ASSESSMENT OF THE STATUS OF E-LEARNING AS COURSE DELIVERY METHOD IN PUBLIC UNIVERSITIES IN KENYA

BY

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DECLARATION

This thesis is my original work and has not been presented for a degree or any other award in any other university.

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DEDICATION

This work is dedicated to my wife Alice Wanjiku and to my parents Mr and Mrs Murage for their love and moral support which kept me moving to the end.

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ABBREVIATIONS AND ACRONYMS

AVU:	African Virtual University
BLMS	Blackboard Learning Management System
CAA:	Computer Assisted Assessment
CAD:	Centre for Academic Development
CAL:	Computer Assisted Learning
CBT:	Computer Based Training
CD-R:	Compact Disk Recordable
CD-RW:	Compact Disk Rewriteable
CD ROM:	Compact Disc Read Only Memory
CMC:	Computer Mediated Conferencing
CML:	Computer Mediated Learning
CMS:	Course Management System
CPU:	Central Processing Unit
CRTs:	Cathode Ray Tubes
DEA:	Data Envelopment Analysis
DES:	German Development Service
DLI:	Digital Links International
DN:	Kenya's Daily Nation
DNS:	Domain Name Service:
DVB:	Digital Video Broadcast
DVD-R:	Digital Video Decoder Recordable
DVD-RW:	Digital Video Decoder Rewriteable
EAS:	East African Standard
ECSC:	Ethiopian Civil Service College
ESPL:	Patrice Lumumba Secondary School
FTP:	File Transfer Protocol
GIS:	Geographical Information Sciences
GoK:	Government of Kenya
HE:	Higher Education
HLI:	Higher Learning Institution
HTML:	HyperText Markup Language
HTTP:	Hypertext Transfer Protocol

IT:	Information Technology
ICT:	Information Communication and Technology
IMEP:	Instituto Médio Politécnico
IMM:	Interactive Multimedia
IPP:	Information Policy and Planning
ISP:	Internet Service Provider
ISPU:	Instituto Superior Politécnico e Universitário
JAB:	Joint Admissions Board
JKUAT:	Jomo Kenyatta University of Agriculture and Technology
KCCT:	Kenya College of Communications Technology
KENET:	Kenya Education Network
KESSP:	Kenya Education Sector Support Programme
KNUST:	Kwame Nkrumah University of Science and Technology
KTTC:	Kenya Technical Teachers College
KU:	Kenyatta University
LAN:	Local Area Network
LCD:	Liquid Crystal Display
LMS:	Learning Management Systems
NEPAD:	New Partnership for Africa's Development
MAC:	Media Access Control
MIS:	Management Information Sciences
MMUST:	Masinde Muliro University of Science and Technology
MSc:	Master of Science
ODEL:	Open, Distance and Electronic Learning
ODL:	Open and Distance Learning
OL:	Open Learning
OS:	Operating System
OSI:	Open System Interconnection
PC:	Personal Computer
PPP:	Point to Point Protocol
PSTN:	Public Switched Telephone Network
SLAs:	Service Level Agreements
TCP/IP:	Transmission Control Protocol/Internet Protocol
TEL:	Technology Enhanced Learning

TFT:	Thin Film Transistor
TMS:	Training Managements Systems
TUSK	Tufts University Sciences Knowledge
TV:	Television
UB:	University of Botswana
UK:	United Kingdom
UoN:	University of Nairobi
Univ:	University
URL:	Uniform Resource Locator:
USB:	Universal Serial Bus
VSAT:	Very Small Aperture Terminal
WAN:	Wide Area Network
WBT:	Web-Based Training
WWW:	World Wide Web

