus on student needs by keeping technology projects on task.
2. Allow for integration of technology within school-restructuring efforts.
3. Allow for site-based control in the planning and implementation of technology.
4. Provide for the coordination of all technology efforts including funding and budget decisions.
5. Assist in the identification of the infrastructure and available resources.
6. Involve all stakeholders.
7. Provide equity by addressing the needs of the different student populations, avoiding pockets of neglect.

8. Provide opportunities to explore emerging technologies and determine what is appropriate for each educational program.
9. Provide a tool for the ongoing, self-monitoring of progress--a means of developing and tracking milestones.
10. Provide not only short-term goals for immediate application but also long-term goals for achieving the district's educational vision (Rohrer & Moore, 1997, Developing a Local Technology Plan section).

Baron (2004) identifies, in a study on technology classes in ACOT schools, seven important factors that contributed to their success. They are:

1. Technology initiatives should start with instructional goals.
2. Technology must be linked to curricular goals and framework.
3. Technology and assessment system must be compatible.
4. Teachers and technology need to work together.
5. Teachers require ongoing pedagogical and technological support.
6. Community and parents' involvement enhances the likelihood of success.
7. Business plays an important role in technology and school reform (Barron et al., 2001, p. 6-8).

Jones (1993) argues that there is no one way to write a plan and that it requires time and effort. She says the plan will be the principal means of communicating educational technology goals to decision makers and the public; therefore, it should be organized and clear. She highlights the components of a technology plan as vision, mission statement, goals and objectives, strategy, scope, training and staff requirements,

evaluation criteria, technical standards, cost estimates, timeline, upgrading, maintenance, and obsolete strategies and glossary of terms. The review of these components includes the views from other scholars.

Mission Statement

The mission statement is helpful in guiding any plan. This gives a road map of what is to be done. According to Huston in Whitehead et al. (2003), "the importance of a mission statement is to get where we need to go, we will need to get vision for what we want, and a sense of mission that will shape how we carry out the vision and a deep sense of purpose to ensure that it happens" (p. 33). Whitehead et al (2003) argue that the mission statement that includes students, learning, and teaching is the one that is most likely to direct the project toward successful implementation for students, teachers, and schools.

Vision Statement

One of the essential elements of the technology plan is the vision of learning. Talking about the role of the vision, Jones (1993) argues that the ability to create a vision and communicate that vision to the public is important. She says that the public must know what education will look like after technology is in place, - the new environment that will result from integration of technology in education. According to the Massachusetts Software Council (1994), a vision of learning is critical to the technology-planning process and should be the primary driver of all decisions concerning which technology is purchased and how it will be used. They argue that without a vision of learning there is little hope that technology will contribute to improved student learning. It should be creative but realistic. Sun et al. (1993) indicate that a well-defined vision

statement is a cornerstone of any good plan and that this should be the first priority before drafting goals and objectives. They further argue that the vision should reflect the core values and therefore how technology will help support those values. The vision statement is a single concise paragraph and according to Sun et al. (1993), it answers the questions:

1. Why is technology important to the students and teachers in our schools?
2. Why do you believe that technology is a necessary tool for teaching and learning? (p. 38).

Hardware and Software

With the explosion of technology integration in education, especially in the developed countries, there has been an increase of technology equipment in the market. This might pose the danger of acquiring “poor equipment” from the market. Burniske (2003) argues that educators should question not only the choice of hardware, but also the software used to introduce students to computer technology. He says that this is especially true in professional development programs that influence pedagogy and curriculum. Burniske (2003) observes that, unfortunately, in the developing world, the choice of software is often limited to what well-intentioned organizations donate. People have relatively little choice when it comes to hardware and a little knowledge to make informed choices. Statistically, Burniske (2003) reports that of a quarter billion of functioning computers (desktop) in the world, less that 10% can be found in developing countries, and most of them employ the PC platform and operating system.

In referring to the specifications of the hardware and software acquisition, Sun et al. (1993) writes that software (instructional material and applications) that best suit a

school or district's instructional needs should determine hardware (equipment) purchases. They suggest compatibility and ease of use as the important considerations. Other considerations include networking and multimedia access, safety and security measures, system maintenance, technical support, facilities modification, and other infrastructure support. Bates and Poole (2003) argue that a model for selecting and applying technology is needed and cite the following as criteria for choosing technology:

1. It will work in a variety of learning contexts.
2. It will allow decisions to be taken at both strategic institutional-wide level and at the tactical instructional level.
3. It gives equal attention to educational and operational issues.
4. It is easily understood, pragmatic, and cost effective.
5. It will accommodate new developments, in technology.
6. It will identify critical differences between different media and technologies, thus enabling an appropriate mix to be chosen for any given context. (p. 77)

When preparing a technology plan in a developing country like Tanzania, the choice of hardware and software may be limited to match the standard of contemporary technology integration. Nonetheless, the choice of hardware needs one to take into consideration some factors so that they can effectively fulfill the needs.

The Budget

The budget is the backbone of implementing a plan. According to Slinger (1998), the budget should indicate the allocation of funds for hardware, software, staff development, networking, maintenance, personnel, and ongoing support for the plan. He

argues that it should tie directly to the vision statement and any technology goals at the state level. He suggests that 20% to 25% should be allocated to staff development. Slinger (1998) suggests that the planning committee needs to research costs. In budgeting, the sources of funding need to be determined and established.

Foster and Hollowell (1999) assert that information technology is a major consumer of resources. They suggest that institutions need to develop life-cycle funding plans for technology and that the institutions must be clear about how the timely replacements of departmental equipment will be planned and budgeted. Foster and Hollowell (1999) observe that the key to spending on technology is to assess the needs and apply resources to the highest priorities on places where return will be greatest. They continue: “Technology spending should be thought of as an *investment* in the physical and intellectual capital of an institution” (p. 17). One of the solutions they suggest is charging a computing or technology fee to students to generate revenue. This practice, they say, is now common in state-funded universities in the United States. In the context of Tanzania (the research site) this strategy, funding, and budgeting may be an obstacle to technology integration because of the country’s weak and dependent economy. For example, information from the website of the University of Dar-es-Salaam indicates that much of the technology installed at the university has come from foreign aid and grants. The introduction of technology fee would be a significant burden to the already burdened students as most students obtain tuition fees from government loans.

School Culture

In establishing technology education in schools or states, the culture of the institutions is important to support its existence and development. Raizen, Sellwood, Todd, and Vickers (1995) say that design and technology education requires a school culture that supports teachers who are risk-takers. They argue that school culture must change to support ongoing learning by administrators, faculty, risk-taking teachers, and students.

Carr (2003) points out the claim by the scholar Roland Howasan, who said that the culture of the disciplines and professions are different but functional in their own spheres. He gives an example that faculty in the disciplines identify with scholars in their own disciplines and value theory over application. Carr (2003) highlights one of the challenges that may face technology integration instruction as a matter of culture in institutions. She says:

> The movement to this new focus of learning and integration of technology will not be easy. Technology has a potential to move the university to a learner-centered environment; however, our faculty have spent their academic lives and found success in teacher-centered environment. (p. 83)

Carr (2003) points out another aspect of difference of cultures, that is, between science teachers and arts teachers, which she says stems from the historical development of liberal arts and professional programs in US higher education. With that, Carr (2003) observes that integrating technology brings in a third set of cultures into the environment of old values of academics and argues that this requires great attention to determine

success. She suggests a collaborative approach between faculty of arts, science, and teacher education through professional development programs and teacher education courses.

Professional Development

Romano (2003) argues that empowering teachers with technology is one of the basic prerequisites that can make technology more useful to the students. In his perception of computers in education, he observes that computers allow teachers to provide each member of the class with an increased number of individualized learning experiences based on the learner's needs rather than teacher availability. Computers allow learners to phase into directing their own learning experience particularly at a higher level. Whitehead et al. (2003) argue that appropriate professional development for faculty, staff, and students is critical to the success of linking technology to the curriculum. They argue that one of the keys to successful staff development is to have teachers teach other teachers. Whitehead et al. (2003) highlight ideas from the US experience that have proven effective in staff development at the local level as project-based approach, flexible scheduling, school/college/university partnership, college and university pre-service programs, staff development consortium, and staff development cooperatives.

Cooley (2001) argues that staff development is one of the last best hopes for educational improvement. He says that the reality of improvement and change remains closely related to human resource development and that those who seek to improve education must first focus on enhancing teacher and administrator skills through planned,

coordinated, ongoing staff development. He details a model of staff development, the teachers-as-trainers model. This is a site-based staff development program that emphasizes faculty and staff empowerment, accountability, responsibility, and ongoing support. It consists of four interrelated phases: developing a needs assessment, core team selection and planning, delivery of training, and personnel and program evaluation.

Bradshaw (2002) indicates the need for staff development. He argues that teachers must have new knowledge and develop new skills and attitudes before they can teach others about technology and integrate technology into their classroom instruction in meaningful ways. He points out models of staff development that were identified in research by Joyce and Showers (1995). They include training of trainers' model, model classroom technology training centers, resource centers, networked labs and cyber campuses, and a portable lab using laptop computers.

According to Mitchen, Wells, and Wells (2003), in order to assist the development of effective teacher training regarding technology integration, the United States Department of Education created a program called Preparing Tomorrow's Teachers to Use Technology. Under this program, there were funded grants to help K-12 teachers' professional development. This implies that one strategy is to establish a special program and special fund for technology teachers so as to sustain technology integration at different levels. Howard and Wedmann (2004) argue that past experience has shown that the traditional workshop model for delivering of professional development does not often result in changes in actual practice. They suggest the pre-service teacher educational model as the best.

There are different models of professional development that can be used for teachers to sustain technology integration. One of the features that characterize a good model for technology integration is keeping teachers informed of the current trends in technology and new methods of teaching their respective subjects. The nature of technology integration, as part of the general curriculum, will depend on the factors within the system itself. For developing countries like Tanzania, the factor of resources will play a key role in determining the professional development model to adopt.

The Planning Process

The planning process may be considered one of very crucial preconditions of good technology implementation. This implies that if the planning process fails, the implementation will definitely be hard. Farrel and Gring (1993) suggest a five-step planning model. The steps include:

1. Needs assessment. In this stage, the analysis of situations, environment of institutions, demographic profiles, financial situations, and communication patterns is done.
2. The vision: Creating goals. Here the planning committee creates a vision that leads to the formation of goals.
3. Selecting goals. The goals selected should be clear, attainable, measurable, and appropriate.
4. Writing a plan. This requires a planning committee to prioritize and put in place strategies for implementation.

5. Implementing and evaluating a plan. It is necessary to evaluate the progress of the plan, that is, to see that each goal is attainable. (Farrel & Gring, 1993, p.121)

For each of these steps, there are sub-steps to follow in creating and implementing a plan and these may depend on existing conditions.

The Tanzania Development Vision 2025

The Tanzania Development Vision 2025 was initiated in 1995 under the auspice of the defunct Planning Commission and was presented to the then-president in 1999 when it was enacted. This was the time when the country was undergoing major socioeconomic reform after a long period of socialist ideologies. Three principal objectives of the Vision for the country to be achieved by 2025 include achieving a good quality of life for all, good governance, and rule of law. In these three objectives, the aspect of education in which technology is presented falls under the objective of achieving a good quality of life for all. In section 4, Vision 2025 lists driving forces for the realization of its objectives and strategies of implementation. Relevant to this research is the driving force of competence and competitiveness. According to Vision 2025, this force, among other strategies, would be realized by the provision of high quality education. In elaborating this strategy, Vision 2025 indicates technology strategies as:

1. Promotion of science and technology education
2. Promotion of information and communication technologies

On ICTs, Vision 2025 says ICTs are major driving forces for the realization of the Vision. Vision 2025 continues:

> The new opportunities which the ICTs are opening up can be harnessed to meet the goals of the vision. However, appropriate skills and capabilities would have to be put in place. This task demands that adequate investments are made to improve the quality of science-based education and to create a knowledge society generally. (p. 21).

These strategies of achieving quality placed the institutions in the spotlight as the leaders in implementation. The institutions of higher education such as the University of Dar-es-Salaam need to take a leading role in implementing the vision.

Vision 2025 plays a central role as a philosophical reference for the development plans in the country. The educational policies that were created have made reference to this policy. For example, National ICT policy, the Dar-es-Salaam University ICT policy, and the National ICT Policy for Basic Education have reflected what is contained in Vision 2025.

Summary

The review of literature was organized to build a body of research and issues concerning the implementation of technology integration from the theoretical to the practical level. The literature helps to create a conceptual framework with which to explain and evaluate the encountered situation. The discussion of the concept of technology integration in education was made to establish the essence of the gaps in the technology integration practices in different parts of the world. This builds a body of knowledge about what might be expected from the respondents in assessing the nature of technology integration at the university.

For a better implementation of technology integration in any educational system, it is vital to understand clearly what is to be done and why. Some factors to consider and the model of technology integration build a conceptual framework for which the evaluation of the program of technology integration can be viewed were discussed. Components of a technology plan and a model of technology integration were discussed.

The situation of technology integration in Africa may reflect what the situation is or may be in Tanzania, although there are some factors that are unique or country specific. as a whole, the review of literature helped to establish a sound footing (suggesting possible answers to the research questions) for a study, which is seeking to investigate and assess the implementation of technology integration in higher education in Tanzania using the setting of one university.

Chapter Three: Methodology

Introduction

This study aimed at investigating and evaluating the nature of technology integration by students and teachers at the University of Dar-es-Salaam. The method of inquiry adopted was a qualitative evaluation case study. This chapter focuses on research methodology and presents the research design and data analysis procedures. Research design includes the methods that were used to collect data and the rationale for choosing the methods, instruments, setting, population, and sample. Data analysis includes procedures that were used to make meanings that enabled the interpretations with respect to the research questions. The methodology was designed to collect data to answer the following research question: What is the nature of implementation of technology integration into classroom learning and teaching at the University of Dar-es-Salaam in Tanzania by faculty and students?

The answer to that main research question was obtained by answering the following sub-questions:

1. What technology is available to support teaching and learning, where is it located, and who uses it?
2. How much knowledge and skills do the stakeholders have about technology and technology use?
3. What approaches to and strategies for integrating technology do teachers and students employ in learning and teaching?

4. Are there professional development programs for the teachers? How effective are they?
5. Does the university have technology plans? If so, what are the contents of those plans and to what extent are they being implemented?
6. At what stage of the ACOT Stages of Development model is the status of technology integration at the University of Dar-es-Salaam?

Conceptual Framework

A conceptual framework is used in research to outline possible courses of action. Shields and Tajalli (2006) have identified several types of conceptual frameworks (working hypotheses, descriptive categories, practical ideal type, models of operations research, and formal hypotheses) for the field of public administration. These may also be applied to the field of education. Shields and Tajalli (2006) state that the frameworks are linked to particular research purposes (exploration, description, gauging, decision making and explanation/prediction). The conceptual framework in this study is defined as the body of ideas that are viewed to be more ideal in explaining the process of technology integration that is viewed as more effective in a given environment. These ideas are drawn from a body of literature from different scholars based on their research. This is the nature of qualitative evaluation research. The purpose is to evaluate a process in an educational program, that is, the process of technology integration at an institution of higher learning. It was designed as a formative evaluation looking at technology integration as part of the enhancement strategies of the learning and teaching processes in progress. According to Hall and Hall (2004), before evaluation is done, one needs to

establish the standards. Therefore, the researcher used the presented ideas (as bases for determining quality) to evaluate the practices of the stakeholders (those involved in the process of technology integration at the university) in the integration process. These ideas are taken as the standards with which the study will make a determination of the quality. This means the presented ideas were the indicators that guided in determining the existence or the absence and the level or extent of the condition being looked at. In this study, evaluating the technology integration, it was assumed that there are conditions, aspects, or indicators that explain effective technology integration. These can be explained by the body of literature or a technology integration model. In this study, the conceptual framework used is based on Ely's eight conditions for implementation of educational innovations. These conditions (which will be considered to work the same way as a model) are: dissatisfaction with status-quo, presence of knowledge and skills among the users, availability of resources, availability of time, reward and incentives existing for participants, participation that is expected and encouraged, commitment by those involved, and leadership. These conditions show the broader spectrum of the technology integration. However, this study focused on the implementation in a specific environment of the classroom teaching and learning processes; therefore, from Ely's model, three conditions were used. These are presence of knowledge and skills, availability of resources, and time. The fourth element that was used as part of the conceptual framework was derived from literature. This is technology planning. This study focused on the existence of technology plan or some planning processes. The Apple Computer of Tomorrow (ACOT) Stages of Development model was used to determine

the status of technology integration by teachers at the University. The ACOT model, developed from a project by the United States Department of Education, argue that teachers must travel through a number of developmental stages before they have fully integrated technology into their teaching (ACOT, 1995, p.16).

The Research Design

> Choosing a study design requires understanding the philosophical foundation underlying the type of research, taking stock of whether there is a good match between the type of research and your personality, attributes, and skills, and becoming informed as to the design choices available to you within the paradigm. (Merriam, 1998, p. 1)

The need for such requirements relies on the fact that there are many choices and decisions that the researcher needs to make before and during the qualitative study.

The research applied a qualitative evaluation research design in collecting and analyzing data. The research methodology was a case study which focused on one institution, the University of Dar-es-Salaam, an example of a technologically resourced institution of higher education in Tanzania. Since the study focused on a few aspects that may be used to evaluate the entire technology integration program at the university, it is therefore a formative qualitative evaluation research.

What is Qualitative Research?

Qualitative research is a method of inquiry that is normally contrasted with quantitative research, which is conducted by dealing with empirical data. Creswell (1998) defines qualitative research as follows:

> Qualitative research is an inquiry process of understanding based on distinct methodological traditions of inquiry that explores a social or human problem. The researcher builds a complex, holistic picture, analyzes words, reports detailed views of informants, and conducts the study in a natural setting. (p. 15)

According to Merriam (1998), qualitative research is an umbrella concept covering several forms of inquiry that help investigators understand and explain the meaning of social phenomena with as little disruption of the natural setting as possible. Qualitative research is concerned with exploring phenomena from the perspective of those being studied (Guba & Lincoln, 1989; Patton, 1987). Glesne (1999) points out that three data-gathering techniques dominate in doing qualitative research, and within each technique a wide variety of practices can be carried out. The techniques are; participant observation, interviewing, and document collection. Merriam (1998, P. 6-8) discusses five characteristics of qualitative research that cut across all forms or techniques: The characteristics are:

1. Qualitative researchers are interested in understanding the meaning people have constructed, that is, how they make sense of their world and the experiences they have in the world.
2. The researcher is the primary instrument for data collection and analysis.
3. Qualitative research usually involves fieldwork. The researcher must physically go to the people, setting, site, institution (the field) in order to observe the behavior in a natural setting. Exceptions are pointed out when sometimes documents alone are used.

4. Qualitative research primarily employs an inductive research strategy. That is, this type of research builds abstractions, concepts, hypotheses, or theories rather than tests existing theory.
5. Since qualitative research focuses on process, meaning, and understanding, the product of qualitative study is richly descriptive.

Unlike quantitative research, the actual data that result from using qualitative methods are used to generate theories instead of relying on predetermined hypotheses to test (Strauss & Corbin, 1998; Guba & Lincoln, 1989).

Qualitative Evaluation

The focus of this study was to evaluate the process of technology integration. Therefore, this study was a qualitative evaluation case study. The purpose of evaluation is to inform action (Patton, 1987). Hall and Hall (2004) define evaluation as "the systematic assessment of the operation and /or the outcomes of a program or policy, compared to a set of explicit or implicit standards, as a means of contributing to the improvement of the policy or program" (p. 28).

The definition suggests two features of evaluation, collection of data and making judgments about the value of a program or policy. The assessment may be summative or formative. Hall and Hall (2004) point out that the purposes of evaluation processes fall into three general perspectives: evaluation for accountability, evaluation for development, and evaluation for knowledge. Patton (1987) lists five questions that help in making decisions in an evaluation research of the kind of data that are appropriate in a particular evaluation:

1. Who is the information for and who will use the findings of the evaluation?
2. What kinds of information are needed?
3. How is the information to be used? For what purpose is evaluation being done?
4. When is the information needed?
5. What resources are available to conduct the evaluation?

Patton (1987) asserts that evaluation can utilize both quantitative and qualitative data. However, Al-Washahi (2007) argues that it is important for the researcher to decide which method or inquiry best serves the evaluation's purpose rather than to choose the most appealing and familiar one. Although there is no perfect research design, literature indicates the need to use qualitative methods as a preferable approach to do evaluation. Patton (1987) argues that the emphasis of qualitative methods is on depth and details. He argues that “getting more data usually takes longer and costs more (qualitative) but getting less data (quantitative) usually reduces confidence in findings” (p. 46).

