



UNIVERSITY OF NAIROBI

SCHOOL OF COMPUTING & INFORMATICS

**AN EVALUATION FRAMEWORK FOR THE USE OF ICT TECHNOLOGIES TO
TEACH IN KENYAN UNIVERSITIES: THE CASE OF MULTIMEDIA
UNIVERSITY OF KENYA**

BY

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Science in Information Systems

DECLARATION

I, the undersigned, hereby declare that this research project is my original work and that it has not been presented to any other university for award of any academic qualification.

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ABSTRACT

The extant literature on pedagogical development using ICT technologies is dominated by conceptual analysis, descriptive studies of current practice, critiques of current practice, and prescriptions for better ways to approach practice. The aim of this paper is to create and validate a framework for an interpretive evaluation of the feasibility and extant of application of ICT technologies as tools for teaching in Kenyan universities. A detailed overhaul of two techniques for learning technology evaluation and three evaluation frameworks are discussed, a proposed holistic framework used as an evaluation tool for the use of computer learning technologies in Kenyan universities. The evaluation framework was confirmed by conducting a confirmatory factor analysis using LISREL statistical package so as to ascertain the model fitness vis a vis the data collected. The research design was mainly quantitative involving the use of questionnaires and a few qualitative aspects from interviews which were filled by different university education stake holders regarding the use of computer learning technologies as a learning technology and their response analyzed both quantitatively using SPSS statistical package and qualitatively for a comprehensive study of the subject matter. Multimedia university of Kenya students, instructors, administrative staff and technical laboratory staff were sampled and stratified randomly and used as a case in the scope of this study. To test the hypothesis, correlation coefficients were found, hypothesis tested and coefficient of determination calculated for explanation purposes. Results of this study shows that the use of computer learning technologies improves the learning experience, and has a positive output. However, the process of integration of such technologies is not fully exploited as shown within the Context factor. The study recommends further research on various specific learning technologies such as computer simulations and computer games. Also, the development of effective policies which will offer stakeholders, university administrators and lecturers a platform for effective integration of learning technologies within the curriculum.

Keywords

Computer learning technologies, Pedagogy, ICT technologies, learning technology, LISREL,
SEM

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ABBREVIATIONS

CAL – Computer aided learning

CAI – Computer aided instructions

TILT - Teaching with Independent Learning Technologies

LISREL - Linear Structural Relations

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The emergence of new technologies and the widespread use of computer technology in education have offered an opportunity for learning institutions to benefit by deploying and using learning technologies to improve the learning process. There is a general consensus among scholars and researchers that information and communication technologies (ICT) are transforming various aspects of human activity (World Bank, 2004). Learning institutions realize the fact that education is their key output, any technologies used or incorporated should be geared towards fostering a better level of education in an affordable and effective manner. Institutions of higher learning are in the fore front of embracing learning technologies in a bid to benefit fully from them. Also, at higher levels of education, students are required to develop critical skills at a higher cognitive level compared to primary and secondary education. Recently, there have been calls for educational reforms to improve the quality of education to adequately prepare students in the work place (Kafu, 2011). The Kenyan ministry of education as a result developed the Sessional paper no 1. of 2005. The Kenyan government shows its appreciation and recognizes the fact that ICT has a critical role to play in helping education deliver its mandate.

Consequently, the availability of ICT facilities over the past few years have increased substantially in most learning institutions in Kenya (Kinuthia 2009). A wide variety of educational teaching and learning techniques are available for instructors in a learning environment. Almost all typical face to face learning can now be replicated or aided by use of technology, however, some of the techniques can only be represented in a limited manner. Teaching and learning techniques can be enhanced through technology either by presenting alternative approaches to learning (Aldrich, 2004; Gibson, 2004).

Through the use of technology aids, creating a new understanding of the concepts and knowledge is improved tremendously (Lasater, 2007; Lyon & Milton 1999). Learning by simulations and games enhances the acquisition of new knowledge and skills, according to

Whelan (2005), ICT technologies translate into acquisition of new knowledge, transfer of learning and development of intellectual skills (including abstraction, problem solving and anticipation) and the development of behavior and attitudes. Technology use makes the learners active as it supports constructivism in the learning process. The use of computer simulation tasks to enhance learning in the science classroom either before or after completion of a didactic unit of instruction have become the focus of most recent research studies (Akpan, 2001; Brant, Hooper, and Sugrue, 1991). Works by most researchers done especially in developed countries show that computer simulations improve student understanding and applicability of learnt concepts. Again, most researchers focus on use of computer simulation to aid students in perceiving real life environment as a tool to help them understand better before the actual experiment or before being subjected to the actual real phenomena. An observation and experience of the real world in a learning environment can be recreated by use of computer simulations (Sahin, 2006).

Regardless of all this evident advantages of technology use in education, especially the use of simulations to foster student understanding and intellect levels, there is a minimal integration of such technologies in education. Migwi (2009), In spite of the developments in learning technologies, there is a growing concern among scholars and researchers that the rate at which these technologies are transferred and integrated into the teaching and learning process is slow. Many instructors still hold on to the traditional instructional method which perceives the learners as passive. In order to understand the existing levels, extents and factors surrounding the use of computer simulation as a learning technology, an evaluation of the same is key. In a learning-led educational context, the effectiveness of teaching, whether by an instructor or through interaction with the media can be readily evaluated by the degree to which it contributes to learning (Barry, 2000). According to Barry, an innovation may be judged as “fit for purpose” while the fitness of the purpose itself is questionable. It is important therefore to be as explicit as possible about the starting assumptions, in order that the evaluation of design and implementation can be useful. The match between the outcomes and intentions provide a measure of success of any invention. This study therefore intends to carry out an interpretive evaluation on the use of ICT technologies to teach in institutions of higher learning. There are different approaches and frameworks created for evaluation of learning technologies as will be discussed in the literature

review. An interpretive evaluation offers a wider scope of understanding the technology in its context and all the stake holders involved (instructors, faculties, subject matter and the students) so as to present a broad understanding of any loop holes, predicaments and implications with their possible solutions for action. The study will be carried out at Multimedia university of Kenya.

1.1.1 Use of ICT learning technologies to teach in higher education

The integration of ICT in higher education is 'inevitable' (James & Hopkinson, 2009). ICT has changed the way businesses and industries are conducted and influenced the way people work, interact and function in society (Bhattacharya & Sharma, 2007; UNESCO, 2002). ICT has become common place at home, at work, and in educational institutions (Kirkup & Kirkwood, 2005). The use of ICT, including the Internet at home and work places, has increased exponentially (McGorry, 2002).

As is the trend globally, countries in Africa are increasingly relying on ICT to address various issues including those related to higher education, in the face of depleting natural resources and the need to ensure sustainable development. Education drives the economic and social development in any country (Mehta & Kalra, 2006). Higher education in developing countries serving as repositories of knowledge and human capital has to innovate and overcome the various issues confronting it, and to contribute to the economic development in times of such economic declines (Postiglione, 2009). Furthermore, the rapid rate at which new technologies change and develop also implies that higher education systems must keep pace with advancements in knowledge and skills, in addition to the demands and requirements for employees to stay relevant. It is crucial that universities in the region equip their students with the appropriate knowledge, skills and aptitudes to be competitive in an increasingly global and competitive economy.

Although the use of ICT is not the panacea for all the challenges faced by higher education systems in the region, it does leverage and extend traditional teaching and learning activities, and has the potential to positively impact on learning (Jaffer, Ng'ambi & Czerniewicz, 2007). Furthermore, ICT is becoming increasingly ubiquitous within higher education, and it has been

used far beyond enhancing teaching and learning to include promoting research, scholarly community engagement, and administration (Balasubramaniam et al., 2009; Jaffer et al., 2007).

An evaluation of any learning technology is an important aspect so as to determine its acceptability, compatibility and impact to the overall goal- education. This study therefore offers a holistic framework for an illuminative evaluation of the use of computer simulation to teach in university level. There is quite a range of simulation softwares available for use in different contexts. As discussed in the background of the study, however, many instructors, faculties and students have not embraced such too (Migwi 2009).

1.2 Problem Statement

While there are well-known and significant positive implications for the use of ICT technologies in education, the incorporation and use of such technologies in Kenyan universities is still on the low. Teacher educators in institutions of higher learning with Bachelor's degrees and Master's degrees are in the low levels of ICT integration 72.1% and 63.1% as compared to their Diploma counterparts who have a high number in the high level of integration of 35.7% (Chemwei et al, 2014). The concept of learning technologies is interdisciplinary in that it seeks to combine and explore the interconnections between new and different approaches from different fields and specializations, it tries to respect the multiplicity of differences that can separate one research approach from another (Freisen, 2009).

There is no documented evidence indicating the level of integration of ICTs in instructions especially in colleges (Chemwei et al, 2014). This study therefore comes up with a holistic evaluation model and uses it to conduct an interpretive evaluation to reveal the extents and factors surrounding the use of computer learning technologies and suggest additional strategies for enhancing optimal integration of computer learning technologies in Kenyan universities.

1.3 Research Objectives

The study's general objective is to develop a holistic framework by building on two existing frameworks for an interpretive evaluation of the use of computer technologies for teaching in institutions of higher learning in Kenya. A holistic framework will assess and evaluate all major stakeholders, the study's specific objectives will include:

- i) To develop an evaluation framework for the use of computer learning technologies to teach in Kenyan universities
- ii) To investigate the effects/ impact on the use of using computer learning technologies to teach on students learning and understanding in Kenyan universities
- iii) To determine the factors surrounding the use of computer learning technologies to teach in Kenyan universities
- iv) To investigate the effects of outcomes brought about by the use of learning technologies to teach in Kenyan universities

1.4 Hypothesis of the Study

The following null hypotheses were used as a guide for the study:

- i) H1: There is no relationship between student motivation/understanding and the adoption of computer learning technologies in teaching.
- ii) H1: There is no relationship between institutional financial support and the adoption of computer learning technologies in teaching.
- iii) H2: There is no relationship between policies and evaluation and the adoption of computer learning technologies in teaching
- iv) H3: There is no relationship between the use of computer learning technologies and the cost/expense incurred by learning institutions
- v) H4: There is no relationship between the use of computer learning technologies and the time spent in teaching
- vi) H5: There is no relationship between availability of computer learning technologies (resources) and the adoption of such technologies in teaching.

1.5 Research Questions

In order to achieve the study's general and specific objectives, the study will answer the following research questions:

- i) How does the use of computer learning technologies affect students learning and understanding in Kenyan universities?
- ii) How does the learning environment (milieu) impact on the use of computer learning technologies in Kenyan universities?

- iii) How does the feedback/outcome of the use of learning technologies impact on the implementation and improvement of such technologies?
- iv) How do university administrative and management factors affect the use of computers as a learning technology in Kenyan universities?

1.6 Significance of the Study

The study is of significance to the following stakeholders: Kenyan universities in gathering data/information relating to the role of Computer technologies in teaching and its impact on the level of education in Kenya. Findings of this study will create awareness to students, universities faculties and administration on existing levels of computer learning technologies as a learning tool. Curriculum planners and organizers will also be exposed to best approaches of integrating computer technologies in their contexts and content.

1.7 Scope of the Study

The study was confined to students, technical laboratory staff, administrative staff and instructors currently at Multimedia university of Kenya.

1.8 Limitations of the Study

The study was conducted within one Kenyan University that is representative of all Kenyan universities in terms of level of computer technology and ICT use as a learning technology. Generalizations about the factors affecting the use, level and nature of use of computer technologies as a learning tool within all Kenyan universities may be difficult to articulate.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature on the use of computer learning technologies levels especially at higher education level, an empirical review on the evaluation of learning technologies models and frameworks and a critical discussion of each evaluation.

2.2 Theoretical Framing

Learning tools are almost always intended as part of a series of lessons in a curriculum. These learning tools are suitable to motivate students to research further about the subject under study. In the modern time schools and institutions of higher learning have increased possibilities; According to Hargrave and Kenton (2000), computer learning technologies are used to teach students many topics in science subjects, because the mental and physical dexterity requires the use of such technologies so as to fully engage students in the learning process. Such tools are more and more focused on designing complete electronic teaching modules.

Computer technology as a learning tool is one of the main subjects in information science education. The use of computers within a learning environment is called computer assisted learning (CAL). Implementation of simulation models as a learning tool into the educational process can provide an information or demonstrative. Computer simulated environments have advanced significantly in the past 10 years. Recent advancements in graphics and processor technology have allowed for the creation of realistic electronic environments that closely replicate the job environment. Promising research and development in the areas of virtual reality and simulation engines are yielding glimpses of how future training and education may be delivered.

Learning technology appears to have great educational potential. It can be motivating, time-efficient, and particularly effective at supporting the learning of conceptually difficult topics (Atkins, 1993). However, it would be naive to treat such resources as a foolproof solution. There remain a wide variety of problems associated with its use. Access to resources has always been a problem (Hammond, 1994). Even when access is assured, simply providing a tool does not guarantee that the tool will be used at all, let alone used effectively or even appropriately (Phillips, 1988; Draper, 1997; Gunn, 1997). The effect of Learning Technology is not consistent across subjects or age groups (Hammond, 1994). High-ability and low-ability learners benefit from different types of Learning Technologies, offering different degrees of support (Atkins, 1993). A lack of expertise amongst students or teachers can also create difficulties (Hammond, 1994). Perhaps most significantly when considering evaluation, it can be extremely difficult even to specify or measure 'educational value', making it hard to judge whether any benefits have occurred (Mason, 1992)

2.2.1 Cost effectiveness of learning technologies

A different perspective brought about by learning technology's researchers has to do with the cost effectiveness of integrating the technologies within an educational context. Growth in student numbers and cuts in unit funding have increased pressures in higher education to be more 'cost-effective' in teaching and to respond to demands for greater flexibility in access to learning. One response, adopted by the Dearing report and many university managers, is to highlight the contribution that CITs can make. However the notion of cost effectiveness in this context is both poorly defined and poorly understood, Methodologies such as Measurement Theory emphasizes the importance of being able, at the outset, to 'designate the set of objects which form the target of the measurement, and to select the key properties which must be measured' (Kaposi, 1991). According to Kaposi, when it comes to cost effectiveness in teaching, we seem far from being able to agree what is to be measured, and how. Analysis is limited and often predates current communication and information technologies.