ABSTRACT

e-Learning is the acquisition and use of knowledge distributed and facilitated primarily by electronic means through the multi-media , telelearning , the flexible learning and the intelligent flexible learning models. This form of learning currently depends on networks and computers but would likely evolve into systems consisting of a variety of channels like wireless, satellite and technologies like cellular phones as they are developed and adopted. e-Learning may incorporate asynchronous or synchronous access and may be distributed geographically with varied limits of time. The central problem in this study was that despite the fact that e-Learning as a mode of course delivery in institutions of higher learning in Kenya has several positive attributes which include: high degree of interactivity between users, capacity to cater for high enrolment against the background of insufficient physical facilities, promoting education for the working population at low opportunity costs, and reducing administrative loads by making routine information and resources available online among others, the paradox was that the emerging body of literature globally and nationally indicate that e-Learning as a mode of course delivery is not being practically implemented effectively and efficiently. As a consequence, full benefits could be realized by expanding the implementation of e-Learning to meet the high social demand for education and training in Kenya public universities and this could eventually enhance the capacity of educational planners and university management in broadening the market of university courses. To this end, this study was designed to determine the status of e-Learning as course delivery method and assess the range of barriers faced by public universities in implementing e-Learning. The specific objectives were six fold: assess the e-Learning components applied and status of e-Learning infrastructure in public universities in Kenya ;identify the features that are associated with the current e-Learning in public universities in Kenya; establish costs involved in development and production of e-Learning courses, maintenance of e-Learning courses in presentation, storage and delivery including transmission of e-Learning courses and materials in public universities in Kenya; determine the benefits of e-learning course modules from both the demand and supply sides; identify the constraints faced by the public universities in implementing e-Learning; and propose possible strategies and interventions that can be applied to improve dissemination of course modules via e-Learning in Kenyan public universities. The study adopted an exploratory descriptive survey design. The units of sampling were the seven public universities in Kenya. From each sampling unit the researcher collected data from all ICT managers/e-Learning directors and university e-Learning technicians and purposively sampled members of the academic staff on the criterion of their specialized role in e-Learning course delivery. The study utilized questionnaires, interview schedules, direct observation and observation schedules for data collection. The instruments were piloted to determine the reliability using split half method. Validity was determined using experts opinion. Data analysis was done using both qualitative and quantitative approaches. The following conclusions have been drawn on the basis of results obtained from this study; universities make use of a variety of hardware in production, storage and distribution of the e-Learning courses. Universities endeavour to acquire the state of art hardware so as to be in line with changing technological trends; In reference to the software applied, it was concluded that universities make use of a variety of software. The use of assortment of software facilitates in performance and execution of the many e-Learning activities; The features of the hardware and software are custom made and support e-Learning activities; It was also found that different categories of staff are involved in development and transmission of e-Learning course modules; It was also concluded that, there are no students who undertake their courses purely via e-Learning rather what is applied is blended learning where both e-Learning and face to face sessions are utilized. In terms of the overall costs involved in production, development, storage, maintenance and transmission of the e-Learning course modules, it was found that the variation was not significant. The following recommendations were arrived at in the light of the study findings. e-Learning coordination to be restructured to be under ICT departments. It is also recommended that the server should be re-located to KENET offices. Students and staff should be encouraged and motivated to use the e-Learning systems through sensitization on matters related to e-Learning and its importance through seminars and training workshops. All lecturers should be trained and exposed to writing e-Learning materials and content development tools. Lecturers should be sponsored to e-Learning conferences and establish a directorate to specifically handle e-Learning issues.

CHAPTER ONE

1.0 INTRODUCTION AND BACKGROUND TO THE STUDY

In this chapter, background to the study is explained and the problem statement given. The purpose of the study, the objectives, research questions, theoretical framework and conceptual framework are also given.

1.1 Background to the Study.

e-Learning is the acquisition and use of knowledge distributed and facilitated primarily by electronic means through the Multi-media , Telelearning , the Flexible Learning and the Intelligent Flexible Learning Models. This form of learning currently depends on networks and computers but will likely evolve into systems consisting of a variety of channels like wireless, satellite and technologies such as cellular phones as they are developed and adopted. e-Learning may incorporate synchronous or asynchronous access and may be distributed geographically with varied limits of time. It incorporates application of ICT in performing various institutional activities including course delivery geared towards achieving the goals of an institution. e-Learning platforms provides a high degree of interactivity between users. e-Learning incorporates the following: Software applications, Presentation technologies, The World Wide Web, Computer Mediated Conferencing – CMC, Multimedia materials, Computer Assisted Assessment – CAA, Computer Based Training – CBT, Audio conferencing and Videoconferencing, Streaming Audio and Video, Simulations, Visualization tools and Email. e-Learning incorporates providing outreach for programmes, expertise and support from established faculties to students in remote areas with no or limited educational infrastructure. It allows access to programmes, expertise and support that is available at an institution through creating new opportunities for cost-efficient programmes with partner institutions and experts abroad. The mode reduces administrative load by making routine information and resources available online and improving the communication with and support of students. e-Learning allows access to digital libraries and resources on the World Wide Web. The mode reduces assessment and marking loads through the use of “Computer Assisted Assessment

and making it easier to maintain and update contents, lectures and programmes. e-Learning ensures quality assurance, quality management and accountability in teaching and learning, (Leopold Reif Hoffmann & Reif Consultants, 2007).

e-Learning can also be defined as the process of learning via computers over the internet and intranets. e-Learning is also referred to as web-based training, online training, distributed learning or technology for learning (Hall, 2000). e-Learning process meets three criteria: a geographical distance separates communication between the teacher and the student; the communication is two way and interactive; and some form of technology is used to facilitate the learning process. Economic, social and technological forces continue to change the global economy, and the way of life in organizations and the world. Specifically, these forces have and continue to revolutionize teaching and learning in organizations. Urdan & Weggen, (2000) contend that there is the need for different learning models due to skills gap and demographic changes and demand for flexible access of lifelong learning. Karon (2000) discussed the convenience factor of well-designed computer-based training which is part of e-Learning by saying that, "any well-designed computer-based training- whether it's networked based or delivered via the Internet – is more convenient than traditional instructor-led training or seminars".

Online training was classified as an all encompassing term that refers to all training done with a computer over a network, including an institution's intranet, the institution's local area network, and the internet, (Footstall, 2000). Online training is also known as net-based training. It constitutes just one part of e-Learning and describes learning via internet, intranet and extranet. It can extend from a basic to a sophisticated online learning programme. Sophistication would include animations, simulations, audio and video sequences, peer and expert discussion groups, online mentoring, links to materials on corporate intranet or the web, and communications with corporate education records. Footstall (2000) added that this usually implies linkage to a computer. This

makes learning to be a life-long process, that could be accessed anywhere at any time to meet a specific need or want. e-Learning also covers a wide set of applications and processes, including virtual classrooms, and digital collaborations, audio/video tape, interactive TV, and CD-ROM.