This evaluation study was intended to understand the nature of the practices of technology integration at the university by obtaining data from participants. The use of a qualitative approach was necessary to extract detailed data to enable the researcher to arrive at a fair judgment about the effectiveness of the process and the program based on the identified standards. The findings and generated ideas from the discussion may be used to inform the policymakers and implementers at the University of Dar-es-Salaam about the nature of technology integration at the institution for more evaluation and/or improvement.

Qualitative Case Study

Case study, according to Marshall and Rossman (1999), is a qualitative research strategy that is used when focusing on studying about society and culture –whether a group, program, or an organization. Case study is an approach within qualitative research. Merriam (1998) defines qualitative case study as an intensive, holistic description and analysis of a single instance, phenomenon, or social unit. She says that the single most defining characteristic of case study research lies in delimiting the object of study. According to Merriman, three words describe the case study: particularistic, holistic and descriptive. It is particularistic because it focuses on a particular situation, event, program, or phenomenon. It is descriptive because the end product of the case is rich, thick in description of a phenomenon. Lastly, it is heuristic because it illuminates the reader's understanding of the phenomenon under study and extends the reader's experience. Merriam suggests that a qualitative case study is particularly suitable when the researcher is interested in the process. A case study may entail multiple data collection methods such as interviews, questionnaires, document analyses, observations and even surveys. Yin (2003) argues that the case study is the method of choice when the phenomenon under study is not readily distinguishable from its context. He asserts that such a phenomenon may be a project or a program in an evaluation study. Since this study focused on an educational program at one institution that involved a group of people at one setting, a case study was a preferable approach to this study. Yin (1994) indicates that "case studies are the preferred strategy when 'how' and 'why' questions are being posed, when the investigator has little control over events and when the focus is on

contemporary phenomenon within some real-life context" (p. 1). Yin (2003) identifies six kinds of case studies: single case exploratory, single case descriptive, single case explanatory, multiple case exploratory, multiple case descriptive, and multiple case explanatory. He elaborates that exploratory is aimed at defining the questions and the hypotheses of subsequent study; descriptive case study presents a complete description of a phenomenon, and an explanatory case study presents data bearing a cause-effect relationship. The distinction between single and multiple simple indicates the number of cases involved in the study regardless of the orientation. From Yin's description, this study is a single case exploratory.

Rationale of Research Project and Methods

Rationale of Research Project

The rationale for conducting a research study about technology integration was based on several factors ranging from the situations surrounding the researcher to the society's perspectives on the role of technology in education. However, the choice to do such a research was dominated by the researcher's perspective on the role of technology in education. The researcher sees that research on technology integration in learning and teaching is ultimately one of the more relevant aspects in determining the utility and impact of technology use in education. This is to say that there are many aspects that could be looked at as far as technology in education is concerned and they all build a body of knowledge that is useful in theory and practice of the educational experiences. Nevertheless, some issues have an ultimate impact in understanding the practical utilization of technology. The researcher chose this topic believing that technology

integration is generally one of those issues that exhibit the direct impact of technology in the educational process. This, being a case study research that examines technology use in a particular setting, concretely provides relevant input in improving educational programs in Tanzania. Conducting an evaluation study has an implication in regard to the Tanzania Development Vision 2025. The Vision 2025 has identified a weakness from the past experience. It says:

> Tanzanians have developed a propensity to prepare and pronounce plans and program, and ambitions which are not accompanied by effective implementation, monitoring and evaluation mechanisms. As a result, implementation has been weak. This situation has given rise to the erosion of trust and confidence among the people on their leaders. (Vision 2025, ¶ 2.2.4)

Such a study fills some gaps of evaluation that are created by the weaknesses described in the policy. It is necessary to evaluate the implementation so as to gather the information necessary for the improvement of the use of technology in education.

Rationale for Methods of Study

According to Marshall and Rossman (1999), a researcher may well have to develop a justification for qualitative research methods in general before describing the specific genre and approach. By justifying the use of the method, the researcher is showing that the research questions were best addressed using the method chosen. Qualitative research was considered most suitable in evaluating how computers were used in classroom situations at the University of Dar-es-Salaam in Tanzania. Using this method of study provided richer data about the program and about the participants'

feelings and perspectives. Compared to other methods, qualitative research methods enable one to get firsthand information using a variety of ways. Lincoln and Guba (1985) view it as "relying on field study as a fundamental technique, which views truth as ineluctable, that is, as ultimately inescapable" (p. 55). Marshall and Rossman (1999) argue that qualitative research is an appropriate and valuable choice for real-life situations and processes. Qualitative research is concerned with interpreting and bringing meaning to what human beings are doing or saying in the world at certain times and places. Silverman (2000) states that qualitative research is grounded in the lived experiences of people and that selection of a qualitative approach takes into consideration the fact that human behavior is never divorced from the setting in which it occurs. Qualitative research uses a series of representations in data collection, and it privileges no single methodology over the other (Denzin & Lincoln, 1994). According to Glesne (1999), the use of multiple data collection methods contributes to the trustworthiness of the data. A qualitative approach is more appropriate for this study because it is a naturalistic non-manipulative inquiry that focuses on intact situations and objects (Patton, 1987). Qualitative method enables the researcher to interview and to interpret the results according to the real-life situation on the site. It allows the use of expressive language and the presence of the participants' voices in text. This is important because voices bring in other aspects such as moods and tones that may contribute to the quality of data. So, using a qualitative approach gave the researcher the opportunity to interview the participants and to take took advantage of qualities of this method. Furthermore, the justification for using qualitative methods in this particular research on technology

integration stemmed from the fact that the research focused on practice in the real-life situation of technology integration at an institution as an ongoing process of education.

Data Collection

The study was completed by applying a variety of methods that characterize qualitative research. These primary methods were guided written interviews, telephone interviews, and document analysis. Secondary tools were telephone interviews of purposefully selected participants and e-mails.

The study was approved (for compliance of human subjects) on November 2007 by the Ohio University Institutional Research Board (IRB) (Appendix A) based on the original research proposal. Due to necessary changes that were made on the methodology, the approval period was extended to enable the completion of the research. This extension was granted without requiring new bureaucratic procedures, as the changes were not so significant to require a different scrutiny on the part of the IRB.

The process of collecting data began in late September 2007 and ended in late January 2008, after the researcher had completed communications with the research assistant. A research assistant for collecting data was necessary because the researcher could not travel to Tanzania. The research assistant was a university lecturer at the Dar-es-Salaam University College of Education, which is a constituent college of the University of Dar-es-Salaam. He is a chemistry teacher with 14 years of experience in teaching including 3 years as a lecturer at the university. He has a Ph.D. earned in Japan. His tasks were to identify the participants, administer written interviews to participants,

scan the written interviews, and send them to the researcher. He obtained phone numbers of participants and sent them to the researcher for telephone interviews.

Interviews

According to Patton (2002), the purpose of interviewing is to allow the researcher to enter into another person's perspective. Unlike other methods, the power of interviewing is that the researcher is able to "go inside the interviewee", meaning that he/she is able to explore feelings, attitudes, and other contexts for which access is unavailable by other methods. Wilkinson and Birmingham (2003) state that while other instruments focus on the surface elements of what is happening, an interview gives the researcher more insight into meaning and significance of what is happening. An interview can be face-to-face with an individual or can be with a focus group. Semi-structured interviews were used in collecting data for this study. The interviews took two forms: written interviews and telephone interviews.

The researcher used semi-structured interviews of students, faculty academic staff (teachers), and heads of department/faculty. Semi-structured interviews were conducted in order to remain focused, given a limited time for administering the questions, yet to also allow for flexibility. The initial design called for the researcher to go to the field to collect data in person but the contingency of researcher's plans to travel required adaptation, therefore, the researcher was not able to travel to meet the subjects face-to-face. Instead, the adaptation was to use telephone interviews and written interviews, which were sent through e-mails.

Telephone interviews were used with teachers and administrative heads. The telephone interview, according to Carr and Worth (2001), in research terms, is "a strategy for obtaining data that allows interpersonal communication without a face-to-face meeting" (p. 512). Telephone interviews have been widely used where face-to-face interviews were not possible. However, in some situations, telephone interviews are deliberately used to capture the strengths they have over face-to-face interviews. Sturges and Hanrahan (2004) indicate four aspects of interviews that would drive a researcher to use telephone interview. These are sensitive topics that are hard to do by face-to-face, access to hard-to-reach respondent group, interviewer safety, and cost effectiveness in data collection. For this study, telephone interviews were used because it was difficult to reach the respondents for face-to-face interviews.

Nevertheless, telephone interviews have some shortfalls compared to face-to-face interviews. For example, Genovese (2004) argues that unlike face-to-face interviews in which an interviewer can read facial expressions and body language and respond accordingly, interviewers who conduct telephone interviews are constrained by what they can hear and say. She says that the visual cues that most of us rely on so heavily in our daily interactions are stripped away and that we are left to engage total strangers in conversation with the power of our word and voice, and we draw heavily on our hearing to understand the meaning. Creswell (1998) notes that the use of the telephone deprives the researcher of seeing the respondents' informal, non-verbal communication but, contends that, it is appropriate when the researcher does not otherwise have access to the respondent.

As far as the technique of conducting telephone interviews is concerned, a researcher might be compelled to understand some aspects surrounding the interview process. For example, Genovese (2004) asserts that at its core, the telephone interview is about mastering the production and interpretation of sounds. She says: “It is as much about knowing how to speak as how to listen. A good interviewer knows what to say, how to say it and when to deliver it. Equally, they know how to listen, how to interpret and how to react” (p. 216).

Carr and Worth (2001) suggest that the introductory statements made by the interviewer are crucial in ensuring a good response rate. They suggest that the initial question should be straightforward and simple, to help to increase respondents’ sense of competence and to reduce anxiety. They indicate that so as to ensure reliability, it is important to develop rapport before the interviewing process begins.

The guidelines for selecting the respondents (Appendix B) were sent to the research assistant. After the respondents were identified, the researcher sent pre-prepared interview questions to the research assistant, who administered the written interviews, scanned them, and sent them by e-mail together with the respondents’ phone numbers (teachers and heads of faculties/departments) for telephone interviews. The researcher called the respondents to make appointments for the day and time of the interviews. Sometimes the respondents asked the researcher to conduct the interview there and then without setting up appointments. Although the interviews were conducted based on the set of prepared questions**,** the researcher provided room for open–ended expressions through additional probing questions to facilitate clarifications and elicit additional

opinions from respondents based on the real-life situation. The telephone interviews were completed at the researcher's house using a touch-tone phone. To allow audible sound for recording, the phone speaker was switched on. The interviews were recorded using a digital telephone recorder Olympus WS100. Before each interview, permission was sought from interviewees to record the interviews. All interviews were conducted in English. On average, each interview took 20 minutes. The telephone interviews were transcribed and two interview transcripts were appended to the final version of the dissertation (Appendixes C and D).

In transcribing, the approach suggested by Hall and Hall (2004) was followed. They suggest that, unlike a conversational analytical study, evaluation needs some slight editing, such as omitting unnecessary features, correcting, and choosing alternative expressions. The editing may include leaving out hesitations and hesitation fillers like 'I mean' and interviewer's responses like "I see", correcting false starts, and using standard dialect, spellings, and punctuations. However, they suggest that these changes should be done with caution so as to not to change the intended content.

Document Analysis

Document analysis is a method of qualitative research that involves studying different documents or parts of documents in order to gain a deep understanding of the issue being researched. Patton (2002) indicates that document analysis includes studying excerpts, quotations, or entire passages from organizational, clinical, or program records, memoranda and correspondences, official publications and reports, personal diaries, and open-ended responses to questionnaires and surveys. Other documents may include

newspapers, accounts, letters, as well as the published data used in a review of literature. Glesne (1999) justifies the vitality of the use of documents as a source of data, writing:

> Documents corroborate your observations and interviews and thus make your findings more trustworthy. Beyond corroborations, they may raise questions about your hunches and thereby shape new directions for observations and interviews. They provide you with historical, demographic, and sometimes personal information that is unavailable from other sources. (p. 58)

Glesne (1999) describes the need for document analysis by asserting that documents enrich what one sees and hears by supporting, expanding, and challenging portrayal and perceptions. In addition, "Your understanding of the phenomenon in question grows as you make use of the documents and artifacts that are part of people's lives" (p. 59).

In this study, various documents were analyzed. The rationale was that when we talk of technology integration in education, it is basically a question of policy implementation. The objective was to look at technology integration as part of policy implementation. Examining the related documents was valuable in determining the essence of what was practiced. The documents analyzed included Tanzania Development Vision 2025 and Tanzania National ICT Policy of 2003. These were downloaded from online. Another document was the University of Dar-es-Salaam Information and Communication Technology Policy. This document, which was sent to the researcher by the research assistant, was obtained from the Directorate of Planning of the University.

The other documents analyzed were the university websites. The focus was on the ideas related to technology integration, especially strategies for use of technology in teaching.

Secondary Sources of Data

The above methods or strategies were the primary strategies for data collection from the field. Some valuable data were obtained from other sources to complement or elaborate data collected using primary methods. They included the following:

1. E-mails (two e-mails were used – one from a former UDSM lecturer and one from a Development Studies master's student).
2. Telephone conversations with selected people from the university community. One interview was conducted with a lecturer from Political Science, one with a professor in Linguistics and Foreign Language department, and one with a Development Studies master's student.

The Role of the Researcher

Apart from other roles, a researcher is also a research instrument**.** A good qualitative research begins with the researcher when he/she comes to terms with all factors that surround the research process. This means that the quality, competence, and knowledge of the researcher are important in shaping a research study. On the quality of a researcher, Glesne (1999) argues that a researcher must be a good listener, a good inquirer, a good observer, good rapport builder, and a good responder in a number of different situations. This means the quality of the researcher's interactions and his or her self-awareness have the potential to affect the research**.** Regarding competence, a researcher should be the one to make connections between what he or she observes and

the body of knowledge about the phenomenon that is studied. The researcher is not a passive presenter; rather he or she is an active creator of knowledge through the data gathered. Therefore, the researcher should demonstrate critical ideas about the findings and the theoretical framework they used. Furthermore, he or she should indicate clearly the position taken in regard to the issues dealt with in a very professional and logical way.

The influence of the researcher on a research study relies on subjectivity**.** Peshkin (1988) clarifies that subjectivity refers to the qualities of an investigator that affect the results of observational investigation. He argues that since subjectivity affects the entire process of research, "the researchers, notwithstanding their use of qualitative methods, their research problem, or their reputation for personal integrity, should systematically identify their subjectivity throughout the course of their research" (p.13)**.** Since subjectivity may affect or bias the results of a research, it should be minimized. Although the researcher takes a position concerning the issues, that should be done objectively. Bogdan and Biklen (1998) point out that there are some strategies the researcher can keep in mind to reduce subjectivity or biases. These strategies include objectively studying the subjective state of the subjects and focusing on the primary goal of the researcher, which is to add to knowledge, rather than pass judgment on issues.

As a researcher, I followed the procedures of my study as planned, in an attempt to reduce subjectivity. I used my experience as a researcher, as a former student at the university, as a teacher and as a student with my knowledge gained in my program of study to analyze the data to arrive at a viable conclusion. As a researcher, I was involved

in a number of research projects in Tanzania about various educational issues in teacher education. As a teacher, I taught at a teachers college as a teacher trainer for ten years before pursuing graduate studies in the United States. I believe, as a researcher, this experience was a substantial tool in analyzing my data.

Trustworthiness and Triangulation

One of the major objectives of a research study is creating knowledge**.** The findings of the research need to show credibility of the data that have been used to arrive at a conclusion about the research topic. 'Trustworthiness' is the term that corresponds with the term 'validity', which is common and easily measured in quantitative research. Both terms are all used to explain the indicators that may be used to establish confidence of the findings. In other words, they are aimed at establishing credibility of the study. Hall and Hall (2004) argue: "Because the research, through its interim and final report, is aimed at an audience who will be able to use its findings, the research methods need to be understandable and credible" (p. 97). Glesne (1999) states that, the credibility of your findings and interpretations depend upon your careful attention to establishing trustworthiness. Lincoln and Guba (1985) pose a question that underlies trustworthiness: "How can an inquirer persuade his or her audience (including self) that the research findings of an inquiry are worth paying attention to, worth taking account of?" (p. 290). Lincoln and Guba (1985) offer four criteria through which trustworthiness may be achieved as: true value, applicability, consistency, and neutrality. These, they argue, are the determinant of validity of research in a naturalistic approach, which is qualitative

research. There are different strategies that have been suggested by scholars to test and maximize validity. However, triangulation is a strategy that is highly recommended.

Triangulation, according to Creswell and Miller (2000), is “a validity procedure where researchers search for convergence among multiple and different sources of information to form themes or categories in a study” (p. 126). Patton (2002) argues that triangulation strengthens a study by combining methods. He observes that studies that employ only one method are vulnerable to many errors.

According to Denzin (1978), there are four types of triangulation;

1. The use of different sources of information (data triangulation), for example, using different groups of people to find the same information**.**
2. The use of different investigators or researchers using the same qualitative method and the findings are compared to find the commonness of their results.
3. The use of multiple professional perspectives to interpret a single set of data or information (theory triangulation). This can be done using different experts from different fields to look at the same issue**.**
4. The use of multiple methods of qualitative research to study a phenomenon, and the results are compared. This is the most widely used triangulation in qualitative research though it needs more time. (Denzin, 1978, p. 301-302)

This study used data triangulation and methodological triangulation to achieve trustworthiness. For data triangulation, this study used students, teachers, and heads of departments as different source of data. This was achieved by having some questions that appeared across all groups in the interview schedules. For methodological triangulation,

as indicated earlier, two primary methods or strategies were employed: interview and document analysis.

Setting

The setting of the study was the University of Dar-es-Salaam in Tanzania, the largest and oldest university in Tanzania. It was first established in 1960 as a college part of the University of London. In 1963, it became part of the University of East Africa, which comprised campuses in three countries – Kenya, Tanzania, and Uganda. In 1970, it became an independent university, the first university in independent Tanzania. The university is located in the city of Dar-es-Salaam, which is the largest commercial city in the country and the former capital city of Tanzania. The university is nicknamed 'Mlimani' a Swahili word that means "on the hill" because it is built on the hill that is the highest point in the city. However, sometimes people use it to connote "the highest point educationally". That connotation was more valid when the university was the only one in the country. According to the website of the University of Dar-es-Salaam, the university consists of six faculties, five institutes, and four colleges. The faculties are Faculty of Arts and Social Sciences; Faculty of Commerce and Management; Faculty of Education; Faculty of Engineering; Faculty of Law; and Faculty of Science. The institutes include Institute of Development Studies, Institute of Kiswahili Research, Institute of Marine Sciences, Institute of Production Innovation, and Institute of Resource Assessment. The colleges are the University College of Lands and Architectural Studies, Dar-es-Salaam College of Education (DUCE), Mkwawa College of Education (these two colleges of education were established during the research period), and the Muhimbili University

College of Health Sciences. The university operates a Computing Centre, a library and four bureaus: the Economic Research Bureau in the Faculty of Arts and Social Sciences; the Bureau for Educational Research and Evaluation in the Faculty of Education; the Bureau for Industrial Cooperation in the Faculty of Engineering, and the University Consultancy Bureau. The university admits students from other East African countries, mainly Kenya and Uganda and students from several other countries in the world through established links, exchange programs, or individual applications. For this study, the main campus was used as the setting of the study.

The site of the study was selected based on the suggestions of Marshall and Rossman (1999). They suggest that a realistic site of the study is which the following are most applicable:

1. Entrée to the site is possible;
2. There is a high probability that a rich mix of the research processes, people, programs, interactions, and structures of interest is present;
3. The researcher is likely to be able to build trusting relations with the participants in the study and trust is very important in getting reliable and enough data.
4. The data quality and credibility of the study are reasonably assured. (p. 69)

From the perspective of the researcher, the University of Dar-es-Salaam had these qualities over the other institutions of higher learning in Tanzania. Concerning entrée, the researcher is an undergraduate alum of this university. This suggested that the researcher was likely to be granted permission to conduct the study in a manner explained

above. Furthermore, the researcher was assisted by the research assistant, a college staff member at the university. Because the university was the largest, oldest, and the first university in the country, it was a relatively well-established institution in higher education in Tanzania. This indicated the possibility of rich data and hence better quality and credibility of the study compared to information that may be obtained from newly established universities. Prior to starting the study, the researcher determined whether entree was possible and facilitated permission for entry by writing a letter to the administration (Appendix E). The researcher applied for permission to conduct a human subject study from Ohio University's IRB (Appendix A). This provided the researcher with a license to interview the sampled students, instructors, and administrators.