2.2.2 Learning Technology evaluation Frameworks

A wide variety of approaches are used to evaluate educational technology. Some are extremely specific, designed with only a narrow range of evaluation styles in mind. Others are more general, and are intended to be applicable to educational technology evaluation in any situation. This section reviews two mainly used evaluation techniques and three frameworks for evaluation of learning technologies. A model framework is thus derived and justified to be used for this study

2.2.3 Experimental evaluations

Experimental approaches are characterized by the need to measure and control the processes being observed. Although a number of different experimental models can be adopted, most share certain characteristics. For example, they test hypotheses that are specified in advance of the experiment being carried out, and their results focus on the concept of ‘significance’. With all experiments, there is a chance that a result is untrue, and has been caused by inaccurate measurement, an unrepresentative sample of participants, or some other type of error. As a result, findings are always presented with a measure of significance, which indicates the percentage chance that the effect was caused by one of these errors. Typically, 5% margins of error are considered acceptable, although in areas such as medicine findings may only be considered significant if the chance of error is 0.1% or lower. It is because of this margin of error that the ability to repeat experiments, and thus add credence to findings, is considered so important. Another key factor of experiments is that the data that are to be collected must be measurable. This is not as problematic as it may at first seem. There are a large number of statistical tests available, each designed for specific types of data. As a result, most things can be measured in some way, even if this is simply by noting whether or not something happened. Experimental approaches have a long tradition in educational evaluation (Light & Smith, 1970), and have an appeal through their claim to rigour and generality. Conversely, they have also received considerable criticism, mainly on the grounds that controlling the study inherently reduces its authenticity. It is argued, as a result, that the findings of such studies may be true for laboratory-style conditions but have little relevance to authentic classroom practice. Such criticisms have some validity. Typically, experiments will demonstrate that one factor (such as gender,

instructional material, and so on) has an impact on education, all other things being equal, and then attempts to give an indication of how much of an impact using the metric employed to quantify the data. Clearly, one factor that can have an impact is the change in instructional setting from a controlled ‘laboratory’ to real classrooms. However, the fact that this factor is rarely accounted for in studies does not detract from the importance of any other findings. Closely related to this issue is the criticism that since educational innovations often changes the nature of what is learnt, comparative experiments addressing this factor are inherently flawed. The attempt is often illustrated with the analogy of trying to compare apples and oranges. Ironically, this analogy highlights an error in the assumption. With educational innovations, students’ preferences, pace, and performance in tests or exams, which in practice rarely change as a result of innovation, can all be used as the basis of comparison. A more pertinent criticism, and one which must be addressed on a case-by-case basis, is whether or not these measures reveal anything of educational importance. Attempts to increase authenticity, either through the adoption of complementary approaches or the development of quasi-experimental methods (Muller, 1985), are common. Such approaches retain the desire for ‘scientifically acceptable’ results, but concede that criticisms such as those outlined above illustrate the importance of context and authenticity.

2.2.4 interpretative/Illuminative evaluation

The primary concern of illuminative evaluations is to describe and interpret events, rather than measuring or predicting. As a methodology, it is adaptive, responding to changes in the programme of study as they occur. This makes it ideally suited to long-term or longitudinal evaluations, and means that it can contribute to the development of grounded theory (Strauss, 1987). However, the long-term or general relevance of these results can be limited, and generic effects can only be identified by carrying out comparable studies at a range of institutions and integrating the findings. The impact of illuminative approaches in this area has been considerable, as will be shown with the following frameworks. Even when methodologies do not adopt this approach explicitly, common features abound. An example of one such variation is the Situated Evaluation of CAL (SECAL) framework (Gunn, 1997), which rests on a similar

philosophy to that adopted by Parlett & Hamilton (1987), and can be viewed as a mid-point between illuminative studies and action research evaluation (Zuber-Skerrit, 1990).

The key differences between SECAL and illuminative evaluations are the small scale for which it is intended, together with its aim of providing rapid and immediately applicable results. Illuminative evaluations are primarily ethnographic, as opposed to experimental, and were largely introduced as a ‘social anthropological’ alternative to experimental evaluations of educational programmes (Parlett & Hamilton, 1987). As a result, this study aims to discover the factors and issues that are important to the participants, instead of assessing how well computer simulation performs on standard measures of assessment. The illuminative methodology consists of three stages: observation, inquiry, and explanation. In the first phase, data is gathered from observations, interviews with participants, questionnaires and document analysis. This is then used to “illuminate” problems, issues, and features through exploratory data analysis. Analytical methods are adopted pragmatically, in an approach similar to that of the naturalistic paradigm (Guba & Lincoln, 1981), and different techniques are triangulated in order to explain common problems and cross-check findings. Overall, the process will aim to produce an explanation of the general principles or patterns surrounding the use of computer simulation in higher education. One of the main contrasts between experimental and illuminative approaches is the importance placed on context. Illuminative evaluations pay considerable heed to the institution’s organization, the operating assumptions held by the faculty, individual instructors’ characteristics, and the students’ perspectives and preoccupations.

2.2.5 The TILT framework

As part of its research, the Teaching with Independent Learning Technologies (TILT) project developed an evaluation framework that can be viewed as a development of the illuminative approach (Draper et al., 1996). This framework is essentially integrative, seeking to establish new or more appropriate roles for the courseware being evaluated. As a result, considerable attention is paid to the educational context. The TILT framework is designed to be applied to the course as a whole, not just the resource being used. It has been argued that integrative evaluation provides the kind of feedback instructors are really seeking – not the properties of Learning

Technology, devoid of context, but strategies for more effective use of these resources in their teaching situation (Draper et al., 1996). Further motivation for this approach has come from studies where factors that would be uncontrolled in most experimental studies, such as the timely intervention of teachers, seem to have played a key role. An interesting feature of the approach is the involvement of the practitioner. Involving the teachers in the evaluation process increases relevance, and ensures that the interpretation of data by the evaluators makes sense to a subject expert.

Another distinctive element, relating to practitioner involvement, is the formalization of the process of evaluation design and data analysis. The ‘inner method’ is in many ways similar to the illuminative approach discussed earlier, covering the design of the study and data capture. However, in addition to this the TILT framework proposes an ‘outer method’ that brings the practitioners and evaluators together to discuss goals, evaluation questions, details of the teaching situation, the creation of assessment methods by the practitioners and the higher-level design of the study.

2.2.6 The CIAO! Framework

The CIAO! Framework was derived by researchers at the Open University in order to evaluate the use of Learning Technology in their courses (Jones et al, 1996). This approach focuses on three main themes: context, interaction and outcomes. Several methods of data collection are used, including questionnaires sent out prior to the start of the course, postal and on-line questionnaires completed after computer use, interviews with staff and students, post-course questionnaires, and logs of computer usage and terminal time. These last have been found to be particularly important, emphasizing the importance of the detailed tracking of work. There is a long history of the use of computers in teaching at the Open University (Butcher and Greenberg, 1991). This history has informed the development of a model for evaluation that is laid out in Jones et al. (1996) as reproduced in Table 1 below.

	Context	Interactions	Outcomes
Rationale	In order to evaluate CAL we need to know about its aims and the context of its use	Observing students and obtaining process data helps us to understand why and how some element works	Being able to attribute learning outcomes to CAL when CAL is one part of a multi-faceted course is very difficult. Both cognitive and affective learning outcomes
Data	Designers' and course teams' aims Policy documents and meeting records	Records of student interactions Student diaries On-line logs	Measures of learning Changes in students' attitudes and perceptions
Methods	Interview CAL designers and course team member	Observation Diaries	Interviews Questionnaires

Table 1. The CIAO! model for evaluation

A framework for the conduct of evaluations, CIAO!, focusses on three aspects: context, interactions and outcome. Context refers to a wide interpretation of the rationale for use of the software including the aims of the use. This includes considerations of questions such as how the CAL fits within the course, where is it used (at home/in the classroom), who uses it and whether

it is used alone or in groups. Interactions refer to a consideration of ways of examining and documenting how students interact with computers and each other, focusing on the learning process. Often, in recording such interactions, inferences can be drawn about the learning process. An outcome refers to a wide interpretation of the changes in students, which result as a consequence of using the program. Restricting consideration of outcomes to cognitive ones is too limited as often other consequences emerge which need exploration. This means that learning outcomes still need to be considered but so also do changes in learners' perceptions and attitudes. One aspect of measuring outcomes is the fact that it is very difficult to attribute learning outcomes to a particular use of ILT or to a particular use of the computer, when that is only one part of a multi-faceted experience of a course.

Looking vertically down the framework, the data row highlights the different types of data that needs to be collected to inform the work, and the methods row specifies how this is done. Many different types of methods have been used: interviews with staff to inform an understanding of context, questionnaires sent out prior to the start of the course, post course questionnaires and logs of computer use and terminal time. The framework reflects its origin in the evaluation of distance learning courses where questionnaires are often used to collect information from large numbers of students, while small-scale studies can supplement this picture with observations and interviews. This framework however overlooks the methods and processes to be used for evaluation; emphasis is placed on the context, outcomes and content of the learning technologies.

2.2.7 The CCP Framework for evaluating information systems

This framework reflects the social, political and cultural factors that influence the economic benefits and emphasizes the need for an integrated approach to evaluation. This Framework was built on the context, content, process (CCP) idea originally proposed by Pettigrew (1985) for his work on organizational change, and later used to critique the literature on IS evaluation by Symons (1991). Evaluation is guided by addressing the questions: why is the evaluation is being done? What is being evaluated? Who affects the evaluation? When is the evaluation taking place? And how is the evaluation to be carried out? The framework reflects the identified need

for more holistic processes for evaluating information systems and explains the role of interpretive methodologies in identifying the complex interplay of issues

2.2.7.1 Content

A decision on what is to be evaluated is a more complex process than might first appear and is significantly influenced by the stakeholders and by the context of the organization. A crucial factor in any evaluation study is an understanding of what is being measured. Researchers in the socio-technological paradigm advocate a shift away from straightforward measures such as the narrow quantification of cost, to include such measures as intangible benefits, risk and an analysis of opportunities presented by the IS (Serafeimidis and Smithson, 2000). The changing nature of IT and its uses mean that the content elements have changed and new methods that account for the richness of more intangible benefits are needed. However, it is very key that whatever is to be measured is known before hand for any evaluation to increase its relevance.

2.2.7.2 Context

The organizational context will determine the reason for an evaluation and affect the influences of the stakeholders and requires the why and who of evaluation to be considered within the context section. Trends and developments in the wider business environment also need to be considered since they are powerful legitimating forces. The purpose of an evaluation tends to be for appraisal of value, a measure of success or recognition of benefits (Guba and Lincoln, 1989; House, 1980). However, evaluation can be used to reinforce an existing organizational structure for political or social reasons and be a ritualistic rather than effective process. The evaluators must decide which groups are relevant to the project being evaluated. The power associated with stakeholder groups and its implications for effective evaluation is a complex issue which the evaluators should be aware of since there is a danger that outcomes may be skewed to meet the objectives of those holding power (Jasperson et al., 2002). It is therefore very important to consider the context within an evaluation model.

2.2.7.3 Process

Guidance on the process of evaluation requires information to explain the how of evaluation (Symons, 1991). Although evidence suggests that organizations remain with these tried and tested methods (Smithson and Hirschheim, 1998), they do not enable a holistic approach to evaluation to be achieved. Thus, many factors that can significantly influence the conduct of the evaluation are ignored and the benefits of the interpretive approach lost. These include recognition of the role of evaluation in organisational learning, more examination of the strategic value of systems and exploration of the softer methods for determining benefits (Farbey et al., 1993). Other how factors to be considered include the involvement and commitment of stakeholders and the conducting of both formative and summative evaluations. Remenyi and Sherwood-Smith (1999) assert that continuous formative evaluation helps to minimise cases of failure, whereas summative evaluation is aimed at assessing outcomes and impacts and is by nature more financial/statistical.

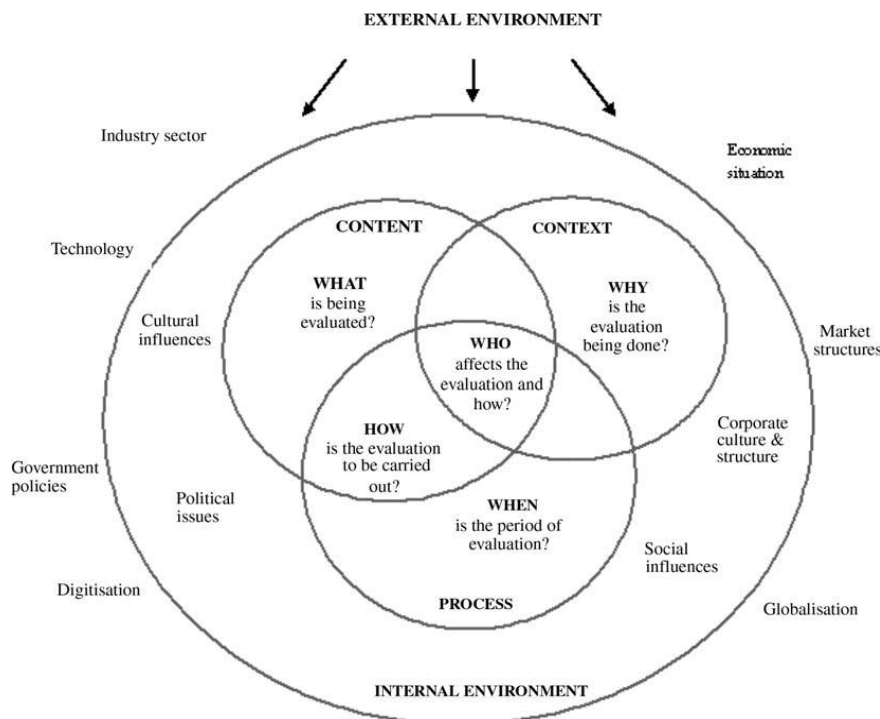


Figure 1: The content, context and process framework

The concepts are broad enough to accommodate the myriad ideas and arguments in this well-documented field, while still providing parameters for reviewing them. A parsimonious framework provides a structure

for building individual evaluation models, thereby supporting Irani's (2002) argument that generic evaluation is not effective. However exhaustive this framework seems to be, it also assumes the effect caused on the outcomes of introducing learning technologies to the continuity and utilization of such technologies. The discussion that follows seeks to come up with a more exhaustive model that will cover most of the aspects in a learning context.