Development of life-long skills in Kenya is still out of reach for many people due to limited physical and financial capacity in the Kenyan higher education institutions. As a result, the institutions can only admit a fraction of the population willing to pursue advanced training. In a bid to respond to the high social demand for life-long development of skills, some institutions in Kenya have started open distance and e-Learning programmes meant to increase access. The task is imperative for attainment of human and economic developmental targets. Life-long development of skills lead to increased life-long production, improved social amenities, improved social perception, support of reformed political systems, alleviation of poverty and innovativeness (Shank,2007).

1.1.1 Generations of e-Learning

e-Learning is often discussed in terms of generations as its forms and methods have been evolving over years. Most often, generations of e-Learning has been discussed in terms of the dominant technologies and pedagogy it utilizes in teaching and learning (Vilaseca, 2004). Table 1.1 presents the various forms e-Learning in terms of its evolvement from the correspondence model which was the first generation model to the intelligent flexible learning model which is the fifth model of e-Learning.

Table 1.1 Generations of e-Learning

Models of Education and Associated Delivery Technologies	Flexibility		Advanced Interactive Delivery
	Time	**Place**	
FIRST GENERATION - The Correspondence Model			
• Print	Yes	Yes	No
SECOND GENERATION - The Multi-media Model			
▪ Audiotape,	Yes	Yes	No
▪ Videotape,	Yes	Yes	No
▪ Computer-based learning (eg CML/CAL/IMM),	Yes	Yes	Yes
▪ Interactive video (disk and tape)	Yes	Yes	Yes
THIRD GENERATION - The Telelearning Model			
▪ Audioteleconferencing,	No	No	Yes
▪ Videoconferencing,	No	No	Yes
▪ Audiographic Communication,	No	No	Yes
▪ Broadcast TV/Radio and Audioteleconferencing	No	No	Yes
FOURTH GENERATION - The Flexible Learning Model			
▪ Interactive multimedia (IMM) online,	Yes	Yes	Yes
▪ Internet-based access to WWW resources,	Yes	Yes	Yes
▪ Computer mediated communication	Yes	Yes	Yes
FIFTH GENERATION - The Intelligent Flexible Learning Model			
▪ Interactive multimedia (IMM) online,	Yes	Yes	Yes
▪ Internet-based access to WWW resources,	Yes	Yes	Yes
▪ Computer mediated communication, using automated response systems,	Yes	Yes	Yes
▪ Campus portal access to institutional processes and resources	Yes	Yes	Yes

Source: (Katz & Oblinger, 2000)

For many years, universities with a significant commitment to distance and open education institutions have been at the forefront of adopting new technologies to increase access to education and training opportunities. Table 1.1 on page 4 shows models of education operations evolvement through the following four generations: first, the Correspondence Model based on print technology; second, the Multi-media Model based on print, audio and video technologies; third, the Telelearning Model, based on applications of telecommunication technologies to provide opportunities for synchronous communication; and fourth, the Flexible Learning Model based on online delivery via the internet. Although many universities are just beginning to implement fourth generation distance education initiatives, the fifth generation has already emerged based on further exploitation of new technologies. The fifth generation of distance education is essentially a derivation of the fourth generation, which aims to capitalize on the features of the internet and the Web. The fifth generation is the Intelligent Flexible Learning Model (Katz & Oblinger, 2000)

1.1.2 The Emerging Issues in ICT in Public Universities in Kenya

The worldwide spread and evolution of Information and Communication Technology (ICT) during the last 40 years has been rapid and challenging to top corporate and ICT management. During this period, new industries have emerged, new structures have been created, new problems have cropped up, new responsibilities have been defined and relocated, and new management strategies have been introduced. New systems have been, and are being developed, which profoundly affect the ways in which organizations operate leading to the need for innovative organizational and ICT management. The effects of the new technology are profound and have been felt far and wide, including public universities in Kenya. The rapid infusion and diffusion of Information and Communication Technology into public universities in Kenya raise important management issues for top management and the technical staff. Although ICT is employed in organizations to gain an advantage over old ways of doing things (Lucas, 2007), modern approaches to course delivery have the advantage of meeting the high social demand for higher education, (Sprague, Ralph, Barbara &

McNurlin, 1993). This situation is evident in the case of public universities in Kenya, which have an increasing enrollment. Based on information gathered by the researcher from numerous internal reports, committee reports and from national newspaper reports complaints from academics, practitioners and opinion leaders show that a lot needs to be done as far as expansion of application of e-Learning is concerned in particular since there is a rising enrollment and few physical facilities.

The lack of sufficient trained and experienced technical personnel to manage, control and maintain e-Learning means that the utility value, effectiveness and efficiency, cannot be ascertained effectively. The lack of theoretical knowledge and practical management, control and maintenance skills of ICT staff leads to these units being managed, controlled and maintained virtually on *trial and error* basis. Looijen, (1998) points out that in the field of education, i.e. universities and high schools, a lack of standards, and pseudo 'standards' that differ enormously, introduce real challenges to achieve a decrease in the capacity and effort required to use the e-Learning facilities optimally. In addition, all the ICT policies in all the public universities embrace the adoption and promotion of e-Learning due to the advantages associated with this mode of learning.

1.1.3 Possible Advantages of e-Learning in Higher Education

Students would get into the practice of making choices between different modes of learning and decide to take courses through ordinary classrooms and lectures, or by distance education through e-Learning. An enabling environment is created for lecturers to develop, design and deliver course content and other materials to thousands of students by use of e-Learning.