Participants

Population

The target population in this study was the University of Dar-es-Salaam teaching and administrative staff and students from different disciplines of study. These were people involved in one way or another in using technology for different functions at the university. Administrative staff included a faculty dean and head of a department. These were regarded as leaders involved in policymaking and planning for technology before it is integrated in classroom teaching. Teaching staff involved instructors or facilitators who were directly involved in the use of technology in teaching. The students were involved in the research because they were regarded as the ultimate beneficiaries of technology integration. The university enrollment was over 16,000 students.

Sample and Sampling

Marshall and Rossman (1999) suggest that well-developed sampling decisions are crucial for the stability of any study. Making logical judgments and presenting a rationale for these decisions goes far in building the overall case for a proposed study. Decisions about sampling people and events develop concurrently with decisions about the specific data collection methods to be used and should be thought through in advance. A purposeful sampling was conducted by the research assistant, with the guidelines from the researcher, to obtain a representative sample.

From that population, 36 participants were selected from two faculties (i.e., Faculty of Education and Faculty of Science) to participate in the study across these 3 categories (students, teachers, and heads of department ad faculty). The justification for choosing that number of participants was based on a number of constraints including financial, time and strategies of collecting data. The Faculty of Education was chosen because the researcher believed that entrée would be easier given the fact that the function of the Faculty of Education is preparing students to teach, and technology integration is a pedagogical aspect. The researcher believed that Faculty of Education staff would give a better assessment of what takes place in class pedagogically than would staff from other faculties. The Faculty of Science was chosen to represent the scientific-oriented faculties. The following research subjects were selected to participate in the study:

1. The Dean and Head of the Department of Education and Department of Science. These were expected to give information about their respective

faculties, particularly with regard to the administrative aspects such as policies, planning, and training. The two heads of faculty/departments were all Ph.D. holders. The head of the department in the Faculty of Science was a senior lecturer with four years of experience in teaching at the university level. The Faculty Dean of Education was a female teaching special education with 12 years of experience.

2. Ten instructors, 5 each from Education and Science faculties. These were selected considering years experience in teaching, subject taught, gender, academic status (including level of education), and availability. Courses taught by respondents from science were chemistry, physics, informatics, and microcomputer; and from education they were education in work organization, research, measurement and evaluation, psychology, and educational management and administration. The experience of faculty staff ranged from 3 months to 12 years, but one had 35 years of teaching experience (however, that included non-university teaching experience). This profile of staff was a good indication of the possibility of extracting varied responses that represented a broad view of technology integration both theoretically and practically. Table 1 presents the summary of participant information. Pseudonyms were used as identifiers of respondents. TS stood for teachers from the Faculty of Science and TE was used for teachers from Faculty of Education. HS1 was the head from science and HE2 was the head from education. Numbers were given randomly as identifiers of number of

respondents (no implications of the order). For example, TS1 is respondent one from the Faculty of Science; TE3 is respondent three from the Faculty of Education.

Table 1: Participant information-Academic Staff and Heads

Pseudonym	**Gender**	**Faculty**	**Teaching subjects**	**Experience**	**Position**	**Interview time**
TS1	M	Science	Informatics& Visual Education	1 yr	Teacher	15 min.
TS2	M	Science	Physics	10 yrs	Teacher (PhD)	24 min.
TS3	M	Science	Chemistry/ Research	12 yrs	Teacher (PhD)	20 min.
TS4	M	Science	Analytical Chemistry	8yrs	Teacher (PhD)	22 min.
TS5	M	Science	Info. & Visual Ed.	3 months	Teacher	22 min.
TE1	F	Education	Psychology	12 yrs	Teacher (PhD.)	16 min.
TE2	M	Education	Research /evaluation	3 yrs	Teacher	22 min.
TE3	M	Education	Curriculum/social studies methodology		Teacher (PhD)	21.5 min
TE4	F	Education	Ed. Manag. &Admin	2 yrs	Teacher	16 min
TE5	M	Education	Chemistry	4 yrs	Teacher PhD	24 min.
HS1	M	Science	Chemistry	4 yrs	Head of Dept	22 min.
HE2	F	Education	Special Education	12 yrs	Faculty Dean	24 min.

3. Twenty-four undergraduate students from education and science faculties were selected following these criteria: year of study, gender, course of study. For the year of study, only students in the third and fourth years were selected. That was because the researcher believed that at that level they would have stayed at the university for a long enough time to have a good knowledge about the teaching and learning processes at the institution. Originally, the plan was to select 12 students from each faculty. In the process, it was found that it was difficult to categorize them exclusively in terms of faculty. This was because some students were taking classes from both faculties. In some cases, students identified themselves as coming from other faculties other than education and science, but actually, they were taking some classes in education and science. The researcher realized that the setup of some the departments/faculties at the university does not suggest that a departments/faculty confined students entirely. Therefore, the subject majors were used as selection factor in sampling. The subject majors of students included (with the number of participants in brackets) were: Swahili (4), psychology (4), linguistics (2), biology (1), geography (3), history (4), chemistry (1), English language (1), and education (4). Some students of the fourth year indicated that their major was education. For example, some students indicated their courses as B.Ed, or Bachelor of Education. They may have had major subjects (academics subjects) in either science or arts and

social sciences. It became clear that such responses were due to the fact that at the University of Dar-es-Salaam, education courses are studied in four years while the academic subjects are studied for three years. Therefore, basically, in the fourth year, students aspiring for educational careers take all their courses in education.

Table 2 shows the number and distribution of participants interviewed at the University of Dar-es-Salaam.

Table 2: Distribution of Participants by Faculties

Type of Participants	Faculty of Education	Faculty of Science	Total
Students	12	12	24
Faculty Academic Staff	5	5	10
Dean of Faculty	1		1
Head of Department		1	1
Total	18	18	36

Data Analysis Procedures

Data analysis involves examining the assembled relevant data to determine how respondents answer the research question(s). Yin (1994) indicates that data analysis consists of examining, categorizing, tabulating, or otherwise recombining the evidence to

address the initial proposition of the study. According to Merriam (1998), data analysis is the process of making sense out of data involving consolidating, reducing, and interpreting what people have said and what the researcher has seen and read. Patton (2002) defines data analysis as the process of transforming information into knowledge. He writes that in qualitative evaluation, the process involves two tasks: the description of beliefs and values of the participants and the physical setting, and the interpretation that includes putting findings together, drawing inferences, and attaching significance to them. Different strategies are suggested in analyzing the collected data. Creswell (1998) points out three analysis strategies by author. They include Bogdan and Biklen (1992), Huberman and Miles (1994), and Wolcott (1994). Figure 2 shows examples of strategies for analyzing data from each author(s) from which the strategies of analyzing the data of this study were selected.

Analytical Strategy	**Bogdan &Biklen (1992)**	**Huberman & Miles (1994)**	**Wolcott (1994)**
Sketching Ideas	Jot down ideas in the margin of field notes	Write margin notes in field notes	Highlight certain information in description
Display data	Develop diagrams, continua, tables, matrices, and graphs	Make contrasts and comparisons	Display findings in tables, charts, diagrams, and figures; compare cases; compare with a standard
Reduce information	Sort materials into categories	Note patterns and themes	Identify pattern regularities

Figure 2: Examples of data analysis strategy by authors (Creswell 1998, p. 141)

The taped interviews were transcribed, some of them after each interview. Since the respondents who completed telephone interviews had done written interviews, too, the transcriptions were cross-checked with the responses of written interviews to ensure that all questions were at least covered. This was necessary because in written interviews, some of the respondents left some of the questions unanswered. The analytical strategies used were a combination of strategies from different scholars. The first one used was Bogdan and Biklen's (1992) strategy of reducing information by sorting materials into categories. These categories were developed from the interview questions. For example, questions that asked the same thing from different categories of respondents were put together, and then Wolcott's (1994) strategy of identifying patterns and regularities was used to describe the category. The categories represented themes implied from the interview questions. In addition, some issues emerged from the interviews and documents without being triggered by interview questions. These were placed together as emerging themes. After categories were created using the mentioned strategies, descriptions of the categories were presented. In descriptions, direct quotations were used as evidence of the underlying themes. Short summaries concerning those thematic categories were presented as findings of the study. The analysis constituted the basis for the discussion that addressed the issues of implementation of technology integration at the university of Dar-es-Salaam. This means bringing together the existing knowledge about technology integration in education with a focus on higher education (as discussed in the literature review) with the emerging ideas (new knowledge) derived from findings from the field. The researcher's experience played a part in explaining some issues regarding the

university and the implementation of technology integration in higher education. In so doing, the researcher advanced his assessment of the nature of implementation of technology integration in that particular context. The assessment may provide impressions that could be applicable in the wider spectrum of higher education in Tanzania.

Lastly, the researcher made recommendations for the improvement of technology integration in higher education in Tanzania.

Summary of Methodology

This chapter presented the methodology of the research. The intent of the research was to investigate and evaluate the nature of the implementation of technology integration at the University of Dar-es-Salaam in Tanzania. Data were collected through written interviews, telephone interviews, and document analysis. The participants were third and fourth year students and teachers from the Faculty of Education and the Faculty of Science. Two heads of faculty and department were interviewed. Data analysis was completed by coding data and generating themes, and that enabled discussion and recommendations on the topic.

Chapter Four: Findings

Introduction

This chapter presents the findings of data collected from the field. A total number of 36 respondents were involved in the study. This number included 24 students, 10 faculty members, and 2 heads of department/faculty. All the subjects came from the University of Dar-es-Salaam (UDSM) in Tanzania. The data presented in this chapter were collected by using the following three strategies:

1. Interview questions to students (Appendix F). The subjects were selected from third and fourth year science and education departments. The responses were provided in writing.
2. Interview questions to academic staff (Appendix G). Their responses were provided in writing and followed up by telephone interviews. The telephone interviews were transcribed (Appendix D – 1 sample). Not all questions were answered. Respondents TS3 and TE2 left 7 questions unanswered.
3. Interview questions to Dean of Faculty and Head of Department (Appendix H). Their responses were provided in writing and followed up by telephone interviews. The telephone interviews were transcribed (Appendix E – 1 sample).
4. Document analysis was completed on the following documents; Tanzania Development Vision 2025, university website, National Information and Communication Policy of 2003, and University of Dar-es-Salaam Information and Communication Policy.

By using these research strategies, the researcher was able to gain understanding of and to reflect on the nature of technology integration in the learning and teaching environment at the university. This enabled the researcher to conduct a formative evaluation by using the established indicators. The indicators based on Ely's eight conditions and ACOT conditions were presented in the conceptual framework. These findings enabled the researcher to put into perspective the technology integration in higher education in Tanzania and its implications for effective integration, and therefore, a trend, in broader perspective, of the implementation of technology goals as stipulated in Tanzania Development Vision 2025.

This qualitative case study was designed to investigate and evaluate the nature of technology implementation at the university. Thus, the data obtained were used to answer the main research question:

What is the nature of implementation of technology integration in learning and teaching at the University of Dar-es-Salaam by faculty and students?

In order to answer the main research question, the study addressed these sub-questions:

1. What technology is available to support teaching and learning, where is it located, and who uses it?
2. What is the knowledge and skill level of stakeholders on technology and technology use at the University of Dar-es-Salaam?
3. What approaches and strategies of integrating technology do teachers and students employ in learning and teaching?

4. Are there professional development programs for the teachers? How effective are they?
5. Does the university have technology plans? If so, what are the contents of those plans, and to what extent are they being implemented?
6. At what stage of ACOT Stages of Development model is the technology integration at the University of Dar-es-Salaam?

Concept and Benefits of Technology Integration

The researcher believes that any application of a tool or strategy is more meaningful and effective when the user has sound knowledge of the conceptual base and appreciates the benefits of using the strategy or tool. In that regard, the researcher viewed respondents' understanding of the concept of technology integration and the recognition of the advantages or benefits of the use of technology integration as important in the effective use of technology in education. These were considered as part of the knowledge base of implementers, which reflected their potential capabilities as well as the motivational qualities of those involved in the process of technology integration. The researcher had not expected their definitions to be the same in form as those given by different scholars or by the operating definition that was given in chapter 1 but expected to have the versions of definitions and descriptions of technology integration that underlie the basic ideas that suggested effective use of technology in learning and teaching. The students and teachers were asked to describe their understanding of the concept of technology integration and then describe the benefits of using technology in learning and teaching.

Varied descriptions were given, but a good number of them indicated that technology integration was the use of scientific methods, techniques, approaches, and knowledge in doing work. Some respondents were a bit more specific and indicated that technology integration was the use of "technologies" in doing work. The following are some of the definitions given by the students (with the fields of study).

Technology integration is:

1. The process in which teaching and learning processes are incorporated in technology devices (third-year Swahili/Geography student).
2. The application of different technologies in education in the sense that technologies are unified to improve human conditions (third-year Linguistics student).
3. The use of advanced techniques and tools in teaching and learning processes. (third-year Swahili student).
4. The familiarization and use of modern devices, especially computers in education. (third-year Biology student).
5. The use of technological machines to do work in a simple manner (fourth-year Psychology student).

As for the teaching staff and heads, respondents were hesitant, and many skipped defining technology integration and hence left blanks in written interviews but gave short definitions of technology integration during telephone interviews. The following are the sample definitions given with corresponding respondents. The definitions that were not

given here were either the same as some of those that were given or whose concepts are covered in the given definitions.

Technology integration is;

1. The use of technology in teaching (TS2).
2. The incorporation of technology in everyday activities (TS10).
3. The use of technology to enhance learning or human activities (TS1).
4. Effective use of technology by teachers and students in teaching and learning activities (TS8).
5. The use of technology or information and communication media in enhancing the process of teaching (HD1).

Thus, according to educators, technology integration has a range of meanings. However, the key concept is to suggest learning.

The telephone interviews of the teachers also produced definitions, and almost all plainly centered on “the use of technology in teaching.” Some of the definitions given were as follows:

1. The use of technology in teaching (TE3).
2. The use of technology to achieve or do a certain task (TE1).
3. The use of information and technology in enhancing teaching (TS 3).
4. The use of technology, I mean, information technology in enhancing teaching (TS2).
5. The way we incorporate the use of technology in the process of teaching (TS5).

The implication to the researcher was that the respondents' conception of technology integration reflected their teaching and learning experience or practices in classrooms. Their definitions suggested the processes that they perceived to be implied by the term 'technology integration,' which was the use of technology in the process of teaching and learning in their situations or environments. Their definitions did not show much disparity between the teachers and students. Six students gave definitions that did not reflect the use of technology as a tool, rather, technology as the scientific approaches or knowledge (abstract), but they all were suggesting the notion of "application." For example:

1. The use of the scientific approach in solving human conditions or problems (third-year Swahili/History student).
2. The application of scientific knowledge for improving learning and teaching processes (third-year education major student).
3. The application of scientific principles for improving teaching and learning processes (third-year education major student).
4. The use of scientific approaches in daily human activities (fourth-year Linguistics student).
5. Technical know-how, the way of how to use skills in doing work (fourth-year Geography student).
6. The application of modern science in worldwide (fourth-year Chemistry student).

However, despite the fact that the definitions did not indicate the use of technology as tools, they suggested some kind of application that is aimed at achieving something better with the use of words like ‘improving,’ ’solving,’ and ‘achieving.’

The respondents were asked to mention the benefits of using technology. This question required them to reflect upon the process of technology integration and tell how they thought they benefited by the use of technology from their own perspective and experience. For the students, the question focused directly on the learning process. They were asked if they learned better by using technology, which implicitly asked for the benefits or advantages of using technology in the learning process. The main focus was the attitude or reaction on their experience of using technology as part of their learning process. For the teachers, the question focused on their experience of teaching using technology. From the teachers' perspectives, the benefits were that the use of technology saves time, enables good storage of knowledge, makes students understand better, makes learning interesting, gives wide knowledge on many subject matters, makes teaching effective, enhances instructional presentation, and makes it easier to deliver knowledge to a large number of students. These conceptual beliefs were obtained from the written interviews. From the telephone interviews, the responses were almost the same except that they were more elaborate. For example:

1. One of the benefits of using technology in learning is that you can involve a lot of people. For example, you can use technology to teach large classes and also people get more information on their own instead of taking information from the teacher (TE1).

2. We use technology to facilitate the implementation of the program in the teaching and learning process and also the facilitation. Here, I mean, the learner to be able to grasp the knowledge which we want them to get (TS1).
3. The benefits are numerous. It depends, for example if you choose instructional media presentation using software – actually there are good kinds of interactive media especially in our case where the classes are too large to handle. At the same time, a concept that you may not be able to demonstrate, like in my geography class on the rotation of the earth or whatever, so through technology such an abstract concept can be taught very well (TE3).

The use of technology when teaching large classes came up from another teacher (TE4). She indicated, the benefit of using technology in relation to large classes, that you can teach a large class many things at once and that if illustrations are used it would be easier for students to copy them, than when they are shown on the chalkboard.

The responses of teachers revealed that teachers perceived the use of technology in teaching to have significant advantages and impacts on their students. The responses revealed that there were concerns about large classes at the university to be discussed later.

The students were positive about the use of technology in their learning. They stated they used computers in their day-to-day learning and indicated the presence of numerous benefits of using computers. The benefits that they indicated included the technology facilitates better learning, helps them in solving many problems, helps to learn easily, makes learning interesting, makes learning more interactive, gives access to

different resources of knowledge and to a lot of information, saves time, gives access to current and up-to-date information, and helps in an easy search for learning materials. The benefit of technology helping in searching for materials or information recurred more frequently than other benefits, suggesting that students use computers more for searching for information on the Internet.

These findings on the concept and benefits of technology integration suggest positive viewpoints and the appreciation of what technology brings in the process of learning. It suggests the presence of motivation, awareness, and positive attitudes by implementers in striving to use that technology in the educational process. Having a positive attitude and appreciating the benefits of integrating technology in the process of learning/teaching were the indications that teachers and students were positive about the process of technology integration. This demonstrated that the respondents were aware of the trend of information technology in this information age. Both teachers and students realized what computers could bring into the environment and processes of learning and teaching.

The Knowledge and Skills of Computer Use

The researcher believed that in order to be able to implement technology integration, the knowledge of computer use was necessary and a prerequisite. The critics and analysts of Ely's conditions for implementation of educational innovations rank the need for knowledge and skills higher among the other conditions. The University of Dar-es-Salaam ICT policy includes a statement that focuses on creating this condition: "The University shall ensure and require that all students and academic staff are trained on a

continuing basis to equip them with requisite skill to fully exploit the digital learning environment (DLE) in the different disciplines" (UDSM ICT, 1996, p. xiv). This suggests that the university is very aware of the potential of having knowledge and skills in implementing technology integration. In that regard the university should take initiatives to ensure that the teachers and the students are equipped with that knowledge. For students, it would be either before they joined the university or getting such opportunity to do that through computer courses made available at the university.

The researcher wanted the students and the teachers to evaluate how much computer knowledge they had. All students except two acknowledged that they did not have enough knowledge of computer use. They stated that they had "little" computer knowledge. These are some of their statements (in their own words) about their knowledge of computers:

1. I have just an elementary knowledge about computer (an introduction to computer).
2. I have little knowledge just to search material only.
3. I am familiar with only two programs like Introduction to Computer and Microsoft Word.
4. Little knowledge after going through a course CT 102 - computer literacy for teachers.
5. Average, this is because, before joining the university, I had studied an introduction on computer use and when I was in second year I studied it. This made me to have knowledge in average way.

Their responses showed that most had knowledge of word processing, use of Internet, Microsoft Excel, e-mailing and PowerPoint. Two students said they had knowledge of searching for information which presupposed knowledge of using search engines like Google. Although the researcher had not asked students to indicate where they had acquired the knowledge of computer use, some students went further and mentioned where they had acquired that knowledge. For example, three students indicated that they had acquired their computer knowledge from the courses that were offered by the university to first-year students. For instance, one mentioned the course in the Faculty of Education coded CT 102 - Computer Literacy for Teachers. Another student indicated another course called 'Introduction to Computer Use.' Two students noted they had acquired knowledge of computer use outside the university before enrolling. For example, one student said he had attended a six-month Introduction to Computer Use course and received a certificate before he joined the university. The responses of the teachers indicated that most students enter the university without having knowledge of computer use at all.