2.3 Proposed Holistic Research Model for Evaluation of Computer learning technologies

While many of the learning technologies evaluation methodologies described so far emphasis the importance of context, few are as outward-looking as the holistic styles of evaluation proposed by researchers such as Mason (1995). Mason's approach starts from the premise that introducing Learning Technology often alters the nature of learning outcomes, rather than the quantity of what is learnt. As a result, methodologies that focus solely on learning gains often find no benefits to CAL use. The alternative, it is argued, is to consider the broader benefits of such innovations, including contextual and institutional effects. Through doing this, it can be argued, the holistic approach addresses both the educational and the economic impact of the development. Such evaluations typically focus on questions such as:

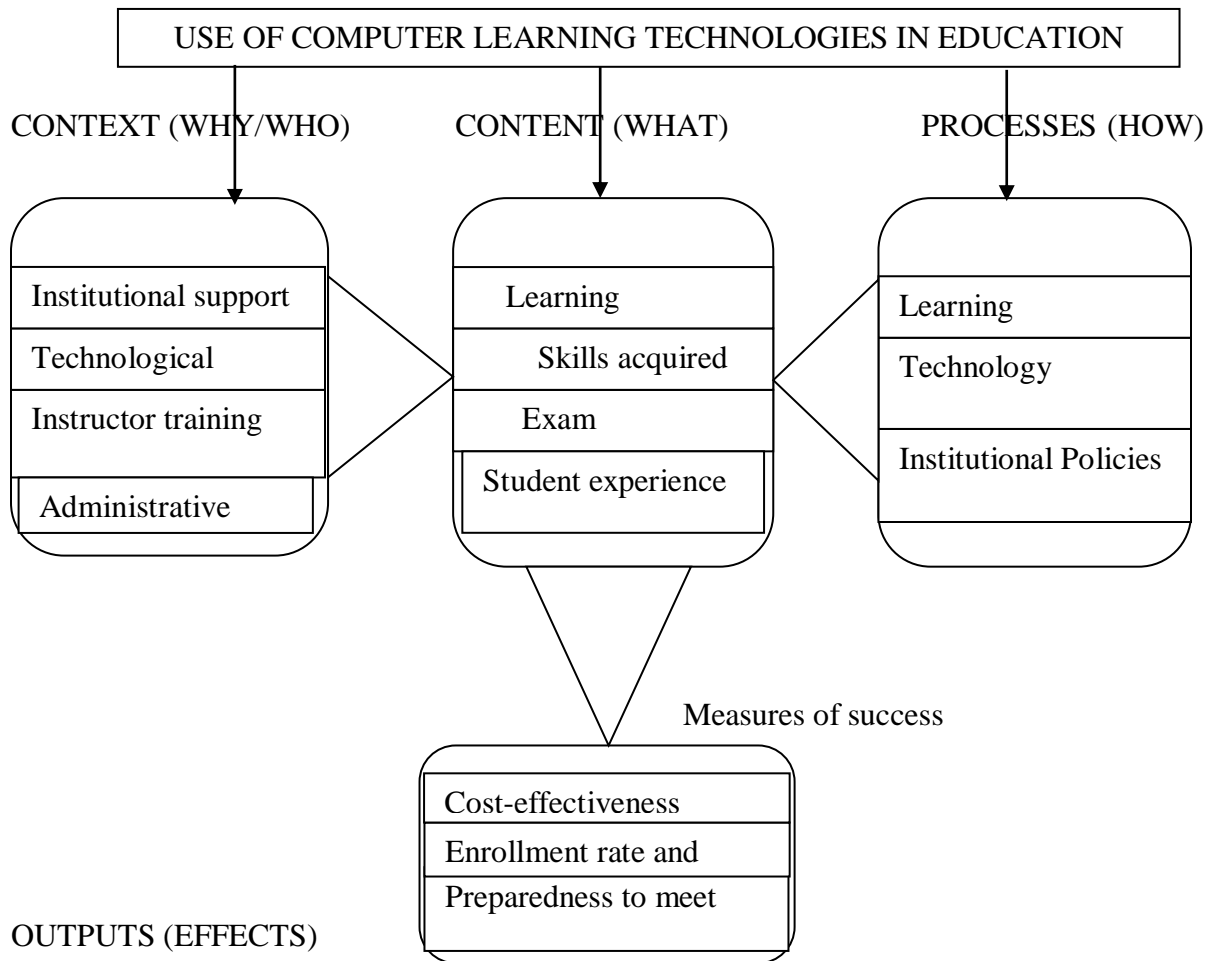
- Are students on technology-based learning programs more motivated and hence less likely to drop out of courses?
- Does the technology allow the host institution to attract new students, either from niche markets or from isolated or disadvantaged situations?
- Do economic savings result from using learning technologies?

Such questions, it is argued, can be answered quickly and simply using data already gathered centrally. Although this view is somewhat simplistic, as the discussion of issues relating to the economic evaluation of educational technology will demonstrate the general point is well made: considerable amounts of data describing contextual benefits are already gathered in most educational contexts. These are seldom made use of by evaluations. Again, the holistic approach seeks to combine qualitative and quantitative approaches. Mason's methodology seeks to identify the positive and negative aspects of technology use, as compared with traditional teaching methods, to build categories from these data, and then to statistically analyze the response patterns in order to arrive at generalisable findings. One important factor relating to the

use of Learning Technology is that of its cost. Even a cursory review of the literature reveals that methodologies for evaluating this aspect of Learning Technology use are comparatively scarce, and that it is far harder to establish what it is important to consider, let alone how these factors can be measured and compared.

Figure 2: Research Model for Influences and extents of using computer learning

technologies in education



2.4 Description of Proposed Research Model

2.4.1 Context

Context refers to a wide interpretation of the rationale for use of learning technologies including the aims of the use. This includes considerations of questions such as how the CAL fits within the sector, where is it used, who uses it and whether it is used alone or in groups. The complexity of an interpretive approach to evaluation owes much to the different perceptions and beliefs of the different stakeholders involved; an aspect that is being recognised in practitioner literature (Boulmetis and Dutwin, 2000). Stakeholder groups include initiators of the evaluation, the evaluators who conduct the evaluation, the users of the systems being evaluated and a range of other parties such as trade unions and government agencies. For the case of this study, the stakeholders within the context will be the decision makers within the university, including administrators and deans of faculties. Their response to the outcomes of integration of learning technologies within the education sector will also be studied. Projects and inclusions need to be evaluated in context and the trends, events and legislation in the wider environment act as a catalyst for many IS implementations. The economic conditions in a country at a given time may encourage organizations to invest in new technological infrastructures. Government policies may encourage or pressure organizations to adopt certain technologies or information management practices.

2.4.2 Process

According to Symons (1991) the process of organizational change is drawn on a chain of interrelated actions and reactions of different interested groups. In IS/IT investments, this includes evaluation by managers, IS/IT evaluators (professionals) and users at all stages of development of IS/IT and operation. Any effective evaluation process besides focusing on value assumptions must focus on organizational policy as well. Moreover, Symons argues on the process view evaluation must comprise multiple stages running through the whole systems development cycle. Guidance on the process of IS/IT evaluation should require information to explain the 'HOW' of evaluation, writes Symons (1991). The 'HOW' of evaluation is managed by

the joint work of evaluators, different group of stakeholders and the program manager (e.g., Serafeimidis and Smithson, 1994). A large number of IS/IT evaluation literature reports the examination of 'HOW' of evaluation incorporated in different evaluation methodologies (Stockdale and Standing, 2006) and strategies is essential for an effective conduct of interpretive IS/IT evaluation approach.

For this study, the researcher adopts a goal-based evaluation approach. The use of learning technologies in education has a common goal of fostering education in terms of efficiency and improved learning outcomes. The evaluation will therefore be goal-based spread through the various stakeholders.

2.4.3 Content

Even when costs can be accounted for, problems arise when the issue of time scale is considered. For example, courses which are costly in terms of resources may have extreme long-term benefits, such as the creation of a pool of graduates qualified to teach the course in the future (Hawkrige, 1993).

Further problems can be seen for long-term studies, or evaluations that involve comparisons with earlier versions of the same course. In such cases, how should inflation be taken into account? Should hardware and software value depreciation be considered? How should staff pay rises be incorporated into the evaluation? (Hawkrige, 1993)

The use of recognised success measures within a holistic interpretive model enables an evaluator to add flesh to the bones of the evaluation process, building on established IS research, thus contributing to a cumulative body of work within the discipline. For the purpose of this research, the content will be the extent to which learning technologies have been embraced and the effects of introducing such technologies to the levels of learning as used to teach in Kenyan universities, Multimedia university of Kenya will be used as a case.

2.4.4 Outputs

The implementation of information systems always has a positive intent towards an organizational performance. The outcomes of any technology then become a very important aspect in determining the success and continuity of any implemented technology. This proposed

research model takes into account the result of an introduction to computer technology in learning. The outcome is perceived through an assessment of the context, mainly the various stakeholders and content, including the aspect being evaluated. The initial CCP framework though very useful, gives no guidance on the important matter of how the evaluation process works in order to realize betterment (the outcome box in the framework is not connected to the context in some way). As this study will perceive it, the betterment realization process that is supposed to follow from the evaluation comprises (at least) two stages; results and effects. Firstly, there are the immediate results that are produced within the different evaluation activities; these are the direct outputs from the evaluation, the results. Secondly, there are the effects that these results have on peoples thinking and doing and further onto the wider organization environment; these effects could be recognized as the outcomes of the evaluation. It is the effects, or the outcomes, that are the reasons for why people engage in evaluation efforts. Further, the outcomes almost certainly determine the response and reactions within the context of the learning technologies. In this study therefore, the resultant effect and action as per the implementation of such technologies will be analyzed.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research methodology used by indicating the research design, target population, data collection method/techniques and data analysis that was utilized in validating the model fitness of the framework and applying it for evaluation of the use of computer learning technologies at Multimedia university of Kenya.

3.2 Research design

In order to investigate the role of using computer learning technologies to teach in Kenyan universities, the researcher adopted a case study research design. Thus, conducting the evaluation process through the methodology of an interpretive case study supports the richness and complexity demanded by the model framework. The acceptability of case study research has suffered from a perceived lack of ability to generalize the findings, a clear outcome of positivist research studies. However, drawing on Yin (1994), Walsham (1995) argues that case studies are generalizable to theory. The researcher undertook a quantitative and qualitative case study of Multimedia university of Kenya as it is one of the major Universities in Kenya. The research design enabled the researcher to undertake an in-depth investigation and interaction with the phenomena using a proposed holistic framework for evaluation of using computer simulation to teach by looking into the student experiences, Instructor experiences and its overall value to the university. The data collected was coded and used to validate the model for fitness. Qualitative case studies involves the study of subjects in their natural settings whereby the researcher conducts a systematic enquiry into meanings, attempting to interpret and make sense of phenomena and the meanings that people attribute to them (Shank, 2002).

3.3 Target population

The target population for this study will therefore comprise of Multimedia University of Kenya. The target population will therefore consist of the following: departmental staff; Students; Faculty staff; Administrative staff; and Laboratory assistants

3.4 Sampling Procedure

To overcome the limitations of this study the researcher employed a stratified sampling and simple random sampling to select three hundred and eighty five (385) respondents from the target population. The researcher will categorize the respondents into five (5) strata namely: Departmental staff; Students; Faculty staff; Administrative staff; and Laboratory assistant. Simple random sampling will then be used to proportionately select respondents from each stratum at 90% representative of the study's population. According to Mugenda and Mugemda (2003) a good sample population should be between 10% to 30% of the entire population.

Table 2: Sampling Procedure

	Population size (N)	Estimate Sample size (n)	Proportion	Achieved sample size	Proportion
Departmental staff	200	100	50%	20	10%
Students	3000	250	25%	90	10%
Faculty staff	50	25	50%	8	16%
Laboratory assistant staff	10	5	50%	2	20%
Administrative staff	5	5	100%	5	100%
TOTAL	1265	385	30.43%	125	10%

3.5 Data Collection

This study collected both primary data relating to the use of computer learning technologies in Multimedia University of Kenya. The data was collected by use of a questionnaires and interviews. The questionnaire contained both open and closed ended questions and are divided into 2 main study areas, the students and the admin staff and lectures subdivided into five sections. The questionnaire were dropped and picked from the respondents after a reasonable period of time. The interviews were carried out at the respondent's venue and at a preferable time as prior appointed.

3.6 Data Analysis

The study used Linear Structural Relations (abbreviated as LISREL) software version 9.10 to conduct a Structural Equation Modelling(SEM) and draw paths in a designed confirmatory factor analysis (CFA) diagram, called the proposed unstandardized model and the second order standardized model, to determine regression coefficients between variables of interest and found Pearson Correlation Coefficient for purposes of establishing the strength of the relationships and calculating coefficient of determination to aid in further interpretation of the relationship.

Before processing the responses, the completed questionnaires and interview documents were edited for completeness and consistency and coded accordingly. A descriptive analysis was then employed to analyze the nature and constituents of the respondents within the research design. The interview documents were well analyzed and coded accordingly with a close scrutiny on the major factors and attributes for this study. A Confirmatory Factor analysis of the proposed research model was done to validate the model fitness to the data collected. Various variable relations between the independent and dependent variables was evident from the Confirmatory Factor analysis. The data was coded to enable the major variables to be grouped into various key model factors.

Confirmatory factor analysis is a suitable method since data was collected using Likert scale.

Five basic steps are followed in performing a CFA:

- i) Define the factor model. The researcher came up with a model framework based on theory and the factors which were to be tested called the proposed research model.

- ii) Collect measurements. This involved collecting data from the respondents.
- iii) Obtain the correlation matrix and regression coefficients. The next step involved obtaining the correlations (or co-variances) between each of the factors in the model and regression coefficients in the relationships.
- v) Fit the model to the data. The study choose Maximum likelihood estimation in LISREL 9.10 to fit the model.
- vi) Evaluate model adequacy. The factor loadings were chosen to minimize the discrepancy between the correlation matrix implied by the model and the actual observed matrix. The amount of discrepancy after the best parameters are chosen were used as a measure of how consistent the model was with the data. The χ^2 goodness-of-fit test was used test model adequacy. The null hypothesis for this test was that the model adequately accounts for the data, while the alternative was that there is a significant amount

Descriptive statistics such as means, median mode and standard deviation were used to help in data analysis of the major independent variables. Tables and other graphical presentations as appropriate were also used to present the data collected for ease of understanding and analysis. Multiple correlation tests were used to determine the relationship between the dependent variables from a correlation analysis of the variables involved.