Individuals would be allowed to manage their own learning whether on the job or not and choose the activity to engage in or to spend more time on like maybe: *watching pre-recorded videotapes*,

VCDs or DVDs, accessing the internet general materials, accessing the digital libraries, or chatting with students and instructors by use of the Learning Management Systems.

In particular, e-learning would empower women, whose responsibilities as mothers and caregivers often tie them down and deny them the opportunity to learn but with e-Learning, they would promote their skills from the confines of their homes by accessing university programmes, obtain degrees and acquire knowledge that can help improve their lives and of their families. Women comprise two-thirds of the world's illiterate people who, naturally, suffer the brunt edge of unemployment in an increasingly competitive job market (Come*r,* 2000).

1.2 Statement of the Problem.

Several initiatives towards finding solutions to e-Learning service provision and e-Learning service support in Kenya have been attempted on a number of occasions but have largely had little real effect. Documentations reviewed by the researcher reveal that e-Learning is being applied in public universities in Kenya whereas not much is going on actual application of e-Learning as course delivery method. From the documents reviewed, there existed a discrepancy on what is documented and publicized and what is actually going on the ground hence this study is set to bring out the actual status of e-Learning in public universities in Kenya in a bid to improve application of e-Learning as course delivery method. The above statement on application of e-Learning in Kenya, led to the formulation of the research problem which justified this research into verifying the actual status of e-Learning in public universities in Kenya, in the hope that full benefits can be realized in expanding implementation of e-Learning as a course delivery method.

1.3 Purpose of the Study

The purpose of the study was to assess e-Learning as a course delivery method in public universities in Kenya. The study also aimed at proposing possible strategies and interventions that can be applied to improve dissemination of course modules via e-Learning in Kenyan public universities.

1.4 Objectives of the Study

The objectives of the study were to:

i. determine the e-Learning components applied and status of e-Learning infrastructure in public universities in Kenya ;
ii. identify the features that are associated with the current e-Learning in public universities in Kenya;
iii. establish costs involved in development and production, maintenance of e-Learning courses in presentation, storage and delivery including transmission of e-Learning courses and materials in public universities in Kenya;
iv. determine the benefits of e-Learning course modules from both the demand and supply sides;
v. identify the constraints faced by the public universities in implementing e-Learning;
vi. Propose possible strategies and interventions that can be applied to improve dissemination of course modules via e-Learning in Kenyan public universities.

1.5 Research Questions

i. Which hardware components do you apply in your institution in transmitting e-Learning course modules?
ii. Which software is applied in transmitting e-Learning course modules in your institution?
iii. What are the features of the hardware and software, which are applied in course delivery via e-Learning in your university?
iv. What categories of staff are involved in development and transmission of the e-Learning course modules in your university?
v. What is the student enrollment in e-Learning courses and which facilities do they use to access e-courses?

vi. What are the barriers that are faced or likely to be faced by public universities in Kenya in dissemination of e-courses

vii. What are the costs involved in setting up and maintaining e-learning hardware and software; costs involved in development, production, storage and maintenance of the course modules?

viii. Which are the strategies and interventions that can be applied to improve dissemination of course modules via e-Learning in Kenyan public universities?

1.6 Limitations of the Study

Limitations are those elements over which the researcher has no control. In the course of conducting this study, it was not be possible to control the attitudes of the respondents. This might have had effects on the research findings since the respondents may just have given the feedback to impress the researcher. The instruments themselves constituted a limitation in that no particular instrument can be regarded as totally absolute.

1.7 Delimitations of the Study

Delimitations are those elements the researcher can control. They are those characteristics selected by the researcher to define the boundaries of the study. In this study the researcher has made conscious exclusionary and inclusionary decisions regarding the sample including such information as geographic location, the variables studied, the theoretical perspectives, the instruments and the generalizability. This study is delimited since it was conducted only in public universities and the conditions in them are unique and different from other institutions like private universities, middle level colleges and other institutions like secondary schools, hence, the findings of this study can only be generalized to the rest of the nation's institutions with caution. The study delimited itself to verifying the status of e-Learning as a course delivery method in public universities in Kenya and other e-Learning activities in universities were not investigated apart from course delivery.

1.8 Assumptions of the Study

Values that are shared by people in a group and that tend to persist over time (organizational culture) which represents the behavioural patterns or style of an organization that employees are automatically encouraged to follow by their fellow employees are assumed that they do not affect adoption of change and implementation of e-Learning in public universities in Kenya. It was also assumed that the respondent's feedback and assessment parameters during data collection i.e (very good, good, average, below average, poor) gave uniform results.

1.9 Significance of the Study

The study will enhance educational planners and university management in appreciating the feasibility and expansion of e-Learning in the delivery of course modules in education and training for life-long skill development and broadening the market of the university courses. This will lead to viable plans on how the university objective of promoting skills and knowledge could be promoted and thus promoting access to training in the various courses.

The study will also lead to an understanding of the status of e-Learning which would lead to devising viable ways of improving delivery of courses in public universities in Kenya via e-Learning. In addition, the study would also show a reflection of the costs required to setup e-Learning programmes. Finally, the study would contribute to the existing knowledge on application of e-learning in course delivery. It would also act as future reference source for stakeholders in education.