It is very unfortunate that most students entering the university in Tanzania do not go through compulsory training in computers because there is no working curriculum for computer knowledge, especially in public schools. Very few students who go through private schools have had an opportunity to use computers. Probably this challenge will be minimized, because in 2007, the Ministry of Education (MoE) enacted an ICT policy for basic education to cover primary and secondary/high schools. The university required that every student in his or her first year enroll in a computer literacy course for one

semester. The effectiveness of these courses was questioned due to the fact that there are a small number of computers compared to a very large number of student enrollments. This was due to a bigger ratio of the number of computers to the number of enrolled students. Tungaraza and Sutherland (2007) reported that in those courses up to 30 students shared one computer. This suggested that those courses were relatively ineffective and the knowledge gained was largely theoretical. For example, one student said he had attended a course, but did not practice, meaning that the course was more theoretical with little practice using the computers. She said, “It is very little knowledge that I studied in AS 217 without practice.”

In seeking to know if the teachers had a sound knowledge of computer use that enabled them to be confident to use technology in teaching, the researcher asked them to indicate how much computer knowledge they had. This was a self-assessment, assessing what they practiced in their classroom environment and what they had acquired through training. In their assessment, they used phrases like “enough knowledge,” “basic knowledge,” and “some knowledge,” and “a little” to indicate their assessment of the amount of knowledge they had. Four teachers (TS3, TE1, TE4, and TE5) gave the answers that implied little knowledge. For example, TE4, a female teacher from education indicated that she had a little knowledge but mentioned that she could use Internet, Microsoft Word, and Excel programs. Respondent TE5, from education, reported that he did not have much computer knowledge and that what he had was from peers. He noted: ‘‘I have never had any formal training of knowledge of computer. What I have is mainly through interacting with people who are experts.” Six teachers and two

heads either said they had good knowledge or some or basic knowledge. For example, one teacher (TS1) answered emphatically about his knowledge, “Ah yes, I have enough knowledge because I have attended some training on some computer programs, for example, Excel, PowerPoint, Microsoft Access. Again, I attended training in computer architecture.”

Almost all teachers were familiar with the use of at least three programs with everyone citing Internet, Microsoft Word, and PowerPoint. One teacher (TE1) reported that she had good computer knowledge and can use computers in teaching but said she was not using computers in teaching because of the large classes she had as well as non-conducive room environment for teaching using computers. The other responses indicated the presence of teachers (not part of respondents) at the university who did not possess computer knowledge and therefore did not use computers at all. For example, in one question, the teachers were asked to reflect on their experience of using technology and state the challenges they, or other teachers, faced in teaching using technology. The responses included lack of enough knowledge on the part of the teachers, which was one of the causes for not using technology in teaching. For example, one science teacher (TS3) said: “Some lecturers don’t use technology because either they don’t have the knowledge itself to use computers or they don’t have computers to prepare the materials for teaching. So that is a problem.” Yet a female teacher from education (TE1) had the following observation: “One challenge is lack of knowledge. Most of us do not have enough knowledge in using that technology of computer. For example, using PowerPoint-- not all teachers here are aware of using it properly.” Two respondents (TS5

& TE5) related the lack of knowledge to age. They observed that some older teachers (those with long service) did not have a good knowledge of using computers and that they were more interested in lecturing.

The faculty members argued that having no knowledge of computer use was one of the challenges in technology integration. The findings, though, gave the general impression that, from the perspective of the research design, a good number of teachers possessed basic knowledge of computer use. Nevertheless, they felt a gap that the knowledge they possessed and that possessed by other teachers at the university was not good enough for the effective implementation of technology integration.

Availability and Accessibility of Computer Technology

The process of technology integration is, in the first place, possible only with the availability of technology. The researcher believes that the whole process of technology integration cannot take off unless tools are available, although it is true that the availability of tools is not enough by itself to guarantee the effective process of technology integration. For instance, the users must possess knowledge of technology as a complement to accessibility to the technology. From that argument, meaningful and effective technology integration in learning and teaching is possible with an amalgamation of numerous factors. Availability of technology, however, is a crucial factor in that amalgamation. The researcher wanted to find out whether the computers were enough and where they were located. The findings generally revealed a lack of enough computers. The respondents echoed this as a major issue at the university, one that, in turn, hindered accessibility. Although this was to be expected by the researcher

from his experience in Tanzania and from the literature about developing countries, the question aimed at evaluating the extent of the problem and the location of the computers. The location was suggestive of accessibility of computers to the students and the possibility of technology being integrated in the learning process.

The University of Dar-es-Salaam ICT policy, which came into effect in 2006, provides a statement that guide implementation in each of the nine identified areas. The areas identified include access; teaching, learning, and research; ICT organization and management; ICT assets management and accountability; disposal of ICT facilities; partnership with government, private sector, and public institutions; acquisition of ICT services; administrative information system support; and human resources development. For access, the implementation guide includes 14 statements. The statements are focused on the availability and accessibility of ICT infrastructure in the form that would enable optimal utilization of technology in learning and teaching. For example, one statement says, “The University shall build capacity for cost effective and reliable ICT infrastructure deployment and management” (p. xiii). The researcher interviewed one graduate student to obtain the number of computers. He had asked the student to count of equipment on some areas at the university to get some statistics. From the website, the university had reported the presence of 300 computers at the university most of which were donated by the Swedish International Development Aid (SIDA)-SAREC project. At the time of the research, the graduate student reported that there were a total number of 30 computers in the Faculty of Education and 20 in the Faculty of Science. With the enrollment of around 1,400 students in the Faculty of Education, that means one

computer to approximately every 50 students. (This excluded computers that are for the staff use and are not accessible to all students). Such a statistical impression was further verified by the answers from the respondents. All respondents acknowledged that there was an acute shortage of computers, and the majority of respondents attributed the situation to the large number of students versus the number of computers. The research further revealed that there were no computers at all in classrooms. Those few that were available were in small computer labs. There was a small computer lab in the Faculty of Education and one in the Faculty of Science. During the interview, one teacher (TS5) revealed that all faculties had computer labs except the Faculty of Arts and Social Sciences. However, he reported that the number of computers was very small in those labs. Due to the shortage, students and some teachers logically pointed out that many students did not have access to computers any time they needed them. One third-year student studying history and Swahili pointed out that there was always a kind of 'competition' for accessing computers in computer labs. Responding to the question that asked if computers were accessible to students when they needed them, the student said, “There are times I need to use the service but not find the computer or sometimes the rooms were closed.” Another student studying geography and education reported that computers are not enough, and among those that were available, some had technical problems. Furthermore, a third-year student majoring in education explained that in the Faculty of Education computer lab, there were computers allocated to undergraduate students and others were for graduate students. She said undergraduate students were allocated times when they could use computers allocated for graduate students but

complained that sometimes graduate students locked the computers. One teacher from the Faculty of Science (TS3) hinted that there was a system in the faculty that gave priority to students in their last year of study and graduate students. These findings are in line with a research-based article by Tungaraza and Sutherland (2006), which revealed that because of a shortage of computers in the Faculty of Education, students had to wait for long hours and sometimes for as long as a day. They indicated that at times such a situation led to despair.

The alternative way to access computers would be other facilities at the university, for example, the main library. The University Main Library serves more than 16,000 students in total (University of Dar-es-Salaam Website, 2008). The findings showed that there were 16 PCs in working condition and six online Public Access Catalogue (OPAC) computers in the main library. This number was clearly too small to meet the demands of such a number of students. There were no computers installed in hostels for students. Responding to the question about access, one student studying geography and education indicated that there were computers in the hostel where he resided, but further investigation showed that he was referring to Internet cafés. This was discovered from telephone communication with the graduate student who said that the university had allowed private Internet cafés in the hostels that were outside the university campus. Students had to pay to use computers in cafés. Three teacher respondents (TS3, TE1, and TS5) reported that some students had taken initiatives to buy their own computers and that the number of students with PCs (especially laptops) had been increasing very fast. As for teachers, the university website reported that there were

442 computers available to academic staff in the faculties and institutes (University of Dar-Es-Salaam website, facts +figures, 2008). Unfortunately, the page to determine the number of academic staff at the university was unavailable and so it was not possible to determine if each teacher would have his or her own computer. On the page of ICT at UDSM, one section indicated that there was equipment, including computers, for staff to borrow. That suggested that not all teachers had full accessibly to computers all the time.

From these findings, the researcher thought that, among other challenges, the process of technology integration at the University of Dar-es-Salaam is heavily affected by the absence of enough computer technology facilities. This observation was evident from the responses of the participants. For example, a teacher (TE1) from education stated that:

> Another challenge is the materials. We don't have some of them like laptops that we can use to do presentations. So they are not enough. Again, another challenge is the rooms themselves where presentations can be done; they are lacking screens and projectors for presentation. That is a problem. We would like our students to use it so as to allow them to participate in presentations but due to scarcity of computers, that becomes a problem.

The observation suggested that the lack of enough equipment denied the students the greater opportunity to a fully 'participatory approach' to learning. This observation was pointed out by another teacher (TS4). However, the respondent (TE2), a teacher from education who taught computer literacy courses and social science methodology, saw the shortage of computers from two perspectives. On the one side, he concurred with other

respondents that it was a challenge. On the other side, he saw it as an instructional advantage. He said:

> But there is a good thing about having fewer computers, particularly when they have to share maybe between two students. In sharing some computers, though that might be seen as a sign of poverty, there is a benefit to that they will tend to share some other social aspects and help each other and helping those students who are not good in computers.

As a way of alleviating the problem of accessibility of computers to the university community, two students from the Faculty of Education and one teacher (TE1) reported that the university had allowed private companies and individuals to set up Internet cafés on the university premises outside the main campus. For instance, one student (history student from the Faculty of Education) specifically indicated that there were Internet cafés in one student residential area the Mabibo student hostels. These cafés served students when they were outside the main campus. As it is in other cafés in the city, she said that one had to pay T.shs. 500/- (equivalent to $ 0.40) per hour to use a computer. The researcher feels that, although it was a good idea as an additional strategy to give access to technology for students, it was creating a divide among students because it was possible that not all students were able to pay that amount of money every time they needed to use a computer. The researcher thought if the University found that it was a viable idea to start the cafés, it would be a better idea for the university to pursue that business and help raise funds to help in improving the university ICT services.

Although the researcher had anticipated such a situation of scarcity, which is not a surprising situation in many developing countries, such as those in Africa, the serious shortage of computers revealed by this research was alarming for an institution with such a high profile in the country.

During the data collection process, one person, a former lecturer at the University of Dar-Es-Salaam now teaching in Canada, sent an e-mail to a listserve of Tanzanian intellectuals called TANZANET. In the e-mail, she expressed her experience of the nature of technology at the university, as she had just returned from a visit there she was appealing for help to the university:

> Laptops and projectors - it came to my attention that although there were computer equipment, projectors were scarce. Moreover, the computers in labs do not last long before they malfunction. I am thinking helping out ONE individual faculty member with a laptop and a small projector will probably make a difference. The faculty member will take good care of the equipment since it will make her/his teaching work easier. On one occasion I was teaching in Nkrumah Hall without my equipment; all I had was a 'mic' in my hand and my voice! Although I felt like a celebrity on the stage (I looove audiences) I felt I was not getting across to students the same way I did when I brought my equipment. Laptop and projector may cost about 1.5 K or less. Even two or more people may put funds together to help one faculty member at UDSM. Log onto the website **http://www.udsm.ac.tz/** and contact a faculty member. Or you probably have a

> friend there already, help that friend. Don't send them money, send them equipment. (S. Mushi, personal communication, March 6, 2008).

The findings reflect the picture of availability and accessibility that is explained in that National ICT Policy of 2003. See chapter 2 for the status of ICT in Tanzania. It points out eight aspects covered by the policy. Relevant to this section are two aspects: access and learning.

Regarding access there are two items worth pointing out. These are Internet availability, hardware, and software. For Internet availability, the policy indicates that Tanzania lacked national Internet Exchange Points (IXP), and, as a result, all information traffic is routed through international exchange points. The policy states that Tanzania lacked its own cheaper and high capacity connections to the global Internet. All connections are done through global Internet backbones in countries like Norway and the United States. All these situations make connectivity and access expensive.

On hardware and software, the policy says that there is no local manufacturer of ICT equipment in Tanzania. Moreover, it points out that there are no standards guiding the import of both hardware and software, and few local companies are developing computer application software. Therefore, Tanzania has inadequate capacities to support the ICT industry for developing and supporting software, and this in turn affects the use of technology in learning. The policy in section 2.2 highlights the status of educational access to ICT in Tanzania and explains the following challenges to educational access (that are related to this section):

1. Few educational institutions have computer laboratories and other multimedia facilities.
2. At university and other institutions of higher learning, few computers are available for use of students and staff.
3. Internet access is limited.
4. There is a shortage of qualified professionals of ICT in Tanzania and no well-established ICT professional profiles.
5. Access to online and distance learning for ICT is still limited. (p. 4)

Thus, the respondents' answers justified one of the aspects that highlighted in the technology integration policies as indicated above, that shortage of technology is one of the major obstacles that affects the accessibility and use of technology in teaching at the University of Dar-es-Salaam.

The Use of Computers as a Tool of Learning

The purpose of the study was to investigate and evaluate the implementation of technology integration at the university. The study investigated computer use specifically in classroom or learning situations. Two aspects of computer use were investigated. The first was to see whether there were any interactions between the students and the computers in the classroom sessions, in other words, to see if there were computers facilities located in classrooms, and if so, if students used them as tools of learning and teachers as tools of teaching. The second aspect was to see and assess the ways computers were used by students and teachers to facilitate learning and teaching. In line with the findings described on the accessibility, it was evident that students were not

using computers in classrooms environments at all simply because of the absence of computers in classrooms. In reality, it is expensive to equip all classrooms with computers even in developed countries. The common approach in many settings is to have institutions build computer labs and make them accessible to classes in sessions. Teachers prepare lessons based on the settings and equipment in those labs. From the responses, that was not the case in the Faculties of Education and Science. Those teachers who used computers in teaching carried them (one teaching computer) to classes. The findings did not indicate any use of computer labs or the existence of a system that allowed class sessions in computer labs, except for the computer courses. At the same time, responses showed that even the classrooms were not built conveniently for computer use and lacked supporting equipment, such as screens and projectors.

Basically there was no interaction between the computers and students during the classroom sessions. In other words, the process of hands-on learning by students was almost nonexistent (for the classroom sessions). That was a great impediment to student learning with technology during the class sessions. However, this is more of an attribute of the shortage of facilities rather than deliberate strategy by the teachers. However, this did not suggest that students were not using computers at all in their learning processes. What was lacking was a learning process designed to have students involved in common activities at the same time in class.

Students indicated that they used computers in other places at the university that had computers. They revealed that they used computers mostly to search for information related to what they learned in class. They stated that most teachers assigned students to

search for information on the Internet to answer given assignments. We can learn that from student answers to Question 11 that asked, “Do teachers give you assignments that require that you use technology to complete them? If yes, describe the assignments.” They responded that:

1. By giving assignments which cannot be completed without consulting Google (third-year Swahili/History student).
2. The teachers give me exercises/assignment to search in computer (websites) (third-year Psychology/Swahili student).
3. Assigning students to search materials over the internet (fourth-year education major).
4. By giving assignments which require us to find answers in computer (third-year education major student).
5. By instructing students to search materials from computers (fourth-year history student).

Some students indicated that teachers insisted that they should do their assignments using computers, and they were compelled to struggle to get access to them. One linguistics student pointed out that the teacher was always insisting that students should type their work to be able to reduce grammatical and spelling errors.

On a question focusing on the teachers, student responses did not reveal substantial information that teachers used computers in teaching. Only 3 students out of 24 indicated that teachers used computers in classroom teaching. Teachers’ responses indicated that some of the teachers used computers in teaching in classroom lessons.

Seven teachers out of 10 indicated the use of computers in their teaching. One teacher (TS2) said that he used the computer for communication with students and colleagues, and Excel for processing data and posting materials to the Blackboard e-learning platform. The university website indicated the presence of the Blackboard e-learning platform. There were 4 online courses listed from the Faculty of Education and 15 from the Faculty of Science. Teachers in the Faculty of Science used the Blackboard platform for instruction more than teachers in the Faculty of Education. Other teachers, mostly from science, said they used computers in classroom presentation and lectures using PowerPoint. Five teachers said they normally assigned students to search for information or materials on the Internet. Three respondents (TE1, TE4, and TS3) indicated that they used computers mostly for preparing materials or notes for teaching. One respondent said he would like to use the computer in teaching, but the classrooms environment did not enable him to teach using computers. He said there were not enough projectors and that the classrooms that they taught in were not well designed for technology use. Another respondent (TE1) from the Faculty of Education said that she had a good knowledge of computers (she attended Ohio State University) but did not use a computer for teaching because of lack of enough facilities and that she taught large classes. In answering Interview Question 6 (Do you use technology in teaching?) she said:

> I do not use technology in teaching because I think the university is basically not ready for that. In our faculty, we have very large classes and the university cannot support having technology in every classroom. I use technology in preparing to teach but not in teaching.

Her lack of computer usage is linked to lack of resources, not lack of computer knowledge. On the other hand, the responses on challenges and suggestions (Questions 18 and 19 of questions to faculty/staff) implied that there were some teachers who did not use technology as a tool of learning because they themselves were not computer literate.

In line with the use of technology in teaching, the researcher wanted to know how the teachers perceived the process of using technology in teaching. That is, he wished to determine if the process of using technology made their teaching easier, manageable, more time consuming, or difficult. The assumption of this question was that how teachers perceived the process of technology use in teaching might be one of the indications of why they used or did not used technology in teaching. All 10 respondents said that it made their teaching easier and manageable. Four (TS3, TE2, TS4, and TE5) indicated that that it was time consuming. Two (TS3, and TE1) said that the process of preparing to teach was what consumed time. One of those (TS3) said:

> It all depends. The teaching itself becomes easier and manageable, but the process of reaching at that point is somehow time consuming because you need to write, you need to edit that, but when you have done that, the process of teaching is easier but the whole process is time consuming.

There was no respondent who indicated that the process of using technology made their teaching difficult.

The responses to this question reflected what the teacher respondents had pointed out as benefits of using technology in teaching. One respondent (TS4) added that the process was expensive, noting that sometimes teachers had to buy materials themselves

to facilitate the use of technology. He said some teachers had bought their own computers, which they used to prepare materials for teaching because the university was unable to give them all what they needed for teaching using technology. One respondent (TE1) said that some teachers shared offices with one computer and therefore it was a common thing for two or three teachers to share one computer.

The general impression about the use of computers as a tool of learning and teaching at the university is that those teachers who managed to use computers were using them for presentation, preparing notes, and assigning students to search for information or knowledge. However, some teachers did not use computers in teaching either because they themselves felt that they did not have enough knowledge and skills to use them or because of other obstacles such as scarcity of computers and other materials, as well as, rooms that were not conducive for using technology. For example, when discussing the challenges of technology integration, TS1 pointed out: “Some of the lecturers don’t use the technology because either they don’t have the knowledge or they don’t have the computers to prepare the material.” However, the respondents’ views suggested that they were making efforts to involve students in learning using technology despite the impediments. For the teachers who managed to use computers to teach, students were mainly involved in searching for information or knowledge. Students were not involved in using the computers themselves (hands-on) during the classroom sessions. It seemed that at a certain level, despite the unfavorable situation, students’ and teachers’ responses showed that they were trying their best to utilize what was available

to enhance their learning and teaching, but in most cases that occurred outside the classroom environment.

Technology Plans and Planning

The central focus of the study was the implementation of the technology integration process. As observed by scholars like Roblyer (2006), effective implementation requires the existence of some optimal conditions. The study looked at one condition that was not in the list of Ely's (1999) conditions of implementation of innovations. This is planning, a crucial processes that precede classroom practices. The planning process for successful technology integration at the institution should start at the institutional level and be directed all the way to the classroom practices. Teachers' planning is at the classroom level. Teachers need planning for their sessions in order to effectively achieve their desired goals. The classroom processes are basically part of implementations to achieve the general institutional goals. The study looked at planning as an indicator to evaluate the process of technology integration. The teachers and heads were asked if any technology plans existed and if there were none to indicate the presence of policies or guidelines from which teaching and learning was mirrored. In addition, they were asked if there were technology standards for assessment of student progress. If there were any standards, they had to describe the contents and who was involved in preparing the plans.