3.7 Limitations of Methodology and how they were overcome

One of the limitations of the questionnaire is misinterpretation of the questions or lack of clear understanding of what is needed. This limitation was overcome by self-administering the questionnaires so that explanations were provided when they were needed.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION OF FINDINGS

4.1 Introduction

This chapter entirely covers a brief case description, findings, data presentation and analysis of the findings on the study of coming up with and using a holistic evaluation framework for the use of ICT technologies to teach in Kenyan Universities, with a case study of Multimedia University of Kenya. It is presented in four major sections: Descriptive statistics of respondents and various factor components which used SPSS (V. 18) Statistical software, A Confirmatory factor analysis of the research model using a different statistical software package used for structural equation modeling (SEM) known Linear Structural Relations (LISREL)-(V. 9.1), then followed by an interpretation of the new standardized model vis a vis the data collected. Lastly is an inter-variable correlation statistic which explains the relationship amongst them and a hypotheses test results discussions from the research findings. A content analysis of the few interviews conducted is shown depicting the qualitative aspects of the study. This chapter also presents and discusses the results of the study.

4.2 Case Description

This study employed a descriptive single-case study design. Multimedia university of Kenya was used as a case for this study, representative of Kenyan universities. Having transited from a non-chattered college to a government owned university, it offers a clear picture of an institution of higher learning within a Kenyan context. The Multimedia University of Kenya is a state owned university. It was established by the Kenya Government under Legal Notice Number 155 of 2008 as a constituent college of Jomo Kenyatta University of Agriculture and Technology (JKUAT) and later granted university charter on 1st March 2013 making is one of the fully fledged Universities in Kenya.

Multimedia University of Kenya offers degree and diploma programmes in Engineering, Computer Science and Information Technology, Business, Media and Communications Studies.

The university consists of various computer laboratories with internet connection. The computers offer a platform within which computer learning technologies can be employed to enhance student motivation, understanding and learning at large. This study aimed at checking how such learning technologies are employed and the factors surrounding their use.

Primary data concerning the use of computer learning technologies to teach in the university was collected targeting four main strata, the students, university support staff, lecturers and Administrative staff for both quantitative and qualitative analysis. There are 200 departmental staff, 50 faculty staff, 10 laboratory staff and a total of 3000 students.

4.3 Descriptive quantitative statistics

4.3.1 Demographic characteristic of the respondents

This presents the bio data of the respondents. This includes the gender, marital status, age, education as shown below.

4.3.1.1 Findings on the gender of the respondent

Gender	Frequency(f)	Percent(%)
Male	81	66.4
Female	39	33.6
Total	120	100.0

Table 3: Distribution by Gender

From the above Table 1, one hundred and twenty respondents participated in the study. These were equally selected with 66.4% of these being male and 33.6% female which shows that there were more male than female who participated in the study.

4.3.1.2 Findings on the respondent's marital status

Marital Status	Frequency(f)	Percent (%)
Single	102	85.0
Married	18	15.0
	120	100.0

Table 4: Distribution by marital status

From the Table 4.2 above, 85% of the respondents were single, 15% married. This is attributed to the fact that most participants were students who are still young in the age bracket of 18-30.

4.3.1.3 Findings on the respondent age

Age	Frequency(f)	Percent (%)
18-24	67	55.8
25-30	33	27.5
31-35	20	16.7
Total	120	100.0

Table 5: Distribution by age

From the Table 3 above, majority of the respondents, (55.8%) were within the age range of 18-24, followed by 27.5% who were within 25-30. 16.7% were within 31-35 This indicate that majority of the participant who participated in the study were age between 18-24 years people who cherish the use of new methods in teaching in their Colleges/Universities

4.3.1.4 Findings on the respondent education

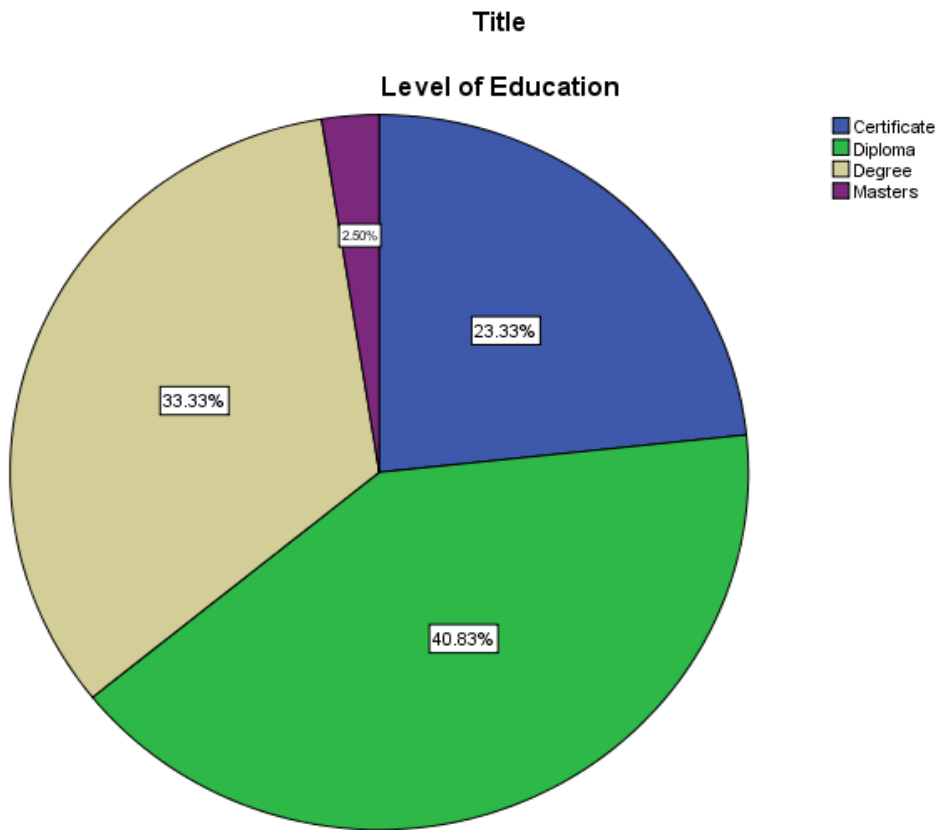


Figure 3: Distribution by education Pie Chart

From the Figure 4.1 above, majority of the respondents were diploma holders at 40.8% followed by degree holders at 33.3 %. Respondents with master degrees were only 2.5%, all of whom were faculty staff, while certificate holders were 23.3% .The study cut through across these groups so as to fully understand the impacts of learning technologies on a wider interpretive scope.

4.3.1.5 Findings on the respondent position in the University

Position status in the university	Frequency	Percent
Student	90	69.2
Faculty	5	20.8
Laboratory assistant staff	25	10
Total	120	100.0

Table 6: Distribution by position in the university

From the Table 4.4 above, majority of the respondents who participated in the research were students at 69.2% followed by Laboratory assistant staff at 20.8 %. Respondents who were laboratory assistant Faculty staff were only 10%, the study thus proves that use of ICT in teaching is a very relevant affairs within the student community in the university. Students, who are the most affected lot by the use of learning technologies appeared much more eager to participate and provide their opinions for the study.

4.3.1.6 Findings on the respondent length of engagement within the University

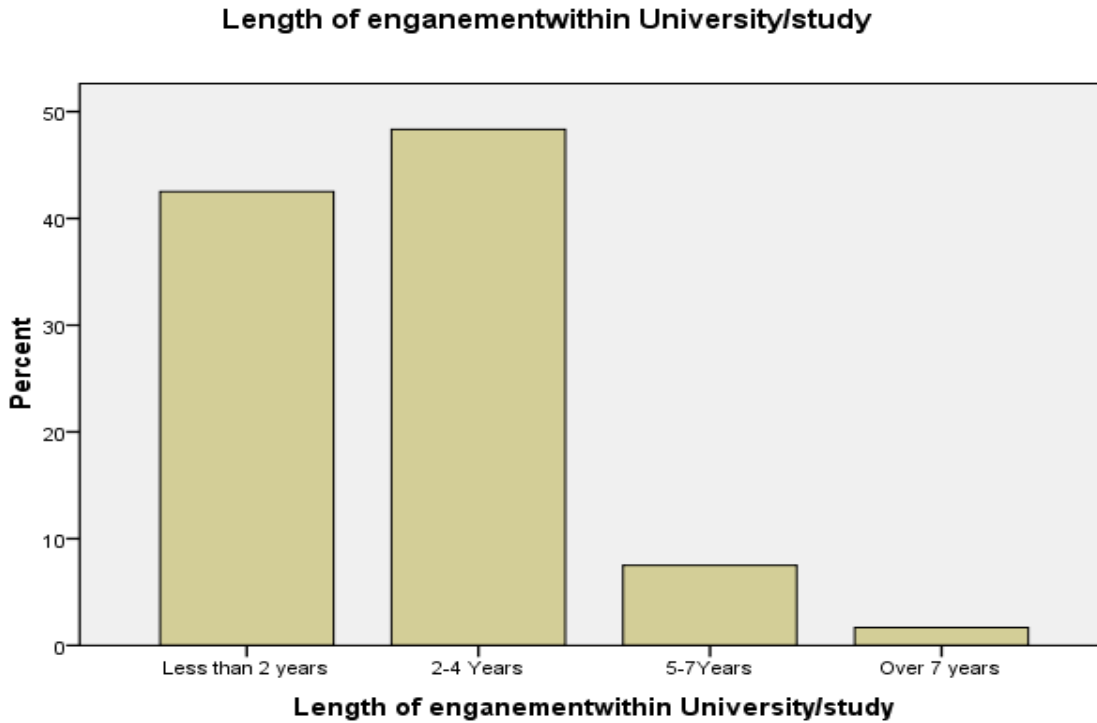


Figure 4: Distribution by Length of engagement within University/study

From figure 4.2 above, majority of the respondents, (48.3%) were within the bracket of 2-4years , followed by 42.5% who were within Less than 2 years. 7.5% were within 5-7 years while 1.7% were within the range of over 7 years working with the University. Thus from the findings it is evidently that the use of ICT in teaching in the universities could not be studied on a long term basis, since majority of the participants who were mainly students had not lasted so long within the university system. The use of this evaluation framework therefore focuses mainly on the current state by which learning technologies are integrated to teach and learning within the university.

4.4 CONFIRMATORY FACTOR ANALYSIS OF PROPOSED RESEARCH MODEL

4.4.1: Proposed research model

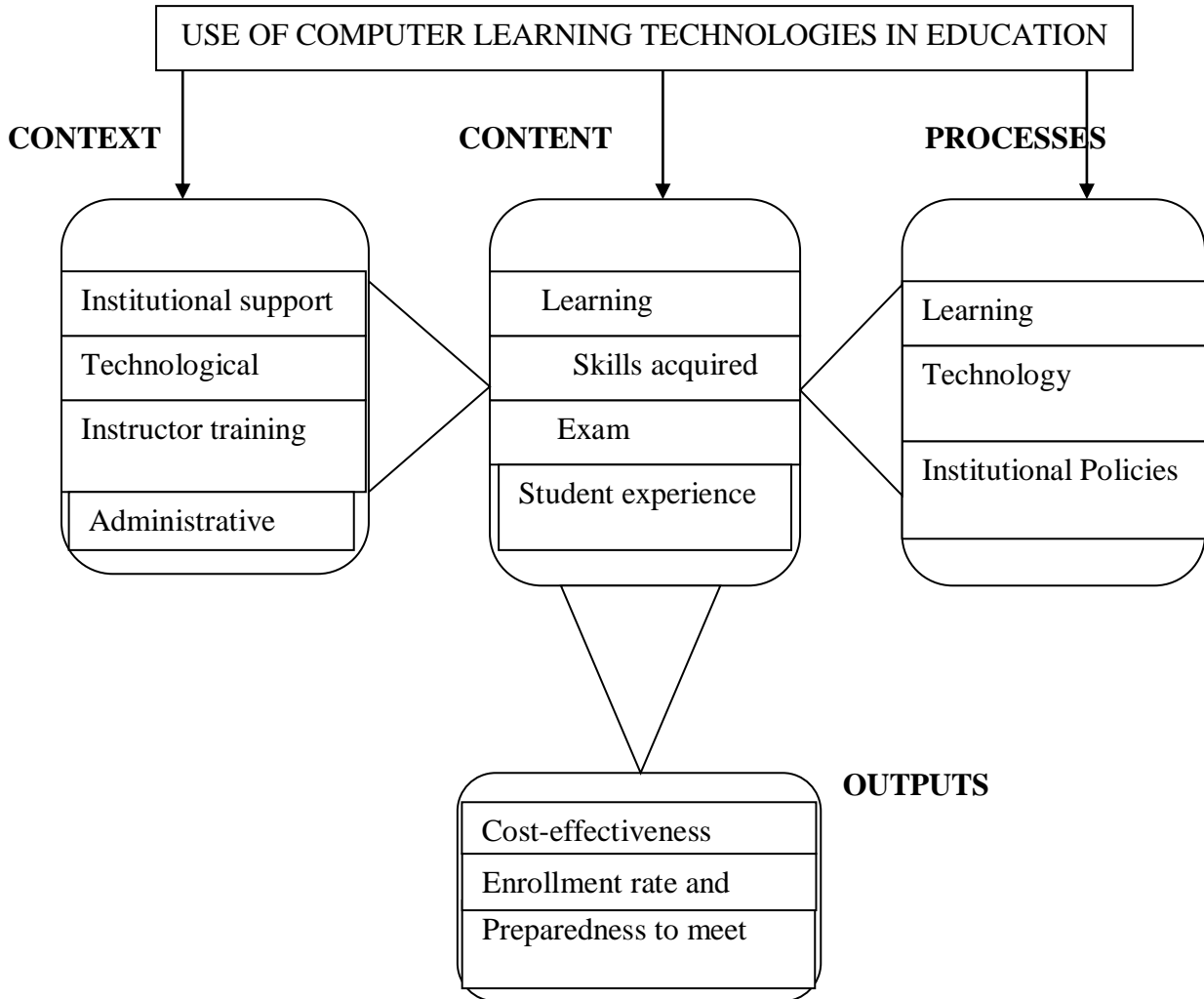


Figure 5: Proposed research model

For the purposes of this section (Confirmatory Factor Analysis), so as to achieve a workable relational matrix, a few strong indicators for each factor were identified and coded with the following codes as shown below

4.4.1.1 Content factor

Strong indicators (Variables)

- i. CON1 – Increased Motivation by students
- ii. CON2 – High Levels of motivation
- iii. CON3 – Increased Understanding by students
- iv. CON4 – Improved class and exam performance by the students

4.4.1.2 Context factor

Strong Indicators (Variables)

- i. COX1 – Policies and guidelines for Integration of computers to learning
- ii. COX2 – Technical infrastructure
- iii. COX3 - Support by the university administration

4.4.1.3 Output Factor

Indicators (Variables)

- i. OUT1 – Cost effectiveness of using computer learning technologies
- ii. OUT2 - Increased student retention
- iii. OUT3 – Increased student enrolment
- iv. OUT4 – Reduced teaching/lecturing time

4.4.1.4 Process Factor

- i. PROC1 – Use of computer applications for research and course work
- ii. PROC2 – Use of advanced softwares e.g simulations in class scenario

The discrepancies between the data collected from different groupings as per the methodology was also resolved by randomly retrieving a sample of 30 entries from the students' data of 90 to form a confirmable matrix of 30 entries by 13 variables. For purposes of Statistical analysis, the following qualitative measures were assigned numerical values in the likert scale used in the research instrument.