1.10 Theoretical Framework

Social Constructionism Theory

Social constructionism as developed by Durkheim at the turn of the 21st century is based on the idea that people learn best when they are engaged in a social process of constructing knowledge through

the act of constructing artifacts for others (Fisher, 1989). The term “social process” indicates that learning is something which is done in groups. From this point of view, learning is a process of negotiating meaning in a culture of shared artifacts and symbols. The process of negotiating meaning and utilizing shared artifacts is a process of constructing knowledge. Since people are not blank slates when they enter the learning process, they need to test new learning against old beliefs and incorporate it into existing knowledge structures. Part of the process of testing and negotiating involves creating artifacts and symbols for others to interact with. People create artifacts and in turn negotiate with others to define the meaning of those artifacts in terms of a shared culture of understanding.

This relates to e-Learning with the first indication in the interface of e-Learning delivery platforms. e-Learning makes use of the tools in an interface that makes the learning task central. Courses can be organized by week, topic, or social arrangement. Additionally, e-Learning adoption support, a content model that encourages instructors to upload a lot of static content as well as focusing on tools for discussion and sharing artifacts. The focus isn’t on delivering information; it’s on sharing ideas and engaging in the construction of knowledge and this design philosophy makes a uniquely teacher-friendly package that represents the educational tools for effective learning.

The technological theory of production and a method of decomposition of the rate of output in terms of labour and capital services

It is assumed that performance of production system can be described with the three variables: amount of production equipment – capital stock K and 'consumption' of labour L and capital services S. It is shown that the production function can be specified as the known Cobb-Douglas production function, in which capital services S stands instead of capital stock K, while the state of the production system itself is specified by the technological index α. Capital stock plays the role of the means through which the labour resource is substituted by capital services. A method for estimating of capital services and the technological index due to known time series of the output Y, capital stock K and labour L is developed which allows one to separate contributions from production factors and structural change. The conventional neo-classical approach to the problem of production distinguishes between influence of production factors and something, which is connected with change (the structural or technological change) of the production system itself. The neo-classical solution of the problem, classically exposed in a famous work by Cobb and Douglas (1928), is to consider output Y to be determined by production equipment measured by its value K (capital stock) and work of labourers L measured, for example, in working hours per year. From a material point of view the process of production is a process of transformation of raw materials into finished and semi-finished items, semi-finished items into other semi-finished and finished items and so on, until the finished items, which can be used by man, are made. A method of producing is technology that determines, first, what one needs to produce, that is the material side of the process of production. Different appliances are invented to perform transformations. This is a material realization of technology, i.e. production equipment. The applied technology determines that one needs a certain amount of efforts of human being (L) and a certain amount of capital services S to produce something, while human efforts can be substituted by capital services. The technological index can be computed by examining technology applied in production of certain level of output.

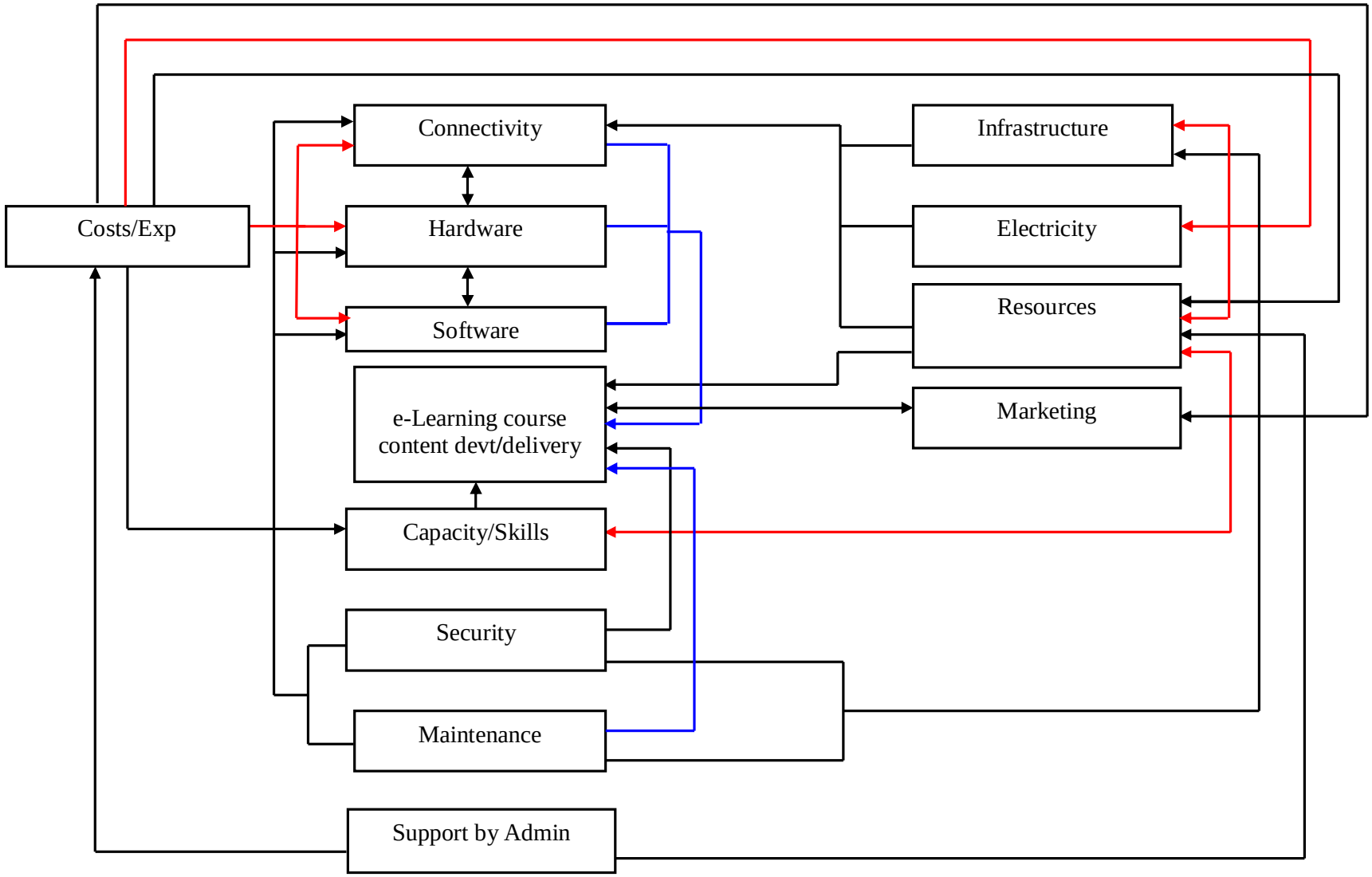
This can be examined for instance by the choice of the hardware, software, connectivity and any other form of technology applied in production.