The findings from most teachers showed that they were not aware of any of planning processes for computer enhancement, such as technology plans, policies, and guidelines. They said there were no clear plans for teachers to follow, but teachers were

encouraged to use computers in their teaching. That means they were not aware of any documents such as technology plans. One education teacher (TE2) said, “We don’t have a formally written document other than course outlines that exist for various subjects. We just encourage teachers to teach using technology.”

Only four (TS3,TS2, HS1, and HS2) out of 12 faculty and heads indicated the presence of a plan, and the remaining eight said there were no plans or said they were not aware of the existence of the plans. Those who indicated the absence of plans stated that the uses of technology in teaching that were modeled by some teachers were a result of individual initiatives. In their responses, most said there was not such a thing as technology plans at the university. Here is what one of the teachers (TE5) said: “Policy! Not to the best of my knowledge. The teachers may adopt anything that they think will help them in teaching but otherwise there is not anything as policy to say a teacher can use technology on this or that.”

Two teachers (TS3 and TS2) and two heads of faculty and department (HS1 and HE2) indicated that there was a general ICT policy at the university that provided the vision and the mission of the university in promoting the use of technology. One respondent from science (TS3) explained that he was aware of the presence of the ICT policy that was operating under the University Computing Center (UCC). He said that the policy was a guide for the whole university. However, he confessed that he was unaware of its content. He stated:

> The technology plan is the University-wide plan which is under the Computing Center of the university. It is the ICT policy but I don’t have the details of the

> policy, but I know it is there. I don't have access to the policy. I just know the existence of the policy itself. At the level of the department or faculty, we follow what is said by the university. The system is centralized in a way. So it is a "top-bottom approach" if you like that term. Everything is from administration downward.

On the university website where there was a heading "ICT at the University of Dar-Es-Salaam," which listed programs, projects, and centers that were involved with ICT activities, but there was not a downloadable document of any ICT policies. The researcher managed to obtain the University of Dar-es-Salaam ICT policy of 2006 through the Dean of Faculty of Education. The policy was under the directorate of planning of the university. It was surprising that only four respondents were aware of the existence of that policy. Of those, two did not know where it was to be found. One teacher (TE3) showed some surprise when she was asked about the technology plan. She asked, "What do you mean by technology plan?" The researcher had to explain what it referred to. This implied that technology planning was a new idea in that context. As a result, faculty and departments, and even individual teachers, utilized the available technologies in the way they deemed appropriate. I asked the dean of Faculty of Education that if there were no technology plans and, what strategies did the faculties and departments have to ensure that technology was integrated into the teaching process. She said they were not forced to use technology in teaching and learning because they did not have enough facilities. I then asked her about the evaluation strategies undertaken by the faculty or departments for the use of technology in teaching and learning. She said they

tried to evaluate their achievements at the end of the semester by just looking at the exam results, but there were no specific guidelines for evaluation of courses specifically for technology. A different strategy of evaluation of technology integration was indicated by one education teacher (TE2) who said that the follow up on the use of technology was done by the heads of departments and the faculty dean at the end of the semester.

The findings about technology plans at the university suggested that although ICT policies (a policy on ICT specifically for the university, the National ICT policies such as Tanzania Vision 2025, and the National ICT policy of 2003) exist, teachers had no common understanding and vision in implementing technology based on the institutional and national policies. The dates on the new university ICT policy showed that it was more than a year since the policy had been reviewed from the original policy document of 1995. It was surprising that many teachers were not aware of its existence. This was presumably, among other causes, a shortfall that could have accounted for the inadequate coordination of technology activities, poor planning, and lack of seriousness in ensuring that technology was used for the betterment of learning and teaching. This was identified as a disparity between policies, planning, and implementation.

Teacher Development Programs

Faculty members play a central role in regards to meeting the expectations of students and the institution as a whole. Their use of technology for teaching is indicative of the possibility of effective realization of technology integration goals. The university ICT policy has in place a policy statement that stipulates: “The University shall ensure and require that all students and academic staff are trained on a continuous basis to equip

them with the requisite skills to fully exploit the Digital Learning Environment (DLE) in the different disciplines" **(**p. xiv). The researcher expected the teachers and heads of faculty to report the existence of such programs at the University of Dar-es-Salaam and to evaluate their effectiveness. Seven respondents (TE4, TS3, TE5, TS4, TE2, HS1, and HE2) indicated the presence of such teacher development programs. Three respondents (TS1, TS5, and TE1) said there were no such programs and two (TS2, TE3) said they did not know.

For those who acknowledged the presence of teacher development programs, four had attended these programs and three had not. One respondent (TS4) said, "I can now prepare and post online teaching modules." He said that from those programs he could access internal refined materials and that he could prepare simulation lessons. However, two of those who had attended (TS4 and TE4) had reservations about the applicability of the knowledge gained from those programs. They lamented that the knowledge gained from those programs was not of ultimate use in their teaching because they could not implement the knowledge because of the lack of facilities computers and projectors. For example, in answering Question 16, one teacher (TE4) said, "Yes, sometimes for some teachers. But it is the knowledge which cannot be practiced due to lack of facilities."

Details from one respondent (TS3) indicated that the university had a center called the Continuing Education Center (CEC) that catered for the in-service courses for, among other things, computer technology education. He said that, although he had never attended that center, he was aware that most teachers, members of the Faculty of Science who had participated in those technology courses offered by the center, were taught how

to use technology in teaching. He explained that in the recruitment procedure, the university invited teachers to attend the courses through their respective faculties and departments by writing invitation letters. He did not know the criteria they used to choose teachers to attend the center courses. The university website noted one project called TEIL which introduced the use of ICT in learning and teaching. More details about TEIL were not available because its webpage would not open. In general, detailed information about the nature of teacher development programs on ICT at UDSM was hard to obtain because many respondents knew little about them. The university website was not very helpful. On the page, "ICT at the University of Dar-es-Salaam," there was a posted side note which read, "The University of Dar-es-Salaam also has video conferencing facilities, ICT equipment (laptops, projectors, etc.) for staff to hire and a number of ICT training programs (a page is being constructed to provide all this information)." The dean of Faculty of Education discussed the details of the programs. She said there are three to four seminars per year where a few teachers are selected for a week and taught how to integrate technology into teaching. She observed that they are short courses for those who are computer illiterate because it was difficult to acquire skills in just one week to be able to use computers effectively in teaching. She added that they are only slightly effective for those who have already been exposed to technology and noted that there are staff members who did not touch computers at all even though they are professors and needed longer time for training.

During the interview with the Head of Department in Science (HS1), he indicated that equipping tutors with ICT knowledge was one of the strategies by the faculty to

ensure that technology was integrated in teaching and learning. The Computing Center (UCC) seemed to be a good resource for providing ICT knowledge for the faculty. The information from the website suggested that most teachers did not benefit much from the center because it appeared that the center was business oriented and was open to the public at large. Details showed that UCC opened facilities on different locations outside the university campus. The establishment of UCC was likely to attract people in business from private sectors. All respondents did not mention having taken courses from the UCC neither did the UCC indicate how it involved the university academic staff in training. Two teachers indicated that the technology knowledge that most teachers at the university used in teaching was acquired during their pre-service academic studies prior to their university career. One respondent (TE5) argued that basically most of the teachers' technological knowledge that they used in teaching was a result of individual efforts. He said, "It depends on individual effort that somebody had acquired at school. There is not a conscious program for teachers; there is not much or nothing like that."

A general conclusion from the findings about teacher development programs can be made. It seemed that the university realized the importance of training faculty members and equipping them with knowledge of technology use in teaching as indicated in the policy. However, it appeared that the impact of the available programs was low and that they were not very effective because of the short duration of the training and because there were not many courses or programs that involved a good number of teaching staff.

Teaching Experience and Challenges of Using Technology

The experience of teachers in using technology was seen as one of the best ways to determine the nature of technology integration at the university. The researcher asked the faculty members to reflect upon the use of technology in teaching, specifically on the challenges they faced or they had seen from other teachers in teaching using technology. However, their reflections were focused on the challenges that they faced in integrating technology. The challenges mentioned were numerous, but there were two challenges that were highlighted by the majority of the teachers. These were the issue of facilities for teaching, especially lack of enough computers and lack of enough knowledge on the part of the teaching staff.

Equipment and Facilities

On the question concerning the challenges they faced in using technology, the issue of shortage of technology emerged. Faculty felt that shortage of computers was one of the challenges that affected greatly the effective implementation of technology integration. Other than shortage of computers, faculty mentioned the absence of enough projectors, screens, and rooms well designed for the use of technology. One respondent said that there was only one projector in the Faculty of Education. In explaining the challenge of the rooms, the dean of Faculty of Education (HE2) argued that:

> The rooms where presentations are done, they are lacking screen, and projectors for presentation. That is a problem. We would like our students to use it to allow them to participate in the presentation but due to scarcity it becomes a

problem…….we wish students to go somewhere and prepare materials for presentation but that is not possible.

Lack of Enough Knowledge

Lack of sufficient knowledge was highlighted as a challenge by many respondents. The result was that some teachers reported not using technology in teaching because they did not have knowledge of computers. The dean of Faculty of Education (HE2) observed that lack of knowledge was the major challenge at the university. She said, "Many of us are computer illiterates. So unless something is done, the use of computer technology in learning won't be effective. We need to be educated." A teacher from the Faculty of Science (TS5) talked of a challenge that reflected lack of knowledge. This was a characteristic of technology itself. He said that technology is changing very fast and therefore teachers are overwhelmed because there is no time to train them for technological advancements.

Some teachers indicated that it is a challenge to deal with students who do not have knowledge of computers. It was pointed out that most first-year students entered the university completely computer illiterate. So teachers found it difficult to teach first year students with computers. One teacher (TS4) estimated that only about 10% of first-year entrants had at least some knowledge of computer and 90% knew nothing. Another teacher (TE2) observed that some students had never used computers in their lives. He said, "When you are teaching you have to handle them with a great care." Lack of knowledge by students was not reflected in the responses of students because only third- and fourth-year students participated in the study. However, it was the experience of the

faculty respondents that, most of the new entrants lacked that knowledge and that was why they were to take computer literacy courses in their first year. Lack of computer knowledge by first-year students could be logically attributed to the whole system of education. Most students entering the university do not learn using computers in their pre-college education in public school

Technical Support Services and Infrastructure

The other challenges mentioned by the teachers and heads were related to the supporting technical services and infrastructure. One respondent (TS3) had the following reaction on the issue:

> There is a lack of seriousness in maintenance and upkeep of these technologies. So you find some of the advanced technologies that are installed are not yet utilized and maintained. So that is a problem. But, sometimes you may get a problem of electricity as it is in many poor countries. Sometimes power cuts interrupt teaching using prepared materials.

This observation points to technology support services and leadership, on one hand and infrastructure, on the other hand. Lack of maintenance as observed by TS3 was pointed out by two other staff members (TE1 and TE5). They talked of the problem of maintenance of the available technologies reporting the presence of computers that had broken down but had not been fixed for a while. That situation made the shortage of usable technologies even more acute. The problem of power outages is a chronic problem in Tanzania. It has been a problem for more than 10 years and it seems that it is not going away in the near future.

Similar and related challenges to those described above were shown by another teacher from education (TE2). Since he taught computer-related classes, those were very significant challenges. He pointed out the problem of Internet navigation by saying that the computers were very slow so it took a long time to retrieve knowledge. He observed that sometimes that tended to discourage the teaching. Other teachers also indicated power disruption. One teacher (TS1) said that the problem of power disruption consumed time necessary to prepare materials for teaching.

Large classes

Five teachers said that the enrollment of students at the university was high and this had generally become a burden not only in regard to computer use but also in regard to teaching as a whole. One teacher from the Education Department (TE1) said she had a class that had more than 400 students. In this situation, she said, even if one wanted to use computers, it was practically impossible, although the computers themselves were unavailable.

Lack of Commitment for Technology

One respondent (TE1) said that not all teachers have an interest in using technology to teach. She argued that this was because the university did not have clear plans for teachers to follow to teach. She suggested that there were not many meaningful strategies that encouraged teachers to use technology in teaching. Concerning this, the researcher had asked the dean of Faculty of Education about the presence of any evaluation strategies that helped to ensure that technology was to be used in teaching. She answered that at the time they were not forced to use technology because they did not

have enough computers. She said those who wanted to teach using technology had to carry their own computers to class and she commented that that was something many teachers did not want to do because it was a bother. Lack of commitment, especially on the part of leadership, was also implied in the respondents' suggestions about technology integration at the University.

Cost of Technology

The high cost of technology was identified as one of the challenges in using technology. This was actually the reason behind the shortage of materials. Two teachers talked about this, and one said that it was difficult for teachers to adopt the technology themselves because computers were expensive. The fact that many teachers used their personal computers as reported by the dean of Faculty of Education was an indication that the university was not able to provide computers to every academic staff, and therefore teachers could not buy other materials that the university was unable to provide.

These were the challenges that teachers said they faced in relation to using technology in their teaching. Their profound ideas gave a clear picture about the nature of technology integration at the university. In addition, the researcher viewed some of the challenges as more administrative. These challenges suggested that the university had not done enough in creating the environment that would enable the teachers and students reap to the maximum to benefit in teaching and learning by integrating technology. The researcher viewed some of these challenges as not being peculiar to the University of Dar-es-Salaam because they reflected the challenges that are eminent in many developing

or poor countries, especially when we consider public universities whose budget structures make them heavily dependent on government subsidies.

Reactions and Suggestions on Technology Integration at the University

The students and teachers were asked to reflect upon their experience in learning and teaching and offer their ideas with regard to the use of computer technology as well as suggestions on what should be done to promote the use of computer technology in teaching.

Students' Reactions to and Suggestions on Technology Integration

The students reflected upon their experiences of technology use at the university, touching on a variety of aspects of technology and its use. First, they reflected on what they felt about the use of technology. They saw using technology as a very beneficial experience to their learning and; therefore, its use at the university should be emphasized in the learning and teaching processes. One student observed that technology use was good and helpful to students in finding materials and increasing knowledge. Another student from education observed that technology should be used to offset the shortage of books and other teaching materials at the university. These and other reactions were the indication that students were passionate about the use of technology and had already experienced the benefits of using technology.

Their suggestions on what could be done to make sure that technology was well in place reflected the gaps that they had pointed out when responding to interview questions. However, the most conspicuous suggestion concerned the availability of technologies and facilities. For example, one student had the following suggestion: "The

use of technology in learning and teaching is very effective. So, I suggest that more efforts be made to ensure adequate ICT infrastructure at the university." More than one-half the students urged the university to provide more technologies for learning. Shortage of computers was reported by respondents as the major challenge to the use of technology at the university. This shortage of computers was coupled with shortage of other facilities that are necessary for the process. For example, one science student suggested that the university should expand different technological facilities, including computer labs, so as to enable every student to have access to computers. To ensure that there were alternatives for computer availability, one student suggested that the university should add Internet cafés for the students' use in the areas of the university campuses.

Other suggestions by students touched on their teachers and their teachers' knowledge of computers. One student suggested the training of teachers so that they could have competent instructors. A student from education said it would be better if all teachers would use technology in teaching. They said students realized that the use of technology at the university was such an optional endeavor by the teachers. Lastly, they talked about student computer literacy. One student suggested more computer literacy courses while another student suggested that the available computer literacy courses should be compulsory for all students at the university because most students were from places where they had never used computers.

The students' ideas and suggestions echoed their passions about the use of technology in their learning along with their frustrations about issues that stood as obstacles in meeting their desires. Their suggestions implied a lack of seriousness by

concerned parties in putting emphasis on the use of technology in their learning process and in providing necessary requirements to ensure that the process of technology integration is implemented and effective.

Teachers' Reactions to and Suggestions on Technology Integration

First, teachers suggested that the university should make using technology in teaching a priority. Six teachers indicated that it should not be a matter of choice by teachers; rather, the university should ensure that teachers are using technology. One teacher (TE5) suggested that leadership should come up with a policy for the use of technology, training of teachers, and acquisition of technologies. The suggestion by that teacher reflected what was found earlier, that some teachers were not aware of the presence of the University ICT policy.

Second, almost all teacher respondents offered suggestions on acquisition of more technology equipment, especially computers. They said that more funds should be directed to acquisition of more technology. They observed that lack of enough computers was a major obstacle in learning and teaching using technology. They argued that the university should acquire more computers, establish more computer labs, and improve the infrastructure with regard to ICT to enable more access points for student and teachers; for example, more computers should be added providing Internet service, more projectors should be purchased, and ICT facilities in classrooms.

Third, the knowledge of computer use by teachers was the second most often cited concern in technology integration. A good number of respondents pointed out this issue and many teachers suggested some programs for training of teachers. They said that

the university should put more emphasis on training all teachers to enable them to acquire skills on how to use computers and therefore be able to teach using computer technology. They suggested the provision of enough workshops, induction courses, or regular training for teaching staff. Respondent HE2 said, “We need to have special programs for teachers, to get some sort of training, particularly on this area of technology use in teaching. That could be better. For me, I find that, this is one thing that is missing.” Two respondents (TS3 and TE5) argued that there should be awareness programs so as to change people’s attitudes towards use of computers.

The fourth suggestion was offered to curb the problem of students who enrolled at the university without adequate or any knowledge of computers. As pointed out earlier, pre-college education in Tanzania does not have a provision in the curriculum for computer knowledge; so many students enter the university without, or with little computer knowledge. Teachers suggested computer education in lower levels. They argued that computer technology integration should be instituted from the primary level on. That means the whole education system should adopt technology integration in the curriculum. This, they argued, would help students to enter the university already computer literate.

During the interview with the dean of Faculty of Education, the researcher asked her, as a leader in the environment of technology integration, “What do you think are the future strategies or recommendations for improving technology integration and therefore improving the quality of education?” The dean said:

> Technology integration is very important especially nowadays when the world is anchored in the use of technology more than anything else. So for us [Tanzanians] who don't use technology much, we will be left behind and in case some of our students go to another country for studying, they will find it very difficult to learn if they don't know how to integrate technology in learning and teaching. So what I would advise for the university to do is to take this as a serious matter and put emphasis, I mean to have more computers so that everybody learns how to use computers so that we can compete in the job market with people from other countries.

Again, the ideas and suggestions of the teachers revealed the nature of technology integration at the university. In general, the picture is that the issue of exploiting the use of technology in teaching was not yet given serious emphasis by the university administration, that is, in terms of preparing or equipping the implementers with awareness and viable knowledge, and in terms of creating conducive physical environment to do so. Physical environment it means refers to equipment, buildings, networking, services, and infrastructure.

The Impression from the University Website

The website of the University of Dar-es-Salaam (http://www.udsm.ac.tz/) was visited to search for more information related to the use of technology. The website indicated that the university had ICT projects and programs that provided or made available computer and other technological equipment accessible to students and teachers. These projects and programs included online learning, the Smart Card project,

African Virtual University (AVU) Learning Center, Instructional Technology Resource Unit (ITRU), University Computing Center (UCC), and the SIDA-Sarec Project. The page on the Smart Card project could not open.

AVU Learning Center is part of a telecommunication network serving universities in the region of Sub-Saharan African countries. It provides educational programs to students with access to online educational materials. The site indicated that programs were provided by satellite broadcast technology, online materials using WebCT, software platform CD-ROM-based materials, video, textbooks, and supplementary notes. The website showed that programs were provided in computer science and business studies**.** Surfing further in the AVU websites, it was surprisingly to find that it was not up-to-date. For example, opening the page titled “Computer Science Programs,” it brought up an AVU academic calendar of semester 2 of the year 2004. This raised the question of the credibility of the center in providing technological services at the university.

The UCC was listed as a company owned by the university. It indicated that it provided ICT programs to university community and general public. That information did not suggest or indicate how the programs had a connection to the classroom teaching and learning.

SIDA-Sarec was indicated as an ICT project funded by the Swedish government in collaboration with the Tanzanian government. The project provided the university with ICT networks to nearly all faculties and colleges. At the time of research, it indicated that the project had provided and installed 300 PCs in different departments, administrative offices, and university colleges. The Faculty of Education had benefited with 15 PCs and

the Faculty of Science with 20 PCs. This made the project a leading provider of technological facilities and networks to UDSM.

The ITRU page, like the Smart Card project, would not open, so the researcher could not access any information on what its function was at the university. The researcher asked the Dean of Faculty of Education and the head of the Department in Science about this (in separate informal telephone conversations), but neither seemed to know what ITRU was. The researcher asked the graduate student and she did not know what it was either.