Likert Measure Number Equivalent

Likert Measure	Number Equivalent
Strongly Agree (SA)	1
Agree (A)	2
Disagree (D)	3
Strongly disagree	4

Table 7: Numerical Values Assignment to Likert Scale

4.4.2 Statistical analysis of the various indicators

Content related indicators Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
CON 1	30	1.00	4.00	1.2333	.43018
CON2	30	1.00	4.00	1.5333	.50742
CON3	30	1.00	4.00	2.3000	1.11880
CON4	30	1.00	4.00	1.1667	.37905
Valid N (listwise)	30				

Table 8: Content related indicators

Context related indicators Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
COX1	30	1.00	4.00	2.5000	.86103
COX2	30	1.00	4.00	1.9667	.76489
COX3	30	1.00	4.00	1.4000	.56324
Valid N (listwise)	30				

Table 9: Context related indicators

Output related indicators Statistics

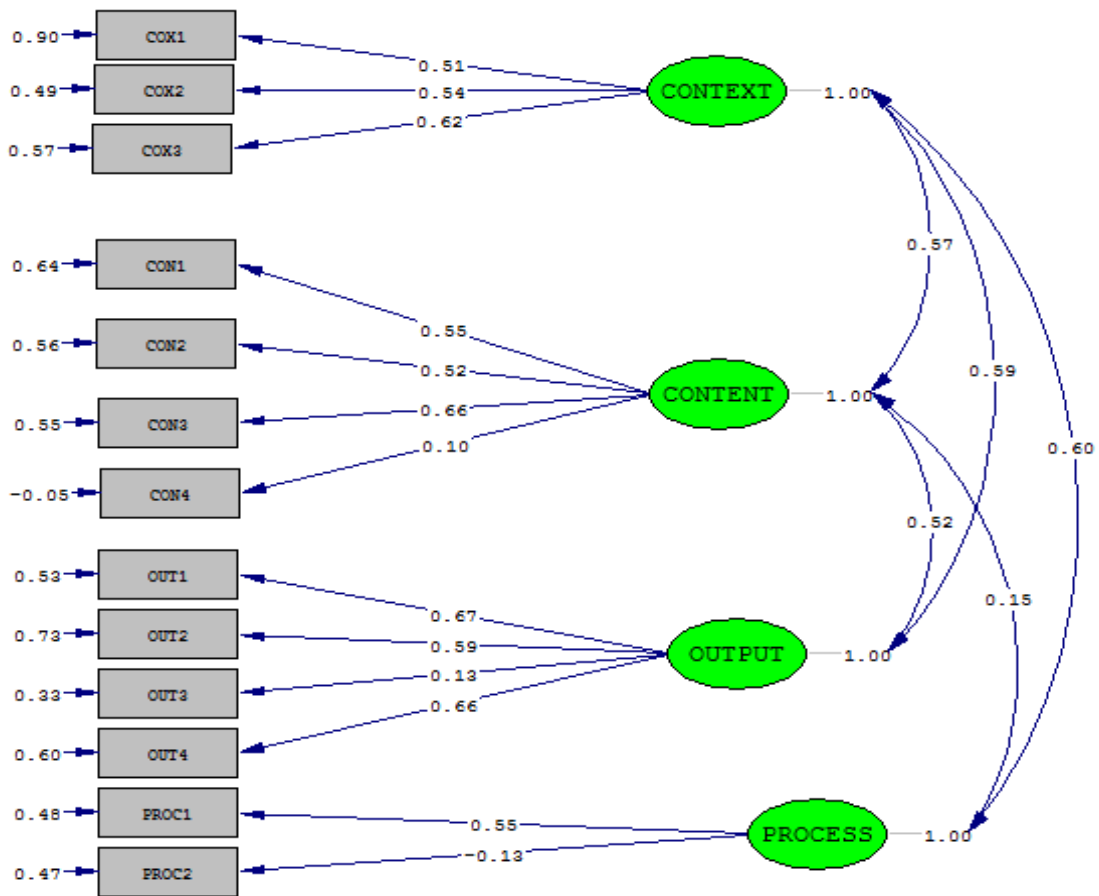
	N	Minimum	Maximum	Mean	Std. Deviation
OUT1	30	1.00	4.00	1.5667	.50401
OUT2	30	1.00	4.00	1.6667	.71116
OUT3	30	1.00	4.00	1.9667	.55605
OUT4	30	1.00	4.00	2.2333	.56832
Valid N (listwise)	30				

Table 10: Output related indicators

Process related indicators Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
PROC1	30	2.00	4.00	3.2667	.69149
PROC2	30	1.00	4.00	1.5667	.67891
Valid N (listwise)	30				

Table 11: Process related indicators



Chi-Square=39.58, df=25, P-value=0.22796, RMSEA=0.088

Figure 6: Proposed research model – Estimated LISREL path diagram

Readings from the output file (extension .out)

Goodness of Fit Statistics

Degrees of Freedom for (C1)-(C2) 25

Maximum Likelihood Ratio Chi-Square (C1) 39.58 (P = 0.22796)

Browne's (1984) ADF Chi-Square (C2_NT) 68.240 (P = 0.2448)

Estimated Non-centrality Parameter (NCP) 33.958

90 Percent Confidence Interval for NCP (11.440 ; 64.414)

Root Mean Square Residual (RMR) 0.0750

Standardized RMR 0.163

Goodness of Fit Index (GFI) 0.735

Adjusted Goodness of Fit Index (AGFI) 0.605

Parsimony Goodness of Fit Index (PGFI) 0.493

Time used 0.078 seconds

The χ^2 statistic for model fit is 39.58 (df=25), which is extremely large enough to reject the null that the model is a good fit to the data (the path diagram displays the Normal Theory Weighted Least Squares χ^2 ; to be consistent with the output). In addition the Root Mean Square Error of Approximation is 0.088. Using a cut-off rule of .05, the RMSEA is high to indicate a good fit. The standardized loadings represent the correlation between each observed variable and the corresponding factor. Considering first the indicators of CONTENT, they are 0.55 for CON1, -0.52 for CON2, 0.66 for CON3, and 0.10 for CON4. Considering the indicators of CONTEXT, the standardized loadings are 0.51 for COX1, 0.54 for COX2, and 0.62 for COX3 for OUTPUT factor, the loadings are OUT1, 0.67, OUT2, 0.59, OUT3, 0.13, OUT4, 0.68 and for the POCCESS factor, PROC1, 0.55, PROC2, -0.13. It is possible to ascertain the statistical significance of the estimates by comparing the unstandardized loadings displayed in the equations under the Measurement Equations heading in the output file with their standard errors displayed in

parentheses. When the unstandardized loadings are at least twice the size of the standard errors the estimates are significant at the .05 level.

4.5 STRUCTURAL EQUATION MODELLING - MODEL FIT INDICIES

In order to explain the model fitness to the data, several measures known as fit indices are measured. The following model fit indices will be read and compared to their recommended values

4.5.1 Model chi-square (χ^2)

The Chi-Square value is the traditional measure for evaluating overall model fit and, ‘assesses the magnitude of discrepancy between the sample and fitted covariances matrices’ (Hu and Bentler, 1999: 2). A good model fit would provide an insignificant result at a 0.05 threshold.

4.5.2 Root mean square error of approximation (RMSEA)

The RMSEA is the second fit statistic reported in the LISREL. The RMSEA tells us how well the model, with unknown but optimally chosen parameter estimates would fit the populations covariance matrix (Byrne, 1998). In recent years it has become regarded as ‘one of the most informative fit indices’ due to its sensitivity to the number of estimated parameters in the model. A RMSEA in the range of 0.05 to 0.08 was considered an indication of fair fit and values above 0.10 indicated poor fit.

4.5.3 Goodness-of-fit statistic (GFI)

The Goodness-of-Fit statistic (GFI) was created by Jöreskog and Sorbom as an alternative to the Chi-Square test and calculates the proportion of variance that is accounted for by the estimated population covariance. By looking at the variances and covariances accounted for by the model it shows how closely the model comes to replicating the observed covariance matrix. This statistic ranges from 0 to 1 with larger samples increasing its value.

4.5.4 Adjusted goodness-of-fit statistic (AGFI)

Fit measure for the percentage of the variances which are explained by the specified model structure. In addition it takes the amount of degrees of freedom into account. -> should be approximately at 1. An agfi of .95 is sometimes accepted but it should be higher.

4.5.5 Standardized root mean square residual (SRMR)

Refers to the average of all standardized residuals which cannot be explained in the model. A measure for the average discrepancy between the samples observed and hypothesized correlation matrices. A measure of the average of the not explained correlations in a model.

-> should be approximately 0. An SRMR of .05 is sometimes accepted but it should be lower.

4.5.6 Incremental fit indices

Incremental fit indices, also known as comparative (Miles and Shevlin, 2007) or relative fit indices (McDonald and Ho, 2002), are a group of indices that do not use the chi-square in its raw form but compare the chi-square value to a baseline model. For these models the null hypothesis is that all variables are uncorrelated (McDonald and Ho, 2002).

4.5.7 Normed-fit index (NFI)

The first of these indices to appear in LISREL output is the Normed Fit Index (NFI: Bentler and Bonnet, 1980). This statistic assesses the model by comparing the χ^2 value of the model to the χ^2 of the null model. The null/independence model is the worst case scenario as it specifies that all measured variables are uncorrelated. Values for this statistic range between 0 and 1 with Bentler and Bonnet (1980) recommending values greater than 0.90 indicating a good fit.

Recommendations as low as 0.80 as a cutoff have been preferred however Bentler and Hu (1999) have suggested $NNFI \geq 0.95$ as the threshold.

4.5.8 Comparative fit index(CFI)

The Comparative Fit Index (CFI: Bentler, 1990) is a revised form of the NFI which takes into account sample size (Byrne, 1998) that performs well even when sample size is small (Tabachnick and Fidell, 2007). A value of $CFI \geq 0.95$ is presently recognised as indicative of

good fit (Hu and Bentler, 1999). Today this index is included in all SEM programs and is one of the most popularly reported fit indices due to being one of the measures least effected by sample size (Fan et al, 1999).

4.5.9 Parsimony fit indices

Having a nearly saturated, complex model means that the estimation process is dependent on the sample data. This results in a less rigorous theoretical model that paradoxically produces better fit indices. To overcome this problem, Mulaik et al (1989) have developed two parsimony of fit indices; the Parsimony Goodness-of-Fit Index (PGFI) and the Parsimonious Normed Fit Index (PNFI). While no threshold levels have been recommended for these indices, Mulaik et al (1989) do note that it is possible to obtain parsimony fit indices within the .50 region while other goodness of fit indices achieve values over .90 (Mulaik et al 1989).