Systems theory

A system is a set of interrelated parts that work together for a common goal(s). Every system has the following characteristics. Goals are the targets to be achieved by the system. All parts of the system should work towards achieving the same goals. For example, an educational institution pursues normative goals which imply the values it aims at imparting to the students. In this study the goal is course delivery via e-Learning. Subsystems are the interrelated parts of elements that form the system. For example, in an educational institution parents, teachers/ lecturers, and students are parts of the school system. A system works in a hierarchy of relationships. All sub systems work interdependently. Subsystems in this study entail management, capacity skills and information and communication technology inputs. Harmony denotes that all the elements in a system work in harmony to achieve the common goals. In achieving successful e-learning course delivery the lecturers, hardware, software and management must work in harmony. Feedback implies the avenue through which a system evaluates its success level in achieving the objectives. Interface is the boundaries between the subsystems. In social systems boundaries are mainly imaginary. For example, the boundary between teachers/ lecturers and students. System boundaries ensure that a specific task is performed at a specific point. A system operates within an environment referred to as the supra system. For example, an education institution as a system operates within a supra system known as the Ministry of Education or Ministry of Higher Education. A system must interact with the environment in order to survive. According to Kumar (2006) the supra system receives the product of an open system which becomes a part of the functioning of the environment. Information is the input from the environment that is processed by the system in order to produce an output. Growth denotes a system is dynamic and as such it grows either through transformation or diversification. The concept of input-transformation-output links the management control system to the environment. Organizations obtain inputs from their

environment, transform them into outputs, and then send the outputs back into the environment. In order to design a good management control system, it is imperative that we have a proper understanding of where in the environment to find the right inputs, what kind of transformation to perform, and what output to produce. In line with this study the researcher considers e-Learning as course delivery method in public universities in Kenya where there are the inputs, the process and output which is e-Learning courses.

1.11 The conceptual model



The arrow points to the dependent variable

Key: Independent V. →
→ Dependent V.

Figure 1.1: Factors leading to e-Learning course development and delivery

The model is classified as conceptual since it is based on the concept of human skill development through creation of a social network. The model is descriptive since it will be used to describe e-Learning in public universities in Kenya. The model illustrates the input mix in development and delivery of e-Learning courses.

In the model, connectivity is dependent on hardware, software, costs/expenditure, security and maintenance. Hardware and software dependent on each other and also on intended connectivity. Capacity/skills is dependent on costs/expenditure and resources. e-Learning course content development and delivery is dependent on connectivity, hardware, software, capacity/skills, resources, marketing and maintenance. e-Learning infrastructure is dependent on security, maintenance and resources. The interrelationships of e-Learning course development and delivery components are described in Figure 1.1. Hardware includes: PCs, Printers, Servers, Data projectors/ screens, TVs, Decoders, Digital Cameras, Telephone (VoIP). Software includes Operating Systems, Ms Office, e-Mail and Internet, Information and Learning Management Systems. Electricity includes any supply of electric current for powering appliances in the universities and it includes hydro-electric power, generators, solar power and batteries. Electricity is dependent on costs/expenditure. Infrastructure is dependent on resources, security and maintenance and it includes container or Lab Room, Server room/space, desks, chairs and Power point projectors. Connectivity is dependent on infrastructure, electricity, resources, software, maintenance and security and it includes, WAN, LAN, Internet/ISP, Content Distribution. Capacity (Skills) is dependent on resources and costs/expenditure and it includes Trainers skills, lecturers ICT skills. Security includes physical and electronic security. Resources are dependent on support by administration and costs/expenditure and include solution architecture, technicians and education specialists and content includes set of e-Learning courses.

1.12 Conclusion

This chapter laid the foundation for this thesis by giving an outline of the problem related to e-Learning application in public universities in Kenya as a course delivery method. The limitations of the study and the key assumption(s) were stated. The chapter stated the research problem and formulated the research objectives and questions. A statement of the purpose of the study, theoretical and conceptual framework were stated. Based on this foundation, the thesis proceeds with a detailed description of the review of related literature in the chapter two, research methodology in chapter three, presentation, discussion and interpretation of research findings in chapter four and summary, conclusions, recommendations and suggestions for further studies in chapter five.