It was surprising that when the respondents were answering a question about teacher development programs at the university, no one had indicated any programs from the previously mentioned centers or projects. That was an indication of disparity between some information on the website and the information provided by the respondents. This suggested that either the teachers were less informed about some technology issues at the university or the coordination or information system at the university was weak.

The impression about the website design might not have a direct implication for the process of technology integration. However, the researcher feels that it might provide a clue to the technology knowledge and the level of seriousness of the people who have leadership responsibility for the use of technology at the university. The researcher had reservations on the design of the website. First, the homepage was loaded with information and did not show expertise in webpage design. The homepage is the “main entrance” to the university information pool; therefore, it should be designed in a welcoming way that gives a good first impression to visitors. In addition, the researcher

experienced surfing problems. A good number of pages in the website could not open, therefore, denying the researcher information suggested by their headings. The researcher kept on trying to open the pages over a stretch of more than two months but nothing opened. This suggests the website was not frequently updated. The researcher took this as a significant problem because the website is accessed worldwide. This might suggest lack of seriousness or lack of expertise to the part of the university and denies people desired information. Nevertheless, the website provided some information that was useful to the research topic.

Emerging Issues on Research

This part of the chapter reports the issues that emerged in the course of the research process. This is the information that was not probed by the research tools or document analysis but the researcher found it to be valuable and had an impact on the use of technology.

Large classes

One of the issues that emerged during the study that the researcher thought was linked to implementation of technology integration was the issue of large classes. The size of the class may be a factor in deciding on what methodology to use in instructional strategy for delivery. The university enrollment was high, and it seemed that teachers had felt the impact of handling many students. One of the significant findings in relation to that was a statement by one respondent (TE1) who said that she was not using technology in teaching because of the large classes she had. The enrollment increase rate did not correspond with the increase in infrastructure and services. An increase in enrollment

decreased the level of accessibility of technology to students and hence minimized the chances of teachers using technology in teaching. One former UDSM lecturer had visited the University of Dar-es-Salaam and was writing to a listserv of Tanzanian intellectuals. Now teaching in Canada, she writes: (Permission was sought from her to include the message to this study):

> Enrolment at UDSM has increased tremendously, if you cannot stand a crowd in front of you, you will run away. In 1990, I taught about 200 students in ATA and ATB [two university lecture theaters] but now how about 980 students for the same course (CT 200)!!! They are organized in two groups of about 500 each for lectures. Thank God for my Power Point equipment I took with me, it would have been impossible to conduct lectures without it!! Sincerely, hats off to all UDSM faculty who handle such huge groups of students with little or no visuals!! I am sure if I were to stay longer, the pleasure I was experiencing teaching UDSM students might start to feel like pain! (S. Mushi, personal communication, March 6, 2008).

This excerpt suggests that the use of technology was a necessity in facilitating instructional delivery to large classes as just some respondents has observed as the benefits. However, the observation was contrary to respondent (TE1) who indicated that she did not use technology because of the large classes she taught. Probably, they were referring to different scenarios. Whereas the former said that using technology for presentation (lecturing) helps to teach large classes, the latter meant that involving students in hands-on computer activities is impossible with large classes.

Summary

This chapter reported the findings about the nature of technology integration at the University of Dar-es-Salaam. Overall, this chapter reported the experiences of students, teachers, and heads of departments in classroom practices and other related aspects that contributed to technology integration. The findings show that although the students and teachers showed positive attitudes towards technology integration as a means of enhancing learning and teaching, there were still many impediments that affected the process. These included:

1. Acute shortage of technology equipment, especially computers.
2. Lack of enough knowledge of computer use among teachers and students.
3. Absence and lack of awareness of policies, technology plans, and guidelines to guide the implementation of technology integration.
4. Lack of enough and effective training for implementers of technology integration.
5. Lack of emphasis in the use of technology by the university as a whole.

Nevertheless, there were significant efforts that were made by the university and the implementers that indicated optimism in a course of harnessing ICT infrastructure in enhancing learning and teaching at the University of Dar-es-Salaam.

Chapter Five: Discussion and Recommendations

Introduction

The purpose of this study was to investigate and evaluate the nature of technology integration in higher education in Tanzania. It focused on one institution, the university of Dar-es-Salaam. This chapter provides the discussion, evaluation, and recommendations. It interprets and discusses the findings presented in chapter 4 and connects the findings to the existing literature and research questions. Recommendations are given in light of what might be done to make technology integration a more effective process in the learning and teaching environment at the university based on the conditions for implementation of education innovations presented by Ely (1995), by the ACOT model of technology integration, and the established planning concepts derived from literature. The main research question was:

What is the nature of implementation of technology integration in learning and teaching by faculty and students at the University of Dar-es-Salaam?

This research question was investigated by answering the following sub-questions;

1. What technology is available to support teaching and learning, where is it located, and who uses it?
2. What is the knowledge and skill level of stakeholders of technology and technology use at the University of Dar-es-Salaam?
3. What approaches and strategies of integrating technology do teachers and students employ in learning and teaching?

4. Are there professional development programs for the teachers? How effective are they?
5. Does the university have technology plans? If so, what are the contents of those plans and to what extent are they being implemented?
6. At what stage of ACOT Stages of Development model is the technology integration at the University of Dar-es-Salaam?

Together with answering the research question, this chapter also discusses other issues that have a strong bearing in explaining the nature of technology integration at the university, issues that were prompted by questions and emerged in the process of data collection. These include:

1. Perception and attitudes of teachers and students
2. The findings in the context of the Tanzania Development Vision 2025

To collect the data for answering these questions, the qualitative approach was employed. Written and telephone interviews, and document analysis were the main strategies. The documents analyzed helped in obtaining some more information about issues related to technology integration at the university. The documents were used as reflective tools of some issues raised by respondents as well as adding more insight into technology integration. A research assistant was used to facilitate the process of recruitment of respondents and to administer the written interviews.

In general, there were indications of the development in capacity in the use of technology in learning and teaching at the University of Dar-es-Salaam in Tanzania from the personal experience of the researcher. The researcher studied at the University of Dar-

es-Salaam between 1985 and 1988. At that time, computer technology was almost nonexistent at the university. Nonetheless, the researcher argues that the innovations leave much to be desired on the implementation capacity in classroom environments and processes of technology integration, which is a crucial strategy in the knowledge acquisition process. The ability of students and teachers to access and harness technology in classroom practices is a critical aspect of the role of technology in education. This panoramic overview was accrued by the following presentation of the study findings.

As pointed out earlier in the literature, the computer age has brought new horizons in the way learning and teaching are examined. New educational trends are evident all over the world. Nevertheless, to some, if not most, countries, such trends have created many challenges because implementing such trends has many implications and impacts in other facets of the societies. For example, adoption of computer technology implies a major overhaul of some aspects of the educational system such as physical structural modifications. This, in turn, needs a strong economic base. Such challenges have given way to a *digital divide* between developed countries and developing countries. To countries with weak economies (mostly developing countries), such as Tanzania, the process of technology adoption, although desirable, has posed intractable challenges. One of the reasons for this situation is a matter of what the priority for survival is. For example, Africa, which is said to be the least computerized continent in the world, is faced with significant problems that are far more persistent than the use of computers or Internet, thus excluding her from participating effectively in the emerging technological revolution (Boyer, 1987; Castells & Tyson, 1989; and Stonier, 1983). This stance does

not suggest that there is nothing significant in technology development in these countries. There is much technological progress in many countries, especially if one looks at these countries at different eras. For example Tanzania, which had a prohibition order on electronics between 1974 and 1984, has achieved tremendous progress in deploying ICT, especially in commerce (Tungaraza & Sutherland, 2007). The then-prohibition order stipulated that importation of communication technology like TVs, videos, and computers could not be done without the approval of the government. The researcher, alum of the University of Dar-es-Salaam, assessing what technology existed at the time when he was a student and the situation at the time of this study, found great disparities which suggest that there has been remarkable progress. For example, there were hardly any computers in the Faculty of Education and the researcher does not remember having seen even the faculty members using computers in their offices during the time he was studying there. Nevertheless, an evaluation of the university's implementation of technology integration is based on what is perceived as an effective model of technology integration against what the findings suggested.

The general impression of the findings indicated that the process of technology integration at the UDSM was a process that was desired by the participants as a useful methodological asset in learning and teaching. Respondents, especially students, had very positive attitudes about using computers in their learning. However, the respondents indicated the presence of many barriers to implementing technology in learning and teaching. Those barriers were both within the participants themselves, and to a greater extent, within the system in which teaching and learning was taking place. The major

obstacle that emerged from interviews was lack of availability of enough technology to enable the students and teachers to attain the benefits of technology integration, especially the lack of enough computers. Knowledge of technology use by teachers and students was also a major barrier. In the sections that follow, these findings are discussed within the frame of the research sub questions in conjunction with the existing literature. The findings also are discussed from the perspective of the Tanzania Development Vision 2025.

Research Question One: Technology Resources

The first question driving the research was, What technology is available to support teaching and learning, where is it located, and who uses it? The purpose of this question was to explore the existence of Ely's condition that focuses on resources. The essence of this condition is that the environments within which technology integration will effectively take place should be rich and conducive with elements that will, in the first place, make the process happen before exploring how it will happen. The presence of resources is one of the major prerequisites. The research projected that the implementation of technology integration in the classroom by teachers and students should, in the first place, be assessed by the availability of technology itself, the location of that technology, and its accessibility to the users. According to Ely (1999), this condition refers to the things that are required to make implementation work. Many things may be implied by resources. In this study the resources were limited to computers and other computer-related equipment such as screens and projectors. This is the condition that encompasses the key words 'availability' and 'accessibility' and it is

supported by the observations by other scholars on factors surrounding technology integration. For instance, Baron et al. (2002) argue that integration of technology into education is not easy because it is still difficult for schools to afford enough resources to meet the demands. This suggests that the resources are required to enable adoption to take place. Edyburn (1998) pointed out limited access to hardware, software, and supports are some of the factors that make integration a complex and difficult process.

The findings of this study showed that at the University of Dar-es-Salaam, there were no computers and supporting facilities in classrooms. The lack of enough computers and other technologies was the concern of every respondent. It was obvious that the need for equipment was the major impediment to the process of technology integration. The university had managed to put up computer labs in almost each faculty, a commendable move that indicated a trend in the right directions. However, the number of computers was too small to accommodate the needs of students. Very few computers were available for students to use, and in some faculties there were restrictions giving priority to some groups of students. The main library had very few computers compared to the population it was serving (31 computers in working condition and 15 out of order serving about 16,000 students). Teachers utilized the computers in their offices but they were not sufficient. A positive sign is that some teachers and students had their own computers. They are aware that the university was unable to provide sufficient facilities. There were some supporting departments that had computers facilities like UCC and AVU, but it seemed they were not easily available or free to students and teachers. Nevertheless, the information as to how those departments contributed to the accessibility of computers for

teaching and learning was not available through interviews or the website. Other equipment, such as projectors and screens, were reported to be very scarce and not available in many classrooms.

Theoretically, the University of Dar-es-Salaam ICT policy casts a different impression on the nature of technology equipment and infrastructure. The executive summary in the UDSM ICT policy (p. xi) indicated an impressive state-of-the- art of ICT infrastructure. It showed that the implementation of the UDSM ICT policy that was developed in 1995 has resulted in sophisticated connectivity. These included fiber optic networks on buildings around the main campus and out off the main campus on its constituent colleges, the Local Area Networks (LANs) in all offices and functional buildings. The policy indicated the presence of a wireless network connecting the main campus, and Muhimbili College of Health Sciences (MCHS) and the presence of Public Access Rooms (PARs) in all facilities and the main library, including in the colleges. That was a good indication of the efforts made by the university to create a sufficient ICT environment. The findings from the field did not indicate the utility of that environment in promoting the implementation of technology integration in learning and teaching processes. This suggests that this impressive ICT environment had little direct impact on classroom learning and teaching.

If we put the findings into the perspective of our reviewed literature, we can characterize the nature of lack of the availability of technology at the University of Dar-es-Salaam in different contexts. In a sociopolitical perspective, we look at the context of technology integration in Africa and developing countries. UNESCO (2004) highlights a

number of barriers to development of environment for technology integration in higher education in Africa. The barriers include lack of sufficient network infrastructure, PC laboratories, and quality ICT instructors to provide most staff or students with adequate access. That is what I found at the University of Dar-es-Salaam. Naidoo and Schuttle (1999) have indicated that the challenges emanating from poor economies have made Africa continually struggle to procure infrastructures, and even when procured, there was a struggle to hold on to them. Tungaraza and Sutherland (2007), in their study about the use of ICT at the University of Dar-es-Salaam, identified eight barriers to using ICT at the university and, among those, inadequate computers was the most often identified by subjects. In their study, they reported that there were only 12 computers in working condition whereas 26 were out of order in the Faculty of Education. They argue that, in common with other African countries, Tanzania's infrastructure to support the development of ICT was weak. In that context, the University of Dar-es-Salaam is a public institution whose budget is highly subsidized by the government. That means in most cases, its funding will reflect the nature of the government budget. In that regard, what is seen to some extent is the reflection of a government socioeconomic position. Information technology is a major consumer of resources, and in most cases the university does not receive enough funding from the government. From the information in the university website, it appears that much technology installed had come from foreign grants. The scope of the study could not establish the presence of any other initiatives that the university had for the acquisition of computers other than from the

government budget. However, such initiatives would have been reflected through the presence of a larger number of facilities.

The other context explaining the lack of technology availability at the university focuses on factors within the administration--leadership. Leadership plays a larger role in affecting the institutional development. Technology needs a good committed leadership, which understands the importance of technology integration (Bettis, 1998). The school or institution should be fully involved in ensuring that technology integration takes place and involves ensuring that technology required is available and is in place. Whitehead et al. (2003) argue that capable leadership and careful planning are critical factors that are consistently interwoven within a fabric of successful school technology initiatives. The findings of Question 7 for the head of Faculty and departments did not suggest the presence of a system or a model that guided acquisition of technologies. Both heads did not reveal any plans or systems of acquiring or upgrading technology. This suggested a gap in leadership of the Faculties. Also, in Question 12 of students' questions, over 15 students gave answers that indicated a gap in leadership. For instance, a third-year education student said: "The University should emphasize the use of technology in learning and teaching" [with the word 'University' suggesting the leaders]. The statement suggested that there was a little emphasis on the use of technology by the leadership. The UDSM ICT indicated the future plans for acquisition and deployment of optimal ICT infrastructure and facilities, but the plans are in the form of statements that delineate how the acquisition will advance. The researcher suggests that the university leadership needs to put into place a framework that details how such plans will be achieved to ensure that

technology availability is not the big problem it appears to be now. The issue of scarcity of resources is the one of the major obstacles in schools in the developing countries. Burniske's (2003) observations that in the developing world, choice of software is limited to what well-intentioned organizations donate. Although the research did not focus on specifications for the technology at the university, such a lack of ability to choose because of the dependency on donors may be one of the explanations why there were many nonworking computers in the College of Education and in the university library. From the findings, Ely's condition of presence of enough resources is not well met at the University of Dar-es-Salaam. That is one of the factors that stand as a barrier to technology integration at the university. This is in line with the general literature on implementation of technology in education in developing countries, especially in Africa.

Research Question Two: Knowledge, Skill Level and Use of Technology

The second question that guided the research was, What is the knowledge and skill level of stakeholders of technology and technology use at the University of Dar-es-Salaam? The purpose of this question was to explore the presence of Ely's condition of 'Existence of knowledge and skills of the users of an innovation' at the University of Dar-es-Salaam. Ely (1999) argues that this condition is one of the most important factors in the process of implementation of innovations. The researcher believes that if the stakeholders have sound knowledge of computers and computers use, the process of technology integration is more likely to take place smoothly. According to ISTE (2001), teachers need to find ways to effectively using technology when teaching. They should clearly understand and acknowledge the importance of technology in their teaching. That

is possible if they themselves are well equipped with the knowledge and skills, both technical and professional, about the use of computers.

At the same time, students too need to possess the knowledge of computer use to be able to follow the instructions or be able to learn to use computers. Literature has indicated that this is one of the prerequisites of technology implementation that can make technology more useful to the students in education (Romano, 2003).

In this study, students and teachers assessed themselves and others on the level of knowledge and skills of technology and technology use. They stated what kind of computer knowledge they possessed. The responses of teachers and students indicated that they had varied levels of knowledge and skills. This means that there were students and teachers who honestly indicated that their computer knowledge was not good enough, whereas there were teachers who indicated that they had enough knowledge to be able to use it in teaching or facilitating the students' learning. Responses from some teachers indicated the presence of other teachers (not involved in research) who had very limited knowledge and skills such that they were not using technology in teaching, let alone, the problem of scarcity of computers. For students, the findings generally indicated little knowledge of computer use that they mainly attributed to their past experience of pre-college education that lacked a computer education component, as well as the absence of effective computer courses at the university. The majority of students came from public and private schools where computers were not part of their learning process or nonexistent for learning. When they entered the university, they did not have even the basic skills needed to interact with technology. That's why they have to be absorbed into

these courses provided by the university. The cause for that is rooted on the education system of the pre-college levels. The Ministry of Education had introduced the computer education syllabus for secondary education, but its implementation was not enforced and proved to be ineffective. In 2007, the Ministry of Education enacted an ICT policy for basic education. The policy will provide for dissemination of ICT knowledge for primary, secondary, and teacher education levels. It is hoped that, this will be a solid foundation for technology literacy among university entrants, which in turn will boost the implementation of technology integration. As for the computer courses, the faculty members had felt that most of the students entering the university lacked the desired knowledge of computers such that they introduced compulsory courses in the first years of their study. That was a good move toward alleviating the problem. However, the findings from the students and teachers showed that those courses were not very effective and helpful.

The implication regarding the current situation was that these students who were in their third and fourth years were likely, upon graduation, to leave with a limited knowledge of computer use and application in their career as teachers. One of the reasons for that was the fact that there were not enough computers to enable students to learn to use the computer. The researcher sees pre-service education as the best time for teachers to gain a clear understanding of technology that will be useful in their careers, which, in a long run, will eliminate the possibility of having teachers who are technologically illiterate in the education system.

Based on the findings, Ely's condition of "Existence of knowledge and skills of the users of an innovation" was not sufficiently met in the faculty of Science and Education at the University of Dar-es-Salaam. The knowledge possessed by the students and teachers (the stakeholders) was not perceived by most of the respondents as sufficient to have a strong impact on technology integration into learning and teaching.

Research Question Three: Approaches and Strategies of Technology Integration

The third research question was, What approaches and strategies of integrating technology do teachers and students employ in learning and teaching? The essence of this question was based on the belief that the presence of technological equipment might not be as important a factor as the process of technology use. This was a question which aimed at examining Ely's condition of 'Existence of knowledge and skills of the users of an innovation' inferred from how technology was used in classroom learning and teaching. In Research Question 2, this condition was evaluated based on the responses of the respondents. One of the main focuses was to explain what and how technology integration took place in the classroom in learning and teaching processes and environments; that means how teachers were utilizing the available technologies in teaching and how students used them in learning. If we look at it in the broader perspective, the achievement of the national goals, as prescribed by the national policies and the institutional goals by the institutional policies, are anchored or achieved by the process in the classroom situations. Promoting efficient learning is the key objective or the central focus of integrating technology. Technology integration is a pedagogical strategy aimed at making the process of learning more efficient. The body of literature in

Chapter 2 has revealed how using computer technology can benefit the learning and teaching process. From the learning perspective, there are indications of how students can utilize the opportunities of technology to improve learning. Valdez (2004) observes that technology offers more opportunities to make everyone a producer of knowledge. Nonetheless, it is not simply the use of technology; rather, it is how the technology is used that will make it beneficial. Fulton, et al. (2004) point out that technology can provide powerful tools for student learning, but their value depends upon how effectively teachers use them to support instruction. The strategies that the teachers use to teach using technology have a greater impact in shaping the learning process by students, for the teachers choose strategies that they believe would help students learn efficiently. The findings revealed the scarcity of equipment, especially the computer, greatly affected and limited the strategies teachers used. For example, there are some strategies that teachers knew were good for learning but due to computer scarcity, they were not used. Some teachers reported that the absence of computers in classrooms or few computers in the labs denied the students participatory learning during the classroom sessions. One teacher (TS1), discussing the limitations posed by scarcity of computers, said: “again, we would like our students to have computers to allow them to participate in presentations but due to scarcity of computers also it is the challenge; they do not get that opportunity.” The result is that some teachers will use other alternative strategies that might not promote as strongly the learning process. Some teachers reported using strategies that were only possible with availability of computers. One of the strategies reported was the use of computers for presentations of materials in class by teachers while students listened or

are involved without using computers. Most teachers who reported using computers for presentation of materials used PowerPoint. That means the students had no opportunity to touch computers. The use of this strategy reflected the second stage of ACOT Stages of Development. While this strategy does not give any indications of knowledge and skills on the part of the students, it indicated the presence of skills on the part of the teachers. The argument was that, in order to be able to prepare a presentation and do the process of presentation itself using technology, one must possess some knowledge and skills about the use of computer. The other strategy reported was the use of the computer for preparing teaching materials, which implies some knowledge of using computers. The use of computers to search for knowledge by students was the major strategy that involved students using computers. Students had some knowledge of the use of computers such as using search engines, sending e-mails, and using word processing. This suggests that teachers and students had knowledge of computers for searching for information. The other strategy that was reported to be used by student was using computers for word processing to write their assignments. In general, we can say that there were strategies that teachers (who used technology to teach) and students used that exhibited the presence of some knowledge. However, the limitation imposed by the scarcity of computers made it difficult to make a conclusive assessment of the students' and teachers' computer knowledge and skills by looking at the strategies they used. The essence of this argument was that it was difficult to tell whether not using some strategies was due to lack of knowledge or the scarcity of computers. To answer this research question, there were strategies that some teachers and students used in learning and

teaching using technology, but they were limited by the lack of availability of technology. The students did not have much opportunity to use computers (themselves the processors of learning processes) in classroom situations. They were simply passive beneficiaries of technology in classroom. They used computers outside classroom sessions when they were searching for knowledge or writing their assignments. The findings agree with the findings by Earl (1997) on the U.S. national survey that the nature of impact of technology use seems to be limited to information retrieval rather than improved teaching methods or revitalized school and classroom structures.