FIT INDICIES	RECOMMENDED VALUES	UNSTANDARDIZED MODEL RESULTS
Absolute fit indices		
Chi-Square value		35.58
DF value		10.39
P-value	<0.05	0.088
Model chi-square (χ^2/DF)	<3	3.423
Root mean square error of approximation (RMSEA)	>0.05, <0.08	0.088
Goodness-of-fit statistic (GFI)	>0.8	0.744
Adjusted goodness-of-fit statistic (AGFI)	≥ 0.95	0.612
Standardized root mean square residual (SRMR)	< 0.05	0.0700
Incremental fit indices		
Normed-fit index (NFI)	≥ 0.95	0.162
Comparative fit index (CFI)	≥ 0.95	0.0
Parsimony fit indices		
Parsimony Goodness-of-Fit Index (PGFI)	>0.50	0.491

Parsimonious Normed Fit Index (PNFI)	>0.50	0.124
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Table 12: Measurement indices for estimated research model

Measurement Equations

CON1 = 0.550*con, Errorvar.= 0.126 , R² = 0.35

Standerr (0.0765) (0.0330)

Z-values 1.834 3.808

P-values 0.067 0.000

CON2 = 0.52*con, Errorvar.= 0.183 , R² = 0.49

Standerr (0.0849) (0.0492)

Z-values -0.405 3.724

P-values 0.686 0.000

CON3 = 0.66*con, Errorvar.= 0.254 , R² = 0.54

Standerr (0.0973) (0.0657)

Z-values 0.706 3.866

P-values 0.480 0.000

CON4 = 0.10*con, Errorvar.= -0.0873, R² = 0.02

Standerr (0.240) (0.462)

COX1 = 0.51*cox, Errorvar.= 0.733 , R² = 0.57

Standerr (0.153) (0.200)

Z-values -0.162 3.662

P-values 0.871 0.000

COX2 = 0.54*cox, Errorvar.= 0.499 , R² = 0.54

Standerr (0.139) (0.116)

Z-values -2.322 4.295

P-values 0.020 0.000

COX3 = 0.62*cox, Errorvar.= -0.298 , R² = 0.37

Standerr (0.164) (0.208)

Z-values 4.879 -1.430

P-values 0.000 0.153
 OUT1 = 0.67*out, Errorvar.= 0.159 , R² = 0.501
 Standerr (0.0941) (0.0486)
 Z-values 3.327 3.262
 P-values 0.001 0.001
 OUT2 = 0.59*out, Errorvar.= 0.474 , R² = 0.49
 Standerr (0.144) (0.130)
 Z-values 1.194 3.657
 P-values 0.232 0.000
 OUT3 = 0.13*out, Errorvar.= 0.202 , R² = 0.03
 Standerr (0.105) (0.0628)
 Z-values 3.102 3.213
 P-values 0.002 0.001
 OUT4 = 0.66*out, Errorvar.= 0.267 , R² = 0.52
 Standerr (0.112) (0.0723)
 Z-values 2.071 3.699
 P-values 0.038 0.000
 PROC1 = 0.55*proc, Errorvar.= 0.479 , R² = 0.61
 Standerr (0.144) (0.105)
 Z-values 0.541 4.541
 P-values 0.589 0.000
 PROC2 = -0.13*proc, Errorvar.= 0.357 , R² = 0.0351
 Standerr (0.213) (0.147)
 Z-values -1.491 2.428
 P-values 0.136 0.015

Correlation Matrix of Independent Variables

con cox proc out

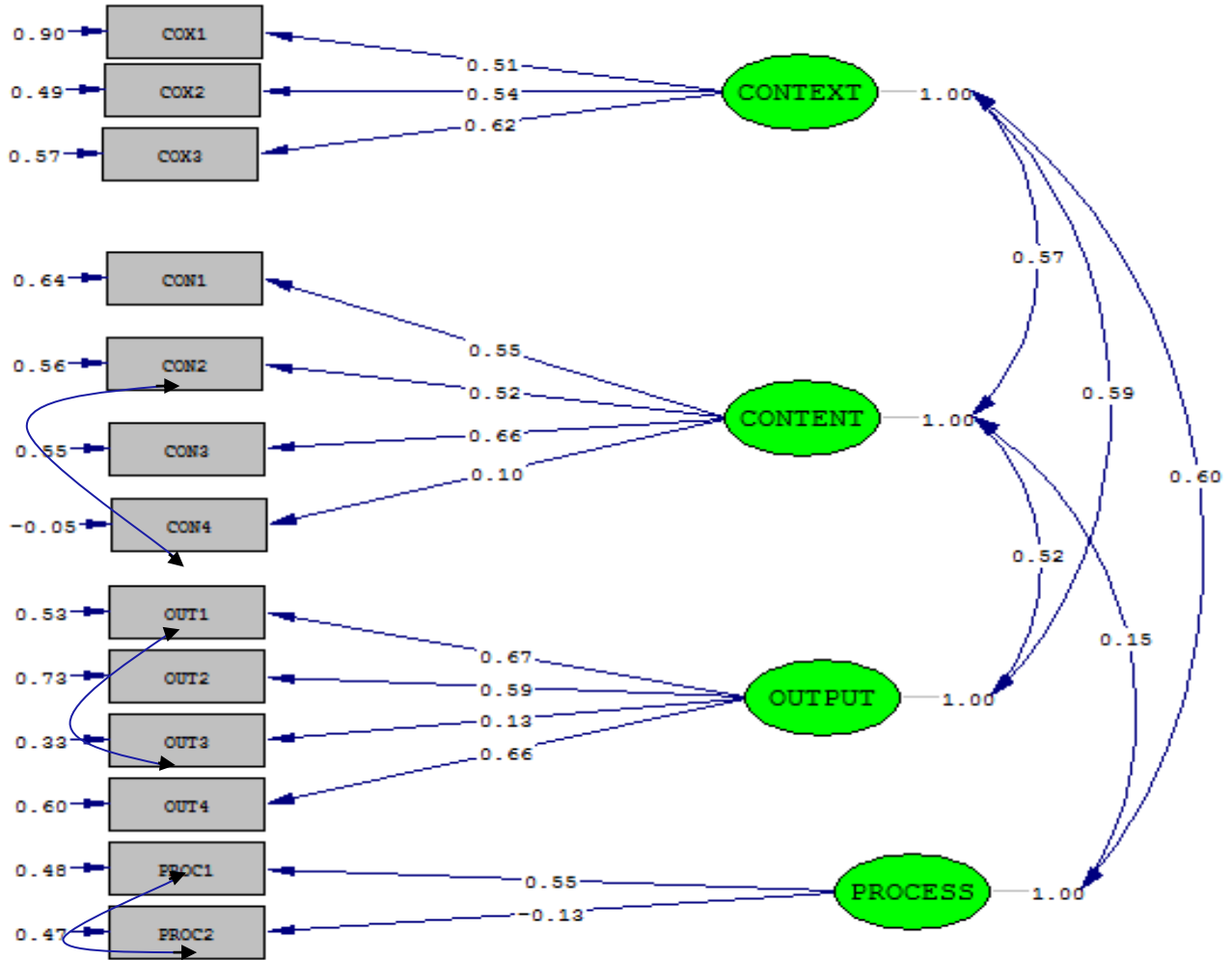
```

-----
con 1.000
cox 0.252 1.000
(0.133)
  
```

```

1.891
proc -0.432 -0.353 1.000
(0.613) (0.472)
-0.706 -0.748
out -0.788 - - - - 1.000
(0.192)

```



Chi-Square=39.58, df=25, P-value=0.22796, RMSEA=0.088

Figure 7: Second order model –Standardized LISREL path diagram

In this case each of the unconstrained estimates is significant. Additionally a good deal of the variance in each observed variable, with the exception of CON4, OUT3 and PROC2. By choosing Modification Indices from the Estimation section and in the output. These numbers offer suggestions for improving the overall model fit. Two suggestions are given in the output: add an error covariance between the three variables CON4, OUT3 and PROC2 to their respective factors. A standardized model shows some relation between the outlier variables and other variables within the same factor as shown in the standardized model below.

The correlation value between CONTENT and PROCESS factors (0.15) also shows a weak correlation, there is a weak relation between the two factors.

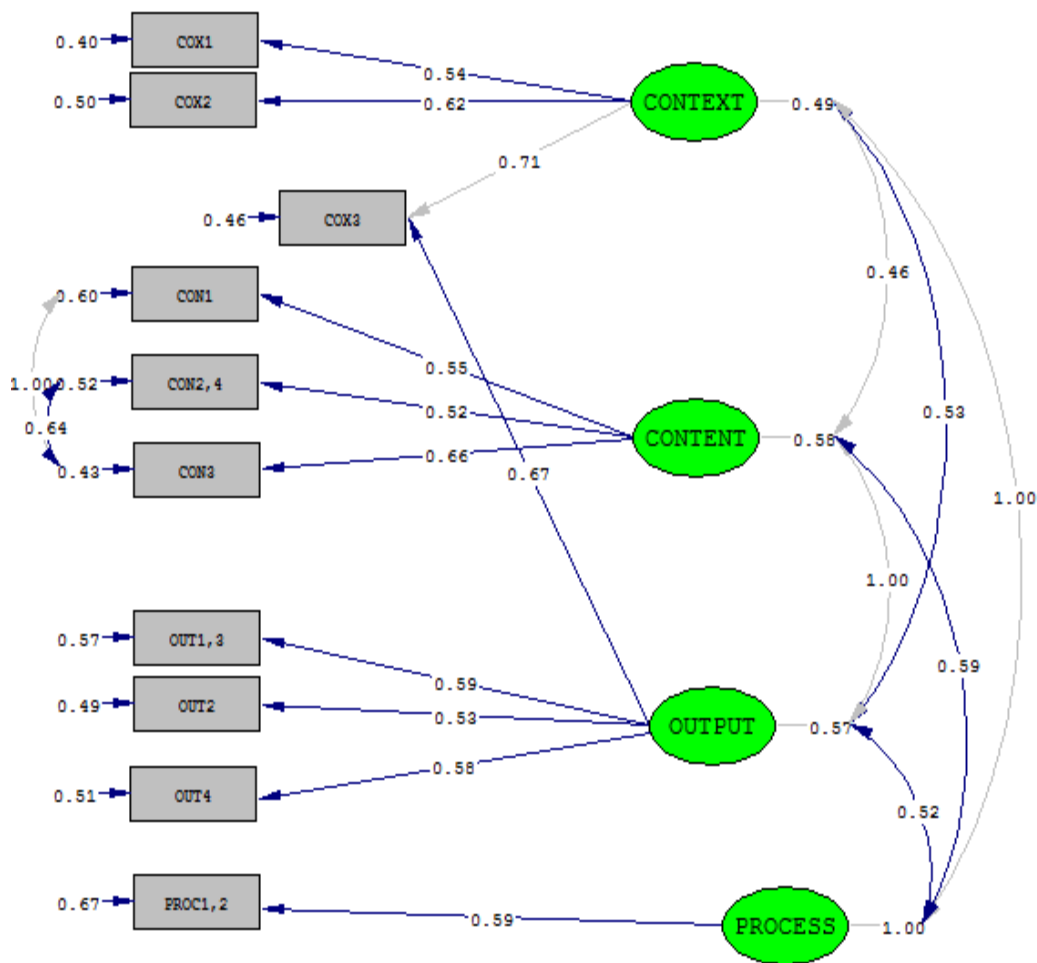
4.6 SECOND ORDER MODEL

In order to create a more befitting model, the highly related variables were merged to create a weightier variable that represents the two variables as follows.

Strong variable	Weak variable	New factor variable
CON2	CON4	CON2,4
OUT1	OUT3	OUT1,3
PROC1	PROC2	PROC1,2

Table 13: Combination of variables

Due to the weak correlation relationship between the CONTENT and PROCESS factors then the correlation pointer between the two was removed so as to standardize the model. The following resultant model was achieved after standardization of the modified model.



Chi-Square=9.58, df=8, P-value=0.22796, RMSEA=0.0481

Figure 8: modified model of standardized LISREL path diagram

Model fit summary for the standardized model

The correlation values between the factors indicates a high level of significance (>0.05). Then the relationship between the variables and the factors are as indicated with the arrow, COX1

has a relationship of 0.54 with the CONTEXT factor, this implies that the COX1 variable causes a dimensional change to CONTEXT factor by 54%. i.e

$$\text{CONTEXT} = 0.54 \text{ COX1} + C_0$$

$$\frac{d\text{CONTEXT}}{d\text{COX1}} = 0.54$$

dCOX1

All other variables likewise relate as such to their subsequent factors. There is also a partial relationship between the variables within the CONTENT factor, CON1 with CON3 and CON 2,4 with CON3. This implies that the variables CON2,4 can be conjoined with CON3 to form a stronger variable within the CONTENT factor. The partial relation can be used as is without much effect to the fitness of the model. The variable COX3 exhibits a strong partial relation with the CONTEXT factor and a stronger full relation with the OUTPUT factor. It is therefore a variable that can be interlinked within the two factors or can be shifted fully into OUTPUT factor. The above model however, satisfies majority of the main model fitness tests as shown in the table below

FIT INDICIES	RECOMMENDED VALUES	STANDARDIZED MODEL RESULTS
Absolute fit indices		
Chi-Square value		9.58
DF value		8
P-value		0.227
Model chi-square (χ^2/DF)	<3	1.423
Root mean square error of approximation (RMSEA)	>0.05, <0.08	0.0481
Goodness-of-fit statistic (GFI)	>0.8	0.744
Adjusted goodness-of-fit statistic (AGFI)	≥ 0.95	0.891

Standardized root mean square residual (SRMR)	< 0.05	0.045
Incremental fit indices		
Normed-fit index (NFI)	≥ 0.95	0.97
Comparative fit index (CFI)	≥ 0.95	0.85
Parsimony fit indices		
Parsimony Goodness-of-Fit Index (PGFI)	>0.50	0.492
Parsimonious Normed Fit Index (PNFI)	>0.50	0.325

Table 14: measurement indices for standardized LISREL model

This model fits the data well. The χ^2 measure of model fit is 9.48 (df=8), which is too small to reject the null of a good fit ($p=0.227$). Additionally the RMSEA has declined to 0.0481, which is small enough (almost 0.05) to indicate a good fit. The unconstrained loadings are all statistically significant at the 0.05 level, having estimates that are more than twice the size of their standard errors. Therefore, we do not reject the null hypothesis that the above construct will fit the data.

4.7. CORRELATION ANALYSIS BETWEEN VARIABLES WITHIN FACTORS

4.7.1 Correlation Analysis between Relationships of computer leaning technology on the level of education and the evaluation/follow up and the financial/resource support to the operation

Correlation analysis was conducted to determine if there are any relationships between effect of instructor/ administrator tendency awareness and the evaluation / follow up on the ICT framework for teaching in the university

		Tendency influences towards the use of computer in teaching and learning	Financial support to adoption of computer technology in learning	Evaluation and follow up of the use of Computers in learning
Tendency influences towards the use of computer in teaching and learning	Pearson Correlation Sig. (2-tailed) N	1 30	.030 .875 30	.202 .285 30
Financial support to adoption of computer technology in learning	Pearson Correlation Sig. (2-tailed) N	.030 .875 30	1 30	.268 .152 30
Evaluation and follow up of the use of Computers in learning	Pearson Correlation Sig. (2-tailed) N	.202 .285 30	.268 .152 30	1 30

Table 15: measurement indices for standardized LISREL model

From the table above it is clearly evident that there is weak positive correlation between Instructor tendency on awareness on the use of ICT in teaching with the amount of follow up at $r=0.202$ however the level for significance was evident at $p=0.285$. Thus from the finding is clearly that for the success of the ICT learning technology to fully be in place in teaching, there is a need for follow up to all the existing framework laid within university couple with the awareness from the instructor/ administrator of the system. On the other side of financial support/resource avail to the University to fully support the use of ICT in learning and teaching and the follow up needed, it was also clearly observe that the rate of correlation was smaller however it was a positive correlation at $r=0.268$ coupled up with a week level of significance at $p=0.152$. Finally in the level of follow up and evaluation on the various framework laid up towards adaption of computers in teaching, it was notes that level of significance was at $p=0.875$ However it was noted that the level of correlation r , was lower with $r=0.030$ Thus from the finding it is ascertained that much as level of significance was lower the positive correlation mean that for any success of the system in teaching to be in place there need to be funding for its operation thus this can explain the reason as to why the use of Computer in teaching within the university haven't being success due to low funding towards it full operation This criterion can be summarized in the table below:

Range of coefficient(r)	Interpretation
1.0	Perfect positive correlation
$0.5 < r < 1.0$	High positive correlation
$0 < r < 0.5$	Low positive correlation
0	No correlation
$0 > r > -0.5$	Low negative correlation
$-0.5 > r > -1.0$	High negative correlation
-1.0	Perfect negative correlation

Table 16: Interpretation of Correlation Coefficients

Variable X	Variable Y	Pearson Correlation Coefficient(r)	Coefficient of Determination(r ²)
Tendency influences	Use of computer in teaching	0.202	0.040804
Financial support	Use of computer in teaching	0.268	0.071824
Evaluation and follow up	Use of computer in teaching	0.030	9×10^{-4}

Table 17: Summary of Correlation Results for the Study

Correlations Coefficients of Determination on cost, time and resource availability in adopting computer learning technology

Table 18: Interpretation of Correlation Coefficients

		Cost Reduction	Time reduction	Resource Availability
Cost Reduction using computer in teaching and learning	Pearson Correlation	1	-.067	-.028
	Sig. (2-tailed)		.724	.881
	N	30	30	30
Time reduction using Computer in teaching and learning	Pearson Correlation	-.067	1	.211
	Sig. (2-tailed)	.724		.262
	N	30	30	30
Resource Availability	Pearson Correlation	-.028	.211	1
	Sig. (2-tailed)	.881	.262	
	N	30	30	30

**, Correlation is significant at the 0.01 level (2-tailed).

*, Correlation is significant at the 0.05 level (2-tailed).