1.13 Definition of Significant Terms

Computer Assisted Assessment: Used to assess student learning both formatively and summatively

Computer Based Training: Also more popularly known as Computer Assisted Instruction or Tutorials, "Computer Based Training" is a process of learning that is not executed in the traditional manner one would find in the educational environment. It involves learning using software applications installed in computers. The student is, in effect, trained by the computer

Computer Mediated Conferencing: Computer-mediated Conferencing (CMC) involves individual members of a learning community composing text at a computer that is networked, the text may be read and responded to by others in that community, wherever they are and at any time. Contributions are held on an archived network. Participants read and respond to items as they choose, or as procedures agreed within the group require

Courseware: Another word for electronic course material, both online material and offline material.

eBook: Shorthand for electronic book.

e-Learning: Is the acquisition and use of knowledge distributed and facilitated primarily by electronic means through the Multi-media , Telelearning , the Flexible Learning and the Intelligent Flexible Learning Models.

E-mail: E-mail (short for *electronic mail*; often also abbreviated as *e-mail, email* or simply *mail*) is a store and forward method of composing, sending, storing, and receiving messages over electronic communication systems. The term "e-mail" (as a noun or verb) applies both to the Internet e-mail system based on the Simple Mail Transfer Protocol (SMTP) and to intranet systems allowing users within one organization to e-mail each other.

Hypertext: Hypertext is text that is not linear constrained. Instead it contains links to many other texts.

Intranet: Accessible only within an institution

NetMeeting: Videoconferencing software from Microsoft.

Navigation: The process of moving from one node to another through the hypertext web.

Offline: An adjective for describing the state of an object connected to the Internet. If the object is offline, it is not accessible through the Internet.

Online: An adjective for describing the state of an object connected to the internet. If the object is online, it is accessible through the Internet.

Simulations: A computer simulation, a computer model or a computational model is a computer programme that attempts to simulate an abstract model of a particular system.

Computer simulations have become a useful part of mathematical modelling of many natural systems in physics (Computational Physics), chemistry and biology, human systems in economics, psychology, and social science and in the process of engineering new technology, to gain insight into the operation of those systems. Traditionally, the formal modelling of systems has been via a mathematical model, which attempts to find analytical solutions to problems which enable the prediction of the behaviour of the system from a set of parameters and initial conditions. Computer simulations build on, and are a useful adjunct to purely mathematical models in science, technology and entertainment.

Status: It is the state of e-Learning in relation to The Multi-media, Telelearning, The Flexible Learning and The Intelligent Flexible Learning Models

Videoconference: Known as a *videoteleconference* is a set of interactive telecommunication technologies which allow two or more locations to interact via two-way video and audio transmissions simultaneously. It has also been called visual collaboration and is a type of groupware. It differs from videophone in that it is designed to serve a conference rather than individuals.

CHAPTER TWO
REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter reviews literature on e-Learning, the rationale for e-Learning and the various ways in which e-Learning is implemented. The issues arising from application of e-Learning in Kenyan public universities are also discussed. An examination of research findings on application of e-Learning in teaching and learning in general are also reviewed. The aim was to establish the research gaps, some of which this study intended to address. Additionally the literature review has been conducted to address the following research questions:

i. Which hardware components do you apply in your institution in transmitting e-Learning course modules?
ii. Which software are applied in transmitting e-Learning course modules in your institution?
iii. What are the features of the hardware and software, which are applied in course delivery via e-Learning in your university?
iv. What categories of staff are involved in development and transmission of the e-Learning course modules in your university?
v. What is the student enrollment in e-Learning courses and which facilities do they use to access e-courses?
vi. What are the barriers that are faced or likely to be faced by public universities in Kenya in dissemination of e-courses
vii. What are the costs involved in setting up and maintaining e-learning hardware and software and costs involved in development, production, storage and maintenance of the course modules?

viii. Which are the strategies and interventions that can be applied to improve dissemination of course modules via e-Learning in Kenyan public universities?

2.2 Delivery Systems and Technologies

This section aimed at addressing research questions number one and two. These research questions are, “Which hardware components do you apply in your institution in transmitting e-Learning course modules? and “Which software are applied in transmitting e-Learning course modules in your institution?.

Several options are available to the training managers, interested in implementing an e-Learning solution within their organizations. Though they might differ in details such as bandwidth, user interface, and interactivity, the technologies used to deliver e-Learning instruction have begun to converge around common technology standards and the delivery infrastructure known as the internet. Approaches to online learning vary from those that use the internet as little more than a distribution mechanism for simple text and graphics content to new technologies that allow live, two-way interactivity over dial-up connections, to science fiction-like virtual reality simulations (Barron, 2000b). This section provides an examination of the various technology systems.