Research Question Four: Professional Development Programs

The fourth research question was, Are there professional development programs for teachers? How effective are they? The embodiment of this question was the researcher's belief that faculty members play a central role regarding meeting the expectations and opportunities of students and the institution as a whole. Their use of technology for teaching is indicative of the possibility of effective realization of technology integration goals. This justifies the tremendous necessity for educational institutions like the University of Dar-es-Salaam to ensure that these implementers are equipped with the necessary technology skills and pedagogy prior and during their careers. This requirement is uniquely necessary with technology because using technology is a relatively new methodological endeavor in the field of education. More significantly, computer technology is a fast-changing field; there are new developments in computer technology almost every day. From that perspective, institutions are better off with providing faculty members with teacher development programs and refresher

courses to keep them abreast of the new technological innovations in the field of education to enable them to be more effective. These programs should be part of professional development of teachers because technology integration is a “tool” to support their instructional approaches to better meet their students’ learning needs. These programs are necessary because seven out of ten teacher respondents and six students reported that there were teachers at the university who had no basic knowledge of computer use. If these courses or programs are not available, the teachers will be left out in the modern teaching experience of using computer technology.

The purpose of this question was to examine the presence of Ely’s (1999) condition of presence of ‘time.’ The presence of ‘time’ as explained by Ely, covers time to learn new innovations as indicated in his statement: "The implementers must have time to learn, adapt, integrate, and reflect on what they are doing" (p. 4). Moreover, he argues that it takes time for people to understand the innovations and develop the abilities to adapt the innovations. That means the teachers should be given opportunity for training

Chapter 4 briefly detailed the teacher professional development programs as a necessary ingredient in ensuring the success of technology integration in an institution, or for any change agent. Coming to terms with Ely (1999), a good number of scholars and researchers have discussed the impact of teachers' knowledge on the technology integration process. Faculty members in an institution play an important role as implementers of technology innovation (Palak, 2004). Shuldman (2004) observes that the most troubling gap in technology integration was teachers' lack of technology understanding. Teacher preparation programs are frequently criticized for their inability

"to fully prepare new teachers to use technology effectively in their professional practice" (Milken Exchange on Education Technology, 1999, p. i). Baron et al. (2002) argue that to effectively use technology in the classroom, teachers require new understanding, new approaches, and new forms of professional development. They need to be helped to overcome struggles to realign their conceptions about the nature of teaching and learning with technology. Their struggle is to overcome, in traditional classroom practices, formidable barriers to real change. Teachers need to develop competence on computer knowledge first and then learn pedagogical aspects of using technology. Therefore, these observations call for institutions and change agents to have strong programs for teacher professional development as an essential element in technology integration plans/programs.

The study's findings show that the University of Dar-es-Salaam had some programs in place to give teachers training on using technology. Nevertheless, the teachers reported that those programs were less effective in equipping teachers with skills to teach with technology**.** They felt that not much was done to equip them with such knowledge and skills. Moreover, some teachers had never attended any of those courses despite the fact that the use of technology in teaching at the university has been in effect for more than 10 years. It was even surprising that some teachers reported that there were no such programs. In their suggestions about what should be done to improve technology integration, a good number of respondents argued for training of staff members on technology. Such responses implied that there were either not enough and / or were ineffective professional development programs.

The findings of this study conform to the study by Batane (2002). In her study about the technology use in secondary schools in Botswana, she reported that teacher training had emerged as the most outstanding problem that impeded the development of educational technology in schools. Most teachers in schools reported that they were not working with technology because they did not feel competent enough to do that. The provision of professional development training should be integrated into the technology plan and addressed as a necessity, rather than as option, and should be an ongoing and permanent aspect of the technology integration process. From the researcher's experience as an instructor in the Ministry of Education in Tanzania, in-service training programs in schools in Tanzania are seldom offered to classroom teachers. The findings suggest Ely's (1999) condition of the presence of time, as explained in the conceptual framework, was not effectively met. To answer the question, the university had the professional development programs, but respondents indicated that there were not enough, and they were not very effective to equip stakeholders to keep up with the demand of effective technology integration.

Research Question Five: Presence of Technology Plans

The fifth research question of this study was, Does the University have technology plans? If so, what are the contents of those plans and to what extent were the plans being implemented?

The literature reviewed for this study had comprehensively established the vitality for the institutions to have technology plans. For a successful implementation of any program, it is almost inevitable to start it without embarking on planning prior and during

the implementation process. Roblyer (2003) argues that the mere presence of technology is not a guarantee for improved education. She argues that planning is a key in addressing key concerns that have been observed as causes of failures in using technology. Whitehead et al. (2003) observe that planning for technology is one of the major prerequisites of successful technology integration in schools. They argue that for it to be effective in instruction or in the process of education, its adoption and its use should be carefully planned and implemented. Titthasiri (2000) observes that a university must have a strategic planning process for both administrative and pedagogical functions to help personnel address the eminent challenges. She found, in her study in Thailand universities, that many universities were unable to create strategic plans because they did not have information and experience. Learning from the context of technologically developed countries, we find that in schools or institutions, the working strategy is to create a technology plan. For example, in the U.S., states, school districts, and some schools have technology plans with set standards to be met at certain grade levels. The standards, among other things, give directions on the evaluation process. Nevertheless, critics like Piacciano (2002) have pointed out that some plans are not carefully planned to enable successful computer education.

The study sought to establish whether the University of Dar-es-Salaam had technology plans or even policies that reflected the presence of processes that guided the implementation process. The study findings did not indicate the presence of technology plans at the university. Most respondents indicated a lack of awareness of such a thing as a technology plan. At one point during a telephone interview, the researcher had to

explain what a technology plan was. The implication for not having a technology plan is lack of clear directions and benchmarks of the implementation of technology integration. Absence of technology plans devalues the process of evaluation, which is a vital element in any program. From the findings, it was determined that there was a random and haphazard process of the use of technology in teaching. A statement such as “the teachers may adopt anything that they think will help them in teaching but otherwise there is not anything like policy to say a teacher can use technology on that” indicates the lack of a clear technology planning process. This situation is also a problem in developed countries, although at different levels. For example, Piacciano (2002) points out that lack of careful planning was a major impediment in successful computer education in schools in the U.S. He argued that unless educators take time to develop clear plans of how technology will be put to work for students, adoption of computers can be a waste. In the developing countries, planning is a far more crucial need because of limited financial resources.

It seemed that although technology integration at the University of Dar-es-Salaam was perceived as a move to improve learning and teaching, its implementation was left unmonitored and in the hands of individual teachers. Technology integration stood as an optional choice for teachers who decided whether or not to make use of it.

The study established the presence of policies that explained issues of technology integration at the university. UDSM ICT policy was the policy that described what the nature of technology integration ought to be. The policy was relatively new (February 2006), although it was a review of the previous policy that came into existence in 1995. It

was surprising that the policy was unknown to many of the teaching staff members. Only 4 out of 12 respondents acknowledged knowing of its existence, and one indicated that he did not know its content. This suggested that the content of the policy was not communicated with teachers and did not translate into classroom practices. The researcher perceived that this was a major blemish to technology integration at the institution. Such a situation also revealed that teachers and academic staff were left out of the planning process.

In the context of the research question, it can be suggested that though there are specific technology plans that exist in institutions, or educational districts, these plans are normally based on broader plans in the form of policies at different levels. In the case of UDSM, we can answer the research question by saying that the university has a broader technology plan (the ICT policy). The university lacks a specific technology plan that is more practical and more specific regarding the implementation of technology integration. The implication is that, because the plan is broader and it is not translated into specific implementable technology plans, the policy (as a broader plan) is not overtly or deliberately implemented. This means that, the fact that there are aspects in the policy that are implemented by the stakeholders, the implementation is not done with deliberate reference to the policy because most of the teachers were unaware of the content of the policy. Within the framework of professional development programs, the university needs to inform the teachers of the existence, the content, and the connection between the policy and practical implementation of it.

Research Question Six: ACOT Stages of Development

The sixth and last research question of the study was, At what stage of ACOT stages of development of technology integration model is technology integration at the university of Dar-es-Salaam? The purpose of this question was to evaluate the status of technology integration at the University of Dar-es-Salaam by using the ACOT stages of development. As indicated above, the findings of the ACOT study indicated that, in order for the process of technology integration to be fully implemented, teachers must progress through five developmental stages. The five stages include entry, adoption, adaptation, appropriation, and invention. Although the ACOT project focused on both teachers and students, these stages focus mainly on teachers' development. The rationale is that teachers are the key implementers in the whole process of education. Ensminger and Surry (2002) contend that faculty members represent an important group of stakeholders in this process of implementing technology at the university level. Their attitudes, involvement, and performance greatly impact how technology integration is implemented. The ACOT stages are chronological, and when teachers are at one stage, it presupposes what is taking place with technology activities at an institution. This study sought to examine the level of the teachers at the University of Dar-es-Salaam. This was inferred from their responses and what they reported doing.

When teachers were responding to other questions, it appeared that, at the University of Dar-es-Salaam, there were two groups of teachers; those who were using technology in teaching and those who were not. Although most of the users were not satisfied with the knowledge they had, they were identified as having the basic

knowledge of using computers. This means that they had gone through the ACOT entry stage. The stage of entry is a period of familiarization. It is the period of baseline exposure to technology. In this stage, teachers become aware of the utility and importance of technology. Then they develop an interest to learn its basics.

Another group of teachers indicated that they used technology to teach. This is a group of teachers who indicated that they mainly used technology for presentation of materials in classroom using PowerPoint and preparing notes using computers. The group indicated that they also used technology to teach by assigning students to search for information from the Internet. Therefore, this group could be regarded to be at the stage 2 of ACOT stages of Development, adoption. They are using technology in their teaching but still they lectured, which is the traditional method.

Then there is a group of teachers who did not use technology to teach. The responses of the teachers indicated that this group constituted those who did not use technology simply because they were not knowledgeable about computers or were not interested or lacked facilities to do so. From the perspective of this study, this group was still at the entry stage. Some of these teachers were, as findings suggested, not using technology because of the environment, such as large classes, which made it difficult to use technology. So whatever the imminent reason for not using technology, this group was categorized at the ACOT's entry stage. Therefore, the level of teachers from the perspective of this study falls into the first two stages of ACOT, the entry stage and the adoption stage.

The determination of those stages can also be supported by other aspects of the findings. The nature of professional development programs are, the inadequacy of teaching equipment would suggest that teachers were not inspired and equipped by the technological environment at the university to progress steadily through the ACOT stages and, ultimately, make much of an impact in the learning process of the students. The level of technology integration at the University of Dar-es-Salaam, as reflected by teachers' responses, was still at the continuum between the entry stage and the adoption stage. Despite the fact that the stakeholders have indicated positive attitudes (which suggests that they were moving away beyond the entry), the knowledge of computer use and availability of equipment were necessary ingredients to move them towards adoption (for those who are not using technology) and toward adaptation (for those who had started using technology).

Related Issues from Findings

Together with the discussion focusing on the research sub-questions, it was necessary to discuss other issues that have a bearing on the nature of technology integration at the university, which emerged in the course of collecting data in response to interview questions.

Perceptions and Attitudes of Teachers and Students about Using Technology

The researcher has used the metaphor of a field game to elaborate on technology integration programs. Teachers and students are "in-field players" of technology integration programs (a game). Some of the "ingredients" for winning a game are how players perceive the importance of the game and their willingness and determination to

win (This is not to discount their skills of the game). So is the process of technology integration. The attitudes and perceptions of the teachers and students in executing technology integration is part of the success story of the process. Leak and Pachler (1999) say that the attitudes of the teachers toward technology is very important in determining how much teachers are willing to learn and use computers with their students. Teachers should be enthusiastic about using technology, and students should be excited about their level of accomplishment in using computers. The building of positive attitudes begins with the realization of the value of using computers. For example, teachers should realize how the use of technology could reduce the stress of facilitating the process of learning. Vankatesh, Morris, and Ackerman (2000) argue that a person's perception about the usefulness of technology or its relative advantage is the most important consideration in determining the behavior of adopting or accepting new technology. Teachers should be helped and be motivated to experience how they can benefit from the technology. Studies have found the presence of the relationship between attitudes toward computer and computer utilization. A survey by Al-Khaldi and Al-Jabri (1998) among Saudi Arabian undergraduates found a significant relationship between attitudes and computer utilization. Their findings indicated that computer liking and computer competence were the strongest predictors of computer utilization.

Teachers and students should be motivated about the use of technology by relating it with their personal benefits in real-life situations. Apart from learning advantages, the knowledge and skills of computers may be related to job market. In many jobs in Tanzania, computer literacy is an added advantage for one to be absorbed in a job.

This may be stressed in encouraging and motivating students to use computers. Realizing the motivational aspect to encourage teachers to use computers in teaching, the university ICT policy has included a provision that ought to motivate teachers. It says: “The university shall review the scheme of service of ICT staff with a view to putting in place an attractive remuneration package” (p. xiii).

The study inferred from the interviews that students and teachers showed positive attitudes toward technology integration. The teachers were ardent when they talked about how they used computers in teaching. It should be kept in mind that in Tanzania, it constitutes prestige to indicate that you have knowledge of computers. During the telephone interview, one science teacher (TS2) expended much time explaining how he used the computer in his lessons. That kind of passion was offset by the expression of blame placed on the administration for the shortage of computers. Some statements signaled despair about that shortage. For instance, one respondent (HS1) said, “You know how things go here,” in talking about what efforts were done to alleviate the acute shortage of technologies. The statement meant not much on the surface, but the respondent knew that the researcher came from Tanzania, and he was implying that it is a common situation and anyone who has lived in Tanzania would understand the situation. In their context, I believe, it pointed to the administration’s laxity and irresponsibility. The researcher felt that there was a coordination gap between the implementers and the administration in executing technology integration at the university and that there should be a common understanding, a commitment, and a shared vision and mission. The finding that teachers did not know about the university ICT policy was an excellent indication of

the presence of that gap. The administration should work closely with the teachers and students to keep them motivated with positive attitudes.

The findings in the context of the Tanzania Development Vision 2025

The Vision 2025 is the major reference point upon which educational and development policies in Tanzania are based. The national ICT policy, the higher education policy, University of Dar-es-Salaam ICT Policy, and ICT policy for basic education all have based their philosophical underpinnings on the Vision 2025. In the Vision 2025, the clause 'well-educated society' is one of the five attributes of the policy and this is a point of reference on educational matter.

As was indicated in the justification of the research, the policy suggests that 'education is seen as a strategic change agent for mindset transformation.' Therefore, it projects that Tanzania should brace itself to attain a high level of quality of education in order to respond to development challenges. From the implication of the policy, Tanzania sees the importance of higher education in taking a leading role in implementing the policy goals. In that regard, the University of Dar-es-Salaam would take a center stage in that endeavor. So the question in regard to this study is, if the university, with the nature of technology practices available now, is ready to take that role. The findings suggest that the university has not yet acquired the technological status to address the requirement of the Vision 2025. What is seen is the reflection of the challenges that are prominent in a lot of social and economic sectors in Tanzania such that implementation becomes an 'ever-flying' goal; it is never perfectly attained. There have been well-drafted policies delineating impressive statements of intentions, but their

implementation has been subtle. Nonetheless, the existence of the policy is not the guarantee that things will progress. Weston (2003) argues that plans made during the early stages of policymaking or program design rarely translate into reality by policymakers and developers. He writes that policies succeed or fail not because of organizational and structural factors but because of individuals, and that who are responsible for implementing the programs do not always do as they are told, instead responding in idiosyncratic, frustrating, unpredictable, if not downright, resistant ways to the efforts of administrators. This might be the case with the university because the adoption of technology in education is relatively new. The university has committed to implement what the Tanzania Development Vision 2025 addresses and created the UDSM ICT policy. However, what is done in practice does not always reflect the commitment stated on paper. This is the challenge that the university and the other institutions of higher education in Tanzania have to address by 2025 or otherwise the Vision 2025 will be elusive.

Nevertheless, observing the situation in the broader spectrum, there is a situation, as pointed out earlier, which is haunting many African and other developing countries regarding the failure to implement technology policies. One of the major causes is the economic decline in many countries. When it comes to education, these economies fail to support the institutions. For instance, for the major problem of shortage of technology equipment, it is clear that the economies are unable to support the supply of educational materials in those institutions.

The findings reflect the observations by Sife, et al. (2007). In their article, they observe that the ICTs have not permeated to a great extent in many higher learning institutions in Tanzania and in many other developing countries because the socio-economic and technological circumstances. They observe that institutions of higher education in Tanzania still face many challenges in undertaking the ICT integration process despite achievements they have realized. They say the challenges include a lack of a systems approach to learning; awareness of and attitudes to ICTs; administrative and technical support; staff development; lack of ownership; inadequate funds; and the difficulty of transforming higher education.

In the context of Tanzania Development Vision 2025, the University of Dar-es-Salaam still faces many challenges in its role of leader in creating an "educated society" as indicated in the Vision 2025. Facing those challenges may require efforts from outside the university.

Recommendations

The development of ICT and technology integration in education is a new experience in the world, but it has swept the world in tremendous ways. It has presented itself as a necessary undertaking given the fact that our lives are now driven and dictated by technology. It is an endeavor that we have no choice but to venture into. Tanzania, like many other countries in the world, acknowledges that fact and has taken initiatives to address it. For Tanzania, one thing that appears to stand out in regard to its Development Vision 2025 is that the policy's main mission of poverty alleviation will be achieved by depending greatly on how Tanzania exploits the use of technology in all

sectors. The process is challenging and there are things that change agents such as the University of Dar-es-Salaam have little control over. The researcher believes that there are many things that the university has control over and therefore can implement without needing resources. The researcher recommends the following in the light of the findings of this study:

1. Teachers' training/induction programs. The emphasis on training of university teachers to acquire computer knowledge should be given more priority. The training should focus on teachers gaining computer knowledge and teachers should be made aware of the policies regarding or related to what they are doing. It seemed that many teachers were not even aware that there are policies regarding technology. For those who were aware, they did not know the content of the policy that guided the use of technology. It suggests that they were using technology without being informed of what the policy says about using technology implementation. The training should also focus on giving teachers methodological skills of using computers.
2. Policies are necessary but they are too abstract to implement. So the university should create technology plans as the more practical guidelines for the implementation process. The technology plans may be created in respective faculties or departments but should be coordinated to avoid a disjointed integration program. Teachers should be part of the teams to create plans because they are the implementers.

3. Creation of an ICT committee that will specifically follow up issues of technology in teaching, such as creating technology plans and evaluations of technology implementation, research on the market, and adoption of relevant technology. The role of the committee should be to oversee the harnessing of ICTs available in Tanzania in teaching and learning at the university.