Variable X	Variable Y	Pearson Correlation Coefficient(r)	Coefficient of Determination(r ²)
Cost Reduction	Use of computer in teaching	0.211	0.044521
Time reduction	Use of computer in teaching	-0.067	4.489*10 ^{-0.3}
Resource Availability	Use of computer in teaching	-0.028.	7.84* ^{-0.4}

Table 19: Summary of Correlation Results for the Study

According to MathBits.com (2000-2012)

<http://www.mathbits.com/mathbits/tisection/statistics2/correlation.htm>, coefficient of determination is a measure used in statistical model analysis to assess how well a model explains and predicts future outcomes. The measure gives the proportion of the variance (fluctuation) of one variable that is predictable from the other variable. It is a measure that allows us to determine how certain one can be in making predictions from a certain model/graph. The coefficient of determination is the ratio of the explained variation to the total variation. The level of significance was at $p=0.01$, cost reduction is one of the major factor upon which adapting the use of Computers in teaching and learning is based on, it was noted that there was level of significance at $p=0.262$ which is far much greater than significance level $p=0.01$ between cost reduction in using computers in learning in form of relationship there as a low positive correlation at $r=0.211$. Time reduction in both teaching and carrying of task was also test upon it was noted that the level of significance $p=0.724$ which was far much higher signifies its greatest contribution in learning, by adopting computers in teaching and learning time allocated for carrying out all the task has been lowered to the minimal level hence allowing wider coverage in various area and task given to both the students and the staff however in the relationship with this factor had a weak negative correlation with other factors at $r= -0.067$ Finally resource availability towards using the computers in learning was also test to evaluate its level on significance as far as adopting computers in teaching was concerned the significance level was also very strong at $p=0.881$ however in its correlation at had a low weak negative correlation at $r=-0.028$.

4.7.2 Hypotheses Test Result from the factors which influences the use of computer in teaching in University

From the values of correlation coefficients, results are as follows:

H1: The results indicate a Correlation coefficient of 0.202 between tendency influences on the computer usage in teaching is positive and significant at the 0.01 level. Thus the null hypotheses is rejected

H2: The results indicate a Correlation coefficient of 0.268 between financial support and the adaption of computer usage in teaching is positive and significant at the 0.01 level. Therefore were reject the null hypotheses

H3: The results indicate a Correlation coefficient of 0.030 between evaluation and follow up towards the framework in adoption of computers in teaching is positive and significant at the 0.01 level. We therefore reject the null hypothesis that there is relationship between the follow up and computer usage

H4: The results indicate a Correlation coefficient of 0.211 between cost reductions in using Computers in teaching is positive and significant at the 0.01 level. Thus we reject The null hypothesis that there is no relationship

H5: The results indicate a Correlation coefficient of -0.067 between time reduction in carrying out a given task is negative and significant at the 0.01 level. Thus the null hypothesis has been approved that there is relationship between time reduction in carrying out a task using computer and its usage in teaching and learning process in the universities

H6: The results indicate a Correlation coefficient of -0.028 between resource availability and the adaption of computers in teaching within the universities is negative and significant at the 0.01 level. Hence we approve null hypothesis that there is relationship between resource availability and the use of computers in teaching within the university.

4.8 FINDINGS FROM INTERVIEWS TO THE ADMINISTRATORS (DEANS)

A number of interviews were conducted to the 5 deans of the various faculties in a bid to get their views and perceptions on the use of learning technologies to teach within the university. They all responded positively to the knowledge of learning technologies and their advantages towards improving the learning experience for both the students and their instructors however, out of the 5 deans interviewed, 3 of them felt that the support and policies for the full integration of learning technologies was on the low. Most times it is left for them to figure out the best approaches and tools to incorporate in class as computer learning technologies. The manner in which such resources are used and applied almost totally depends on their individual decisions. As a consequence, just general and basic computer learning tools are used to teach. The

interviews showed that little or no support is offered in form of guidelines that can be effectively applied to maximize the use of learning technologies as a teaching tool.

4.8.1 Content analysis

A few major questions in line with the research model were identified and the answers received were coded as shown below so as to study the trends especially from the administrators' point of view

MAIN QUESTION	CATEGORIZATION	CODES
What benefits do you think computer learning technologies impact to the university situation?	CONTENT (CONT) Efficient communication(EC) Faster learning(FL) Wide reference scope(RS)	CONT EC FL RS
What challenges are faced by the university system in adoption of computer learning technologies?	CONTEXT(CONX) Inadequate resources(IR) Expense in acquiring and maintenance(EA) Lack of intact guides and policies(GP)	CONX IR EA GP
Does the use of computer learning technologies prepare students in readiness for the job market? Explain	OUTPUTS(OUTP) Direct application of computer skills to the job market(CS) Improved research abilities(RA)	OUTP CS RA
What are your opinions towards the adoption of computer learning technologies within the university	PROCESSES (PROCS) Inclusion of well down policies within the curricula(GP) Use of advanced techniques(AT)	PROCS GP AT

Table 20: Interview Questions Coding

From the responses as represented above, most of the deans believe that the use of computer learning technologies improve on the quality of education by offering a wider scope of reference and ease communication between the lectures and their students that making the learning process more time effective. However, from the second category classification of the CONTEXT, the responses tend to show a need of guidelines and policies to integrate computer learning technologies within the learning process, three out of the five administrators interviewed claimed to use the technologies but on their own necessity and guidance most of which may not be pedagogical.

There was also a 100% agreement from all the interviewees on the advantages of computer learning technologies in preparing the students for the job market mainly by impacting the required skills required by the technological job market and improvement of research techniques. The OUTPUTS category is therefore tends to be a product of the CONTENT category thus showing some relationship between the two categories.

The PROCESSES category was intended to show the techniques of how the computer learning technologies have been applied within the context of teaching and learning, The major variables resulting from this category includes GP which is code for “lack of guidelines and policies”. This factor also reflects within the CONTEXT category which also shows some kind of relationship between the two major categories

4.9 Discussion of Research Findings

4.9.1 Discussion of resultant LISREL path diagram model

The results suggest that the correlations indicated within the proposed model diagram are viable. According to findings there is a statistical correlation between the learning CONTEXT and policies and the adoption of computer learning technologies in teaching. This means that context indicators such as technical infrastructure, university administration support, financial support, sensitization and policies and in general the stakeholders within the university contributes a lot to the systematic adoption of computer learning technologies to teaching. Similarly, a statistical relationship between the CONTENT and adoption of computer learning technologies means that

indicators such as student motivation, student understanding, student performance, improved teaching experiences support adoption and usage of computer learning technologies .

A relationship between PROCESSES and adoption of computer learning processes shows that indicators such as the methods of integration of computers to learning and the nature of technologies employed, presence of policies and procedures and availability of Computers and other infrastructure near users greatly contribute to the adoption of computer learning technologies to teaching. The results also shows that there is a relationship between the OUTPUTS perceived and adoption of computer learning technologies. This means that advantages and challenges experienced during the practical use and application of learning technologies such as cost reduction, increased student enrollment, increased student retention, financial implications and any general effects experienced by the institution in the process of adopting computer learning technologies all contribute to the adoption of such technologies in teaching. The correlation loop from CONTEXT to OUTPUTS is a positive one symbolizing that the context affects the outputs perceived from the use of computer learning technologies to teach, also positive correlation loops are identified between the CONTENT and PROCESS and between the PROCESS and OUTPUTS, this symbolizes that the process of integrating such technologies affects both the content and the outputs perceived.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a brief overview of the chapters and data findings on the adoption of computer learning technologies within Kenyan Universities. The conclusions and recommendations are drawn thereto. This chapter is structured into Brief chapter overview, conclusions, recommendations and areas of further research.

5.2 Brief Chapter Overview

The study aimed at analyzing the factors and extents to which learning technologies have been adopted to teach in Kenyan universities.

In the first chapter of this study, a brief overview of the use of ICT learning technologies is outlined showing the current emphasis the use of such technologies in education. There is also an overview of the benefits accrued to the use of learning technologies and the different ways in which these technologies can be applied for pedagogical and institutional improvement, as shown by researchers. Lasater (2007) noted that the use of technology aids in improving the understanding of concepts by learners. Much emphasis is directed to the use of learning technologies to teach in institutions of higher learning in Kenya. The optimal emphasis by the Kenyan government and educational stakeholders which does not rhyme with the wanting integration of such technologies in the Kenyan scenario is presented through an evaluation research done by Migwi (2009). It shows the low levels by which learning technologies have been employed to teach teacher educators in Kenyan institutions of higher learning. The need for an interpretive evaluation within the learning technologies in Kenyan universities is therefore evident as illustrated in the problem statement.

The second chapter offers a theoretical placement of the study, a critical review of various learning technology evaluations is done. Two most relevant interpretive evaluation frameworks are identified and explained in depth. The Contents, Interactions and Outcomes (CIAO!) framework developed by Scanlon et al. (2000) was reviewed and critiqued in the literature review. Another interpretive information systems evaluation model the Content, context and

Processes (CCP) was also discussed, the model was introduced by Pettigrew (1985). Symons (1991a) reviewed IS literature using the framework and proposed it for IS evaluation. By introducing the outputs factor within the CCP framework, a new research model was created for the purposes of evaluating learning technologies in this study. The conceptual constructs of the new model are well defined within this chapter though still on a theoretical basis as per the review.

Chapter three of this study describes the research methodology and design that was used to validate the research model identified in chapter two. Also the data collection which used a single-case study design to collect both qualitative and quantitative data for analysis in chapter four. Multimedia university of Kenya was used as the case for this study. Data collection was done by use of both questionnaires and interviews to provide a deeper insight on the study. Various tools were stated that were used in the validation of the research model and data analysis for an interpretive evaluation of learning technologies have also been explained in this chapter.

The research findings, data analysis and model validation is done in chapter four. A tabular and graphical representation of the descriptive statistics of the respondents is presented. Before using the new research model to collect data, its constructs from the theoretical conceptual model were validated. The major factors within the new research model therefore narrowed down in to CONTENT, CONTEXT, OUTPUTS and PROCESSES. For each one of them, the independent variables were identified and included within the new framework. So as to check the viability of the new research model, a standardization test was done. All the dependent factors and independent variables were coded and a Confirmatory Factor Analysis (CFA) was done using the Linear Structural Relations (LISREL) method and software. A final research model was arrived at after the factor analysis.

The CCP evaluation framework is commonly used to evaluate information systems within their existing contexts, it offers a broader perspective of the perceived impact of using the information system within an organization. After adding a new OUTPUT factor within the research model and standardizing it by performing a CFA, The model was then used to carry out an interpretive evaluation of the adoption of computer learning technologies in university teaching.

After various tests are done to the model and making sure that it fits the data collected, it is then adjusted to have the most important and determinant factors for the purposes of the study. The

different factors are then analyzed using SPSS statistical tool to show correlations between different independent factors towards the dependent factor. This therefore aids in drawing conclusions towards the hypothesis drawn in chapter one. Within this chapter, the interview documents were coded for analysis and analyzed accordingly. The analysis still based on the standardized and validated research model and constructs.

5.3 Conclusions

The study concentrated on determining the extent of adoption of Computer Learning technologies by these Kenyan universities, to what extent have the Universities adopted Computer Learning technologies processes and functions, how familiar and supportive is the leadership to the use of such, what are challenges that these Universities face while adopting Computer learning technologies. The findings were guided as per the major research constructs which consist of the CONTENT, CONTEXT, PROCESSES, and OUTPUTS. The constructs within the study model were guided by the research questions. The section below portrays how the research objectives were met in relation to the research model used.

5.3.1 To develop an evaluation framework for the use of computer learning technologies to teach in Kenyan universities

This was the first objective for this study. The critical review of two evaluation frameworks within the literature review lead to the conception of the new research evaluation model which is more interpretive. By adding an output construct within the Content, Context, and Processes (CCP) would enable the researcher to evaluate the outputs related to the use of learning technology within a learning context. A validation of the new model was done during data analysis as standardization and model fitness indices are done to the various factors so as to check the validity of the new framework. The tests using Linear Structural Relations (LISREL) software resulted to a combination and reduction of the independent variables within each factors

hence giving a standardized research model and hence a reliable framework for an interpretive evaluation of learning technologies within a learning context.

5.3.2 To investigate the effects/ impact on the use of using computer learning technologies to teach on students learning and understanding in Kenyan universities

This research objective focused on the achievement and benefit brought about by using computer learning technologies to teach in universities. From this objective, the Content factor is derived. The Content factor is geared towards assessing whether the learning technologies achieve their intended purpose. From the findings of the study, it appears clearly that the use of computer learning technologies has a positive impact on the motivation and understanding levels of students in a learning environment. This concurs strongly with Lasater (2007) whose study indicated that the use of technology aids in improving the understanding of concepts by learners. This objective was therefore achieved accordingly.

5.3.3 To determine the factors surrounding the use of computer learning technologies to teach in Kenyan universities

The context factor reflects within this objective. It concerns the environment within which the learning technologies exist. It is representative of the administrative environment and policies formulated to guide the use of computer learning technologies to teaching. Context is crucial and when developing any evaluation tool evaluators must find a way of taking it into account (Jones et al., 1996). From the findings of this study, it was evident that the administrators and lecturers were in agreement of the benefits accrued by using computer learning technologies to teach, factors such as reduced teaching time, decreased financial implications and better management practices were strongly agreed upon. However, the head of departments and lecturers admitted to have very little or no support or guide on the integration of computer technologies into the learning environment. They claimed to use them as per their judgment. No formal guidelines have been enacted to incorporate computer learning technologies in the existent syllabi which makes it a major drawback towards fully exploiting the benefits of computer learning technologies as a learning aid.

5.3.4 To investigate the effects of outcomes brought about by the use of learning technologies to teach in Kenyan universities

The overall results of using computer learning technologies to the institution is a major aspect when evaluating such technologies. The output factor within the research model focuses mainly on this objective. The main goal for any university is to prepare graduates for the job market, also to make this a reality, universities need to ensure optimal enrollment and retention of their students accordingly. This study shows that the use of computer learning technologies motivate students more and most administrators agreed that the use of computer learning technologies led to increased student enrollment, retention and better job-market skills.

5.4 Recommendations

The study recommends that university stakeholders ensure a proper integration of computer learning technologies for full exploitation of such. This is in order to ensure proper guidelines and policies that can be followed to fully enhance and exploit the benefits associated with the use of computer learning technologies to teach in Kenyan universities. Lecturers and support staff should also be well trained and equipped pertaining the best approaches for integrating computer learning technologies in the learning environment. The basic use of computers to research and communicate via online channels has been well exploited, however, the pedagogical influences to student motivation and understanding has not been fully utilized. Creation of models, computer simulations, computer games and virtual environments have been used to ensure better understanding in a learning environment, such strategies need to be embraced too to improve the use of computers as a learning technology.

Based on the findings of the study there is need for empowerment and awareness on the use of computer learning technologies. Therefore the various university education stakeholders and the ministry of education in Kenya need to fully integrate the use of computer learning technologies to teach in Kenyan universities.

5.5 Limitation of the Study

The study was carried out to identify the levels of use and factors surrounding the use of computer learning technologies in Kenyan Universities. A case study of Multimedia university of Kenya was used. The study was conducted within one Kenyan University that is representative of all Kenyan universities in terms of level of computer technology and ICT the generalization of the findings could be difficult to articulate.

The research encountered other challenges such as none cooperation by some respondents. However, the respondents had been assured of proprietary measures that the findings would be accorded and used only for academic purpose.

5.6 Suggestion for Further Research

This study was interpretive in nature in its evaluation of the use of learning technologies to teach in Kenyan universities. Various challenges that face the adoption of such technologies need to be researched on and studied accordingly.

Further research should be done on policies and procedures for adoption of computer learning technologies in institutions of higher learning.

The various learning technologies such as computer games, computer simulations and virtual environments also offer rich research areas in Kenyan universities

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APPENDIX I

An evaluation framework for the use of ICT technologies to teach in Kenyan universities Questionnaire

Case study of Multimedia University of Kenya

Introduction

Dear Sir/Madam,

My name is Mutuku Timothy Muoka , a student at the University of Nairobi undertaking Masters of Science in Information System and I present to you a self administered questionnaire concerning an evaluation framework for the use of ICT technology to teach in Kenyan Universities . The information given is only for research purposes. Please respond as honestly and spontaneously as possible

Instructions: Please tick (✓) appropriately

SECTION A: Bio-data of the respondents

1 Gender: Male Female

2 Marital status (tick where necessary)

a. Single b. Married c. Widow

Others (Specify).....

3. Age bracket (please tick)

a) 18-24 b) 25-30 years c) 31-35 years d) 36-40 years

e) 41-50 years f) 51-60 years

4. Level of Education

- i) Certificate ii) Diploma iii) Degree iv) Masters v) PHD
 vi) Others(Specify)-----

2. What is your position in the university

- i) Student ii) Faculty staff iv) Laboratory assistant staff
 v) Administrative staff

3. Length of engagement or study within the university

- Less than 2 years 2-4 years 5-7 years over 7 years

Section B: The effect /impact on the use of computer technologies to teach on students

(I) The following section should be filled by Students of Multimedia University

1) In the period of your study, have you ever used any of the following learning technologies? (Please tick where applicable)

- Computer applications Simulations and models
 The internet (World Wide Web, email, portals)
 Other (please specify).....

2. i) Does the use of computer learning technologies like computers motivates the class learning scenario? Yes No

ii) If yes, how-

ii) If No explain why.....

3. i) To what extent do you believe that computer learning technologies improves on the quality of educational experience
Large [] Moderate [] Small [] No change []

ii), If No change why do you think so?.....
.....

(II) The following section should be filled by either University administrator or Support staffs of Multimedia University

4. “The use of computer learning technologies in Multimedia University has lowered the cost of teaching and in turn improves the efficiency amongst both the students and the lectures” do you agree with this statement?

Strongly agree	Agree	Disagree	Strongly disagree

5. i) Do you believe that through use of computer learning technologies in teaching within Multimedia University has reduced the time of carrying particular learning activities
Yes [] No []

ii) If No explain further.....

6. The following list of statements relate to the use of computer learning technologies by instructors/lecturers. Please tick indicating against each of the statements accordingly

	True	False	Not sure
I feel comfortable with the idea of the computer learning technologies as a tool in teaching and learning			
If something goes wrong I will not know how to fix it			
The use of the computer as a learning tool excites me			
The computer is a valuable tool for teachers			
The computer learning technologies change the way students learn			
The computer is not conducive to student learning because it is not easy to use			
The computer helps students understand concepts in more effective ways			
The computer helps teachers to teach in more effective ways			

The computer learning technologies are not conducive to good teaching because they creates technical problems			
---	--	--	--

Section C: Factors surrounding the use of computer learning technologies to teaching Kenyan universities.(Multimedia University of Kenya)

(I) The following section should be filled by Students of Multimedia University

- 1 Do you own a personal computer (please tick)? Yes No
2. How many years ago were computers introduced for the first time in your University?
 0-2 years ago 3-5 years ago 7-9 years ago 10 years ago
 Not sure
3. How many computer labs are there in your University? -----
- 4 How many computers are there in each lab? -----
 0-10 11-20
 21-30 31 and above

(II) The following section should be filled by either the university administrator(s) as well as support staff of Multimedia University (tick where necessary)

6. Have you participated in professional development courses related to the integration of computers in teaching and learning? Yes No
7. Please indicate how much you agree or disagree with following statements in regards to their influence on computer learning technologies in teaching in the University

	Agree	Somehow	Disagree	Completely
The ICT coordinator encourages me to integrate computers in teaching and learning				
In faculty meetings, we frequently discuss the subject of integrating computers in the University Curriculum				
The technical support in my University is adequate				
The instructional support in my school is adequate				
The technical infrastructure in my University is adequate				

8. Basing on your personal opinion how influential the following factors are in regard to their effects / impact on the computer learning technologies on teaching in your University? Please indicate by ticking accordingly

	Very influential	Influential	Somehow influential	Not influential
ICT Competence				
Gender				
Teaching Experience				
Teacher workload				
Resource Availability				
Technical support				
Administrative support				

9. Please rate the validity of each of the following statements as regards to using computer learning technologies to teach (*Scale: 1-Very valid: 5-Very invalid*)

	Very valid	Valid	Moderate	Invalid	Very invalid
Student retention					
Increased student numbers					
Increased student performance rates					

Section D: To evaluate the use of computer learning technologies using a holistic evaluation framework.

(1) *The following section should be filled by Administrator as well as support staff of Multimedia University*

1“The use of computer learning technologies in Multimedia University has been fully exploited and has achieved the desired results as a learning technology” do you agree with this statement?

Strongly agree	Agree	Disagree	Strongly disagree

2 . Please rate the validity of each of the following statements as regards to computer learning technologies to teach at the university. (Scale: 1-Very valid: 5-Very invalid)

	Very valid	Valid	Moderate	Invalid	Very invalid
Improved instructional techniques					
Reduced teaching hours					
Replacing lecturer’s jobs and functions in class					

3. What support do you think the administration should adopt to improve the use of computer learning technologies to teach within the University? (Tick as appropriate)

- Instructor training
- Financial investment

- Curriculum integration
- Technological investment
- Others (Specify).....

Please indicate the level which you agree/disagree with the following statements based on the following rankings strongly agree, Agree, Neutral, Disagree, Strongly disagree

4 To what extent do you agree with the following aspect individual factors on the use of computer learning technologies as a learning tool

	Strongly	Agree	Neutral	Disagree	Strongly
Student's attitude towards computer learning technologies has an effect on their inclusion to teach					
Administrator's self-efficacy has an effect on the inclusion of computer learning technologies to teach					
Instructor's innovativeness has an effect on the inclusion of computer learning technologies to teach					
Computer applicability and Compatibility has an effect on the inclusion of computer learning technologies to teach					
software ability has an effect on the inclusion of computer learning technologies to teach					

(II) The following section should be filled by Students of Multimedia University

7. Basing on your personal opinion please indicate your level of usage of the following computer packages as part of computer learning technologies in your University

	I cannot use it	I can use it to a small extent	I can use it satisfactorily	I can use it well	I can use it very well
Word processing (e.g., Word)					
Databases (e.g., Access)					
Graphics (e.g., Paint, Photoshop)					
Multimedia authoring software (e.g., Hyper Studio)					
Presentation software (e.g., PowerPoint)					
Internet					
Concept mapping (e.g., Kid spiration, Inspiration)					

Email					
Publishing software (e.g., Publisher					
Webpage authoring software (e.g., FrontPage)					
Programming languages (e.g., Logo, C)					
Modeling software (e.g., Model-It, Stella)					
Micro worlds/Simulations (e.g., Stage cast Creator, Interactive Physics)					

Section E: To evaluate the effects of outcomes brought about by the use of learning technologies to teach in Kenyan universities

(To be filled by instructors and /or lecturers)

1. As an instructor do you perceive that computer learning technologies has had positive effect on the levels of education?

Yes [] No []

2. i) How do such effects influence your tendency to use computer learning technologies as an instructor/administrator

Encourage [] No much effect [] Discourage []

ii) Briefly explain your answer.....

3. Does the university offer any financial/resource in support of the use of computer learning technologies to teach?

Yes [] No []

ii) If “yes”, Please state in what way that the support is provided
.....

4. Has the university ever made any sort of evaluation or follow up on the use of learning technologies to teach?

Yes [] No []

If yes, in what way(s) has it been evaluated.....

APPENDIX II

**An evaluation framework for the use of ICT technologies to teach in Kenyan
universities Interview Questions
Case study of Multimedia University of Kenya**

Introduction

Dear Sir/Madam,

My name is Mutuku Timothy Muoka , a student at University of Nairobi undertaking Masters in Science in Information System and I present to you an interview questionnaire concerning an evaluation framework for the use of ICT technology to teach in Kenyan Universities . The information given is only for research purposes. Please respond as honestly and spontaneously as possible

INTERVIEW QUESTIONS

1. Have you ever heard of the term “Computer Learning Technology” or “Computer aided learning”? Yes [] No []

2. Of what benefits do you think Computer Learning Technology is impacting or will impact to the student, administrator and even the support staff of the University?
 - i)
 - ii)
 - iii)
 - iv)

3. What is your response (as an administrator) to the outcomes accrued from the use of computer learning technologies?

.....
.....
.....

.....
.....

4. Does the use of computer learning technologies prepare finalist students in readiness for the job market? Yes [] No []

If so explain briefly

.....
.....
.....
.....

4. In an attempt to incorporate Computer learning technology in the University system, what are some of the challenges faced by the University?

- i)
- ii)
- iii)
- iv)

5. Currently what are some of the areas or courses where you have fully incorporated the use of Computer Learning Technology in the University?

- i)
- ii)
- iii)
- iv)

6. What are some of the factors which influences the use of Computer Learning Technology in the University

i)

ii)

iii)

iv)

7. What do you think University should do to increase or improve the use of Computer Learning Technology?

.....
.....
.....
.....

8. Does the university face any infrastructural challenges in its quest to fully integrate the use of computer learning technology? Yes [] No []

If yes, which challenges?

i)

ii)

iii)

iv)

9. Where do you see Multimedia University in 5 years to come via implementing ICT policies toward incorporating fully computer learning technology in their system of teaching?

.....
.....
.....

10. In general what is your opinion towards adapting the use of Computer Learning Technology with the University as well as all higher learning institution in Kenya?

.....
.....
.....
.....
.....

APPENDIX III: Work plan

Project Work plan									
		20							
		14							2014
		M	Ju	Ju	Aug	Septe	Octo	Novem	Decem
		ay	ne	ly	ust	mber	ber	ber	ber
1	Initiate Project								
1.	Propose Project Title								
1									
2	Plan the Project								
2.	Forward Project Title for approval								
1									
2.	Project title approved								
2									
2.	Introduction, Literature review,								
3	Research Methodoly								
3	Defense of Milestone 1								
3.	Defend Milestone 1- Proposal								
1									
3.	Start Milestone 2								

2									
3.	Data collection Process								
3									
3.	Do Data Analysis								
4									
3.	Defense of Milestone 2								
5									
4	Summary- Report Writing								
4.	Final Defense- Milestone 3								
1									
5	Close the Project								

APPENDIX IV: Budget

MONTHS / ACTIVITIES	MONTH	MONTH	MONTH	TOTAL
	1	2	3	
	KES	KES	KES	KES
Literature review i.e. purchasing of relevant books and journals; internet and communication costs	20,000			20,000
Data collection i.e. printing of questionnaires and distribution costs		15,000		15,000
Data analysis and Report Writing i.e. reproduction costs			10,000	10,000
			TOTAL	45,000