4. Sife et al. (2007) have indicated that institutions of higher education should diversify sources of funds to have a wide financial base. The issue of shortage of technology equipment, especially computers, posed a tremendous problem. Given the fact that technology is very expensive and, as pointed out earlier, the government cannot fully support the universities, the universities should seek ways to complement what funds they do receive from the government. Dependency on foreign donors has its limits and conditions that may not be favorable to the institutions. In that regard, the researcher recommends the establishment of partnerships with local people and organizations, who are also stakeholders. These partners may include parents, alumni, business companies, Governmental Organizations (GOs), and Nongovernmental Organizations (NGOs). In some cases, the partnership may be done in exchange for expertise of the university. In line with this, the university may establish the technology fund, and the technology committee may find ways of mobilizing the general public to contribute to this fund or organize fundraising events. Priority should be given to the acquisition of more computers and teachers' professional development programs.

Implications for Future Research

The research focused on examining and assessing the implementation of technology integration at the University of Dar-es-Salaam. This study has implications for the implementation process and the organizing and planning of technology. The study implied the necessity of strong leadership in implementation of technology integration in higher education institutions and even government education bodies in Tanzania, such as the Ministry of Education. Future studies examining and assessing the nature of technology integration could look at other factors such as the planning process, the acquisition and maintenance of technology equipment, and the budget for technology integration. In terms of methods, this study used telephone interview as one of the methods. Similar research may be done by physical presence in the field, and that would provide more concrete evidence of what the process of technology integration at the university looks like.

Conclusion

In conclusion, this study examined and assessed the nature of the implementation of technology integration at the University of Dar-es-Salaam. The findings were brought into perspective with the existing literature regarding the use of technology in education. Ely's eight conditions of technology innovations, ACOT Stages of Development model, and the planning concepts were used to evaluate the nature of technology innovation at the university. Success and challenges in implementation of technology integration were identified. Challenges included acute shortage of technology equipment, such as computers, projectors, and screens; absence of technology plans; a low level of computer

knowledge and skills among teachers and students; lack of effective teacher development programs on technology; and lack of effective leadership practices regarding the use of technology in teaching and learning. The overall implication of the findings was that the university community was aware of the benefits of integrating technology into teaching and learning, and there were processes in place to do that among teachers and students; but there were a lot of impediments within the system that barred the processes from being effective.

This study contributed to the understanding of the nature of technology integration at one of the institutions of higher education in Tanzania. The researcher hopes that the knowledge gained may be used to assess and bring about changes in how technology may be implemented beneficially for teaching and learning in higher education institutions. The study also contributed to the body of literature about technology use in education in Tanzania.

Lastly, since the researcher started to pursue this study, there have been events in Tanzania that are worth mentioning because they have some implications for the use of technology in education in the country. The first is the establishment of the University of Technology -- Dodoma University of Technology. Established in September 2007, this is the first university to focus more on technology. Second, in 2006, Tanzania signed an agreement with Microsoft for technology support. The agreement may help in acquiring equipment for various sectors, including education. The Microsoft head was among the donors who funded the establishment of the University of Dodoma (UDOM). Third, the Ministry of Education enacted an ICT policy for Basic Education in 2007. The

implementation of this policy will probably address the suggestions raised by respondents for the government to emphasize technology integration in pre-tertiary education. All these are indicative of a promising trend in equipping Tanzanian society with technology.

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Appendix A: IRB Letter from Ohio University

OHIO
UNIVERSITY
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06E198

Office of Research Compliance
Research and Technology
Center 117
Athens OH 45701-2979

T: 740.593.0664
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A determination has been made that the following research study is exempt from IRB review because it involves:

Category 1 - research conducted in established or commonly accepted educational settings, involving normal educational practices

Category: 2 research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens if publicly available or recorded without identifiers

Project Title: Implementation of Technology Integration in Higher Education: A Case Study of the University of Dar-Es-Salaam in Tanzania

Project Director: Laxford W. Kajuna

Faculty Advisor (if applicable): Teresa Franklin

Department: Educational Studies

Rebecca Cale

Rebecca Cale, Assoc. Director, Research Compliance
Institutional Review Board

10/6/06
Date

Appendix B: Guidelines to Sampling Respondents

The following are the guidelines for sampling respondents. Please try to vary and/or balance the aspects or criteria for choosing students and instructors as indicated in respective categories.

1. The heads of Faculty of Education and Science. These will be expected to give information about their respective faculties particularly at the administrative aspects like policies and planning. Choose the faculty dean. If the faculty dean is not available or difficulty to get them, find any Head of Department.
2. Ten instructors from Education and Science faculties. (Five from each faculty). With the help of faculty heads these will be selected considering years experience in teaching, subject taught, gender, academic status (including level of education) and availability. Try to balance in terms of course taught. i.e. minimize taking faculty member who teach the same subject
3. Twenty-four undergraduate students from Education and Science faculties. These will be selected following these criteria; year of study, gender, course of study. On the year of study, only students on the third and fourth years will be selected. Also try to balance in terms of aspect above; years of study, academic subjects, faculties.

Appendix C: Telephone Interview Transcript (sample) Faculty Member

Interviewer (**Lx**), Interviewee (**Mb**)

(**Lx**): Dr. Mbofu thank you for your time and thank you for accepting to participate in my research interview. –Aah In which department are you? I mean department and faculty?

Dr. Mbofu (**Mb**): yeah (faint)

Lx: Hello, In which department are you?

Mb: Chemistry Department

Lx: and which courses are you teaching?

Mb: I am teaching Chemistry – ah Physical chemistry

Lx: Yes

Mb: and some courses about research which are not in Chemistry department

Lx: Ok thank you. What is your experience?

Mb: My experience is ah.. I started teaching in 1994 – then as a teaching assistant then I became a lecturer in 1998

Lx: So I would say it is 12 years 12-14 years? So the other question

Mb: Hallo

Lx: So I said your experience is 12-14 years eh do you hear me?

Mb: I don't hear you!

Lx: I said so the experience is around 14 years/

Mb: Yes, Yes!

Lx: ok, right. Now the questions – What is technology integration

Mb: You said technology integration?

Lx: Yes

Mb: At the university or on my side?

Lx: What do you understand by the term technology integration?

Mb: The term technology integration?

Lx: Yes

Mb: Well, I think it is the use of technology in teaching and learning

Lx: Okay, What do you consider to be the benefits of using technology in learning and teaching?

Mb: oh! You mean the advantages?

Lx: Yes

Mb: One is that if you are teaching and the ideas are not proving to be clear you can repeat it ---- while you are using the other technologies like chalk you can not repeat it once you have rubbed the board. So that is one advantage. The other ones also it is possible for students to access information as long as the information required is available. These are some of the advantages

Lx: Do you believe that computers are great tools…….hallo…..Can you hear me? Hallo…!

Mb: I can hear you now

(*long silence*) stops interview for a while!

Lx: hallo

Mb: Hallo, okay now it is clear

Lx: hallo, the question I was asking was how much computer knowledge do you have?

Mb: Ah ok on my part?

Lx: Yes

Mb: Just basic computer knowledge real.. only software that are used for teaching like power point, Excel and Microsoft Word – not very competent with computer-basic use of it.

Lx; Do you use technology in teaching?

Mb: Oh Yes! Very much so

Lx: Uhm, How do you use it?

Mb: I use it…ah… First of all I use it in preparing the notes but also I use technology in the process of teaching. I use it in giving of lectures. I use PowerPoint and Excel

Lx: So Do you believe that computers are great tools to improve the quality of learning and teaching?

Mb: Ah, The quality of learning? Yes but in a way no depending on how the technology is used. If you use technology….. but the materials are not available….. It is

acceptable by students then the technology will be useful because the students can pick what they have been taught and that is what I normally do.

Lx: So on your side does the use of technology make your teaching easier, manageable, time consuming or difficult? Which one do you think applies?

Mb: Well… (laughs) It has... the teaching itself becomes easier and manageable but the process of reaching at that point is somehow time consuming because you need to write, you need to…. Edit what you write …. but having done that, the teaching process becomes easier. The whole process is time consuming. The teaching itself becomes easier. The teaching is now using technology- you have everything

Lx: Okay do you have enough computers at the university or in the faculty for students to use and are they accessible?

Mb: Ah that is the problem. We don't have enough computers. They are not enough computers compared to the number of students. However, some of the students have their own computers but in terms of the university they are not enough.

Lx: okay. So what percentage of student's accessibility do you have to the computers?

Mb: What?

Lx: what percentage of accessibility do students have on computers?

Mb: That I don't know. I will be cheating if I say that percentage but what I can say is that a good number of students don't have access to computers. They have access but they don't have time – the number of computers is not adequate. Most students don't have access to use computers all the time they need them.

Lx: So what strategies do you use to enable students use computers as part of your teaching process?

Mb: The University has the system whereby students can access materials online. The students can access that so long as they have password to access to materials …… But also in the computer center

Lx: okay, Does the university or the faculty have what we call technology plan? Or if not the plan…….

Mb: The technology plan is the University-wise plan and this is under the computing center of the university. It has what we call the University ICT policy. But I don't have the details of the policy itself but I know it is there.

Lx: So there is no specifics for the faculty, it is generally for the university.

Mb: Yes, something like that

Lx: Okay, So you don't have access to the content to the policy itself?

Mb: No, I don't

Lx: Okay

Mb: Yes, I am aware of the existence of the policy itself but I can't give you the details of the policy because that is in another department- the computing center- not in this faculty…… So there the policy but I don't have the details.

Lx: So it is not at the level of the department, I would say.

Mb: Not at the level of the department, the whole issues are decided by the university. The administration of the university of Dar-Es-Salaam is centralized in a way. It is the top-bottom approach, if you like that term. So everything is decided from top administration downward.

Lx: Are there any teacher development programs for technology integration? Meaning that are there set programs which would enable teachers get some knowledge and skills for using technology as part of knowledge itself and /or methodology?

Mb: Oh Yes there are. The most….. there is the center which is called continuing education center whereby in this center such courses are offered but myself I haven't taken part in one but most members of my department have been invited to participate to learn how to use technology in teaching. So they are available- Yes.

Lx: So, is this obligatory- that everyone should attend in these courses?

Mb: Ehm, I am not sure that should be in the policy. So I have no clue but what I normally see is that a good number of lecturers get letters to attend the courses. So being obligatory or by choice I have no clue.

Lx: Okay. So the letters come from the head of department? Right?

Mb: Hallo

Lx: The letters come from the faculty dean?

Mb: Hallo……. I can hear you now.

Lx: I said, so the letters come from the faculty dean right?

Mb: Pardon?

Lx: Do letters to attend these courses come from the faculty dean?

Mb: Yes, but also the faculty dean receives information from the university administration.

Lx: Okay, What are the challenges that you experience or from the perspective of other teachers that they experience in teaching using technology?

Mb: The challenges are many, one is the computers themselves, that are used in teaching they are not enough. That means the…….. but also the gadgets which are needed for teaching process. And also some of the gadgets that are available are somehow underutilized because the fact that some of the lecturers don't use technology because either they don't have the knowledge or they don't have the computers to prepare the materials but also there is a lack of seriousness in maintenance or the upkeep of these technologies because some of the technologies are advanced and are not maintained so you find some of the computers which are installed are not working and so that is a problem. But also the problem that is rampant in poor countries, the power cut. So if you have had prepared to teach but you end up ….. because…… and that is a challenge but also

Lx: I have one minute, what is your suggestions on the learning and teaching using technology? - I will send you this question on your mail can I have you email address? (Faint).

Appendix D: Telephone Interview Transcript (Sample)

Head of Department

Interviewer (**Lx**), Interviewee (**M**)

Lx: Hallo, thank you for you time to participate in this interview

M: Thanks

Lx: You said your department is…?

M: Chemistry

Lx: What is your position?

M: Lecturer.-Head of department

Lx: Academic qualification?

M: PHD

Lx: Years of experience?

M: As a lecturer? Three years.

Lx: Now the questions. What do you understand by technology integration?

M: I think it is the use of technology to achieve/to do certain task basically

Lx: So what are the benefits of learning using technology?

M: You mean as teaching is concerned or you mean generally?

Lx: This is a focus on education basically on learning and teaching

M: Yes, as far as teaching is concerned, it makes teaching easier, makes students grasp ideas better or quicker because they see things graphically. It makes the teaching of content much better actually. These are some of the benefits actually.

Lx: Okay, Does the faculty or the university have technology plans for different courses?

M: The faculty does not as such. It depends on the individual concerned what they think they can use technology to achieve certain things- but otherwise the faculty does not have a policy to require somebody to teach using technology in teaching.

Lx: Is there any educational policy at the college or national level underlying the use of technology in learning and teaching/

M: Policy? No not to the best of my knowledge. The teacher may adopt anything that they think will help them in teaching. But otherwise there is no anything as a policy to say teacher can use technology on this or that

Lx: Okay, what technologies are available for faculty members and students and if they are there are they enough and accessible?

M: We have a few, like we have video. Actually we don't use it so much, computers to present lecturers and may be those two. Also audio is use much but also sometimes we can have audio and video hooked in a computer.

Lx: What are the strategies for acquisition of technology?

M: You mean by faculty of education?

Lx: Yes

M: As far as the faculty is concerned, maybe they are only trying to buy more computers laptops for lectures for presentation in classrooms, get more projectors more than that they don't have plans of acquiring something. I know they are making efforts to buy more computers maybe projectors.

Lx: Are there any strategies that the faculty/ or the department have to ensure that technology is integrated in teaching or learning? The strategies that the faculty does deliberately to ensure the teachers integrate technology in their teaching?

M: There are no such strategies. I haven't come across any of that maybe because they are providing laptops and computers there are no such strategies.

Lx: What are the theories of learning that are considered in creating technology plan? Anyway this will be irrelevant because you said there were no technology plans. So we gonna skip that.

Lx: Are there any teacher development programs for technology integration?

M: Teacher development for technology integration?

Lx: Teacher development programs. By this I mean like if teachers are awarded opportunities to go to learn more about technology integration- like sandwiched courses?

M: No, there are not there. Actually it is done out of individual efforts to acquire basic computer knowledge. There are no any courses as such, there is nothing like that!

Lx: Ok, are there evaluation strategies or procedures for the faculty to ensure that teachers use technology in learning?

M. Because in the faculty we don't have a policy as such, so we do not have any evaluation strategies to check that lecturers are using technology.

Lx: Ok, and what are the challenges and problems that the faculty/or departments are facing in integrating technology in teaching and learning?

M: Mainly is the availability of computers, projectors and also the internet are so slow, you cant use technology, sometimes you cannot use technology in the speed you want

Lx: Okay what are the future strategies or recommendations that you have for improving technology integration?

M: First of all, I think leadership could make efforts to come up with a policy and if they can train teachers at least for technology- on how to use them and then maybe to direct more funds to acquire more technology.

Lx: What are other recommendations for technology integration in higher education as such either at the university of Dar-Es-Salaam or higher education in Tanzania- the recommendations you have about that?

M: technology integration should be part (imposed)/or instituted from primary schools up to higher level – of course it will make learning easy. The whole system of education should adopt technology integration I suggest that the whole system should adopt technology

Lx Thank you so much Dr for your time**.** I appreciate that

Appendix E: Permission Letter for Research to UDSM

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College of Education

Educational Studies
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Chief Administrative Officer
University of Dar-Es-Salaam
P.O. Box 35091
Dar-Es-Salaam
Tanzania

June 6, 2007

RE: Request to Undertake Research at Dar-Es-Salaam University

I am writing to request permission to conduct research at your institution. The research is part of the requirements of my Ph.D. dissertation in Instructional Technology. I am currently a Ph.D. student at Ohio University in Athens, Ohio, USA. I am a citizen of Tanzania.

My research focuses on the implementation of the use of technology in teaching in higher education in Tanzania. This research uses a case study approach in which the University of Dar-Es-Salaam is the case to be studied. The research will involve the faculties of Education and Science. The subjects will be the Chief Academic Officer, the heads of faculties, instructors and undergraduate students. With this letter, I have attached an IRB form approved by Ohio University which allows me to conduct research with human subjects.

Should you have any questions, contact Dr. Teresa Franklin, Associate Professor, Instructional Technology, College of Education, Ohio University at franklit@ohio.edu or call 740-593-4561.

I thank your for your cooperation.

Sincerely,

Laxford Kajuna

CC: Dr. Teresa Franklin, Dissertation Advisor

Appendix F: Interview Questions for Students

a. Demographic Information

Course……

Major……

Year……

b. Questions

a. How would you describe or define technology integration?

b. Do you use technology in your day-to-day work for learning?

c. If you do not have access to technology, do you think you would improve your learning by having access? Why?

d. What type of technology do you use in you learning?

e. Are there enough computers in class/lab/university for students use?

f. Are the computers accessible at the time you need them for schoolwork?

g. Do you use computers to search for information related to school work?

h. What software do you use?

i. How much computer knowledge do you have?

j. What strategies do your teachers use to enable you to learn by using technology?

k. Do teachers give you assignments that require that you use technology to complete them? If yes describe the assignments?

l. What are your ideas and suggestions about the use of technology in learning and teaching at the university?

Thank you for your Time

Appendix G: Interview Questions for Faculty

Demographic Information

1. Department/Faculty……

2. Course Teaching…….

3. Experience……..

4. Highest degree……..

Questions

1. What is technology Integration?
2. What are the benefits of using technology in learning/teaching?
3. Do you use technology in teaching?
4. What type of technology do you use in teaching?
5. Do you believe that computers are great tools to improve the quality of learning? Explain.
6. What and How much computer experience do you have? (Identify yourself as novice, intermediate or expert user of computer)
7. List down the functions with which you use computer as an instructor? As a general computer user?

Check all that apply

In preparing and implementing your lesson, do you use the following types of technology?

___ Word ___ Excel

___ Internet ___ e-mail

___ PowerPoint ___ gradebook

___ video/audio ___ CDRom

8. Does using technology make your teaching;

i. easier?

ii manageable?

iii. Time consuming?

iv. Difficult?

9. Are there enough computers in class/lab/university for students use?

10 Are students accessible to computers all time they need them?

11. Do you assign students to use computers to search for knowledge or finish their assignments

12. What strategies do you use to enable you or your students learn using technology?

13. Does the faculty/department have a technology plan/? If yes, how does that plan help you in preparing and implementing technology integration? What strategies do you use to do that?

14. What are the content of the technology Plan? Who participates in preparing the plans?

15. Does the faculty/department have guidelines for technology integration in classes?

16. Are there teacher development programs for technology integration? Have you attended any? How do they help you improve your teaching with technology?

17. Are there technology standards to be met by students in their learning?

18. What are the challenges do you experience (or other teachers at the University) in teaching using technology?
19. What would you suggest to be done so as to improve the learning using technology at the University of Dar-Es-Salaam?

Thank you for your time

Appendix H: Interview Questions for Head of Faculty/Department

a. Demographic Information

1. Department/faculty…….
2. Your position…….
3. Academic qualification…….
4. Years at the University (as faculty)…….

b. Questions

1. What is technology integration?
2. What are the benefits of learning/teaching using technology?
3. Does the faculty/Department have technology plans for different courses?
4. If yes, who creates the plans and what are the processes of creating technology plans?
5. Is there any educational policy at the University or national level underlying the use of technology in learning/teaching?
6. What technologies are available for faculty members and students? Are they enough and accessible?
7. What are the strategies for acquisition of technology? And more integrating technology in teaching/learning in the faculty/department?
8. What strategies does the faculty or department have to ensure that technology is integrated in teaching and learning?
9. What theories of learning are considered in creating technology plans or strategies for learning using technology?

10. Are there teacher development programs for technology integration?
11. What are the evaluation strategies or procedures the faculty has for the use of technology in learning/teaching?
12. How is the technology integration policies and procedures of the faculty/department linked with that of the university?
13. What are the challenges and problems that the faculty/department face in trying to integrate technology in teaching/learning?
14. What are the future strategies or recommendation for improving technology integration hence improving learning at the faculty level?
15. Other comments/Ideas about technology integration in higher education?

Thank you for your time

Appendix I: The Documents used in Document Analysis

Follow the URL to retrieve the document.

1. Information and Communication Technology (ICT) policy for basic education, http://www.moe.go.tz/pdf/ICT%20Policy%20for%20Basic%20Education.pdf
2. National Information and Communication Technology policy of 2003. http://www.tanzatrade.co.uk/policies/ictpolicy2003.pdf
3. University of Dar-Es-Salaam Website http://www.udsm.ac.tz/
4. University of Dar-Es-Salaam Information and Communication Technology Policy. This document could not be found online. The researcher obtained it from the office of the Directorate of Planning and Development of the University of Dar-Es-Salaam through the research Assistant who is the member of the university staff.