2.2.1 Text and Graphics - HyperText Markup Language (HTML)

Perhaps the most basic delivery method used in e-Learning is through static HTML pages. Hall (1997) describes this medium as consisting mostly of text and- graphics web pages that utilize the basic capabilities of the World Wide Web. These courses tend to be primarily informational in nature, and represent most of the e-Learning courses that are currently available. One advantage of using intranet-based training and performance support is that cross-compatibility of the HTML language. All that is needed to access e-Learning courses is a web browser, and it also frees an organization

from being tied to any one supplier's proprietary system. Text and graphics based courses include many different types, such as courses that exist purely on e-mail, bulletin board/online discussion forums, and static HTML web pages that consist of text and graphics. This delivery format is often used as a supplement to traditional face-to-face instruction (Hall, 1997). While these courses represent the bare minimum in terms of utilizing the capabilities of the web, designing interactivity into text and graphics courses can augment their instructional effects. One common way in which this is accomplished is through the use of multimedia.

2.2.2 Multimedia

Multimedia training is a type of computer-based training that uses two or more media, including text, graphics, animation, audio (sound/music), and video. In practice, multimedia utilizes as many tools as is practical to produce a colourful, engaging programme delivered via the computer. A typical programme allows users to control their progress and pace through the course so everyone can learn at his/her own speed. Multimedia languages such as Java are becoming increasingly used to deliver e-Learning. However, multimedia is not without its drawbacks. Limited bandwidth presents a special problem when designing internet-based education with multimedia. Connection speeds can be slow and downloads can be long due to factors which trainers often have little control over. Barron (2000c) explains that “the visually rich, highly interactive medium and sophisticated authoring tools of the CD-ROM era have been replaced with the bandwidth constraints of the Internet and authoring limitations of HTML. Combing the advantages of each seems to be the best solution, and can provide the learner with far more interactivity (retrieved September 2009, from http://www.caicbt.com/hybridinfo.html). One way to help make this manageable is by creating an infrastructure that supports collaborative learning.

2.2.3 Collaborative Technologies

With the hype that e-Learning has recently received, organizations may rush to implement a solution without considering some important instructional components. Collaborative tools are often some of the tools sorely missed in some e-Learning offerings (Hall, 2000). Collaborative tools facilitate interaction and communication among online learners. e-Learning programmes that omit collaborative tools rob the learner of a well-rounded learning experience. Collaborative learning networks may consist of many technologies, such as bulletin boards, conferencing software (i.e. Microsoft's NetMeeting), and streaming media (i.e. RealPlayer). The purpose of these technologies is to create an environment that fosters the students' learning through interactivity. In a collaborative paradigm, instructors take on more of a facilitator role than a lecturer role, often mentoring virtual teams as they work through problems and questions that relate to the instructional objectives for the course. Horn (2000) has put together a chart comparing web-based training (WBT) to collaborative learning network.

Section 2.2 identified several hardware components and software applied in dissemination of course modules vial e-Learning for instance bulletin boards, conferencing software which includes Microsoft's NetMeeting and streaming media (i.e. RealPlayer). Nevertheless the section didn't specify the various hardware components like routers, bridges, satellite dishes, wireless cards, hubs and fibre optic connection. In addition, components applied in collaborative learning environments, designing online and WebPages and designing multimedia course materials were not specified. Accordingly, these gaps have been addressed in this study in chapter four, section 4.1.

2.3 Information and Communication Technology (ICT) and Education

This section aimed at addressing research question number three. The research question is, “What are the features of the hardware and software which are applied in course delivery via e-Learning in your university?. These are the features associated with e-Learning in course delivery.

2.3.1 Online Interaction and Communication

The role of the learner is changing. Traditionally, students meet instructors face-to-face in a physical setting, with e-Learning, students meet instructors virtually via electronic media. Certain learner-related issues must be discussed when considering an e-Learning platform in any organization. Another form of empowering online learners is by providing multiple forms of interaction and communication opportunities. Davie & Wells (1998) relate that a sense of mastery and community are two elements that support personal power. While a sense of mastery entails acquisition of skills for participation in the electronic classroom, a sense of community is the feeling of belonging to a supportive group of individuals working together to make meaning, combat mutual isolation as distance learners, to provide support for and challenge one another and to learn to value the contributions of oneself and others. As facilitators, trainers are encouraged to increase interaction with students because instructors that are aware of their students as unique individuals are in a strategic position to support a sense of mastery and community. Another empowering opportunity is synchronous and asynchronous learner- learner interaction. Collaborative learning techniques driven by the course content and process or informal techniques established by the students and enhanced by collaborative technologies are excellent mediums for interaction and communication. Soo and Bonk, (1998) in asking experts to rank types of interactions found that asynchronous learner - learner interaction was rated the most important type

of interaction. Soo and Bonk, (1998) however, also note that technology seems to be the factor that enables and constrains the learning we want to instill in these online environments. Overall, learning styles, attitude towards using technology, online learner skills and online interaction and communication are some important factors that need critical consideration when planning, designing and implementing an e-Learning system.

2.3.2 Participation and Interaction

Communication and interaction among learners in an educational or training course is a very important component of effective instruction. Interaction allows students to learn from one another and from the instructor. Thompson, (2000) suggests that procedures for out of class communication between learners and instructor are important, because students are potentially and geographically dispersed in e-Learning courses. Special attention must be focused on building interaction and communication into course design. In a study of a university distance learning course, Smith (1998) discovered that the interpersonal relationships and interactions of learners affect the distance learning experience. He suggested that instructor-to-student and student-to-student interactions are critical components of the e-Learning experience. Thomas, (2000) relates that potentially inadequate levels of human interaction should be considered as a critical factor in the success of technology-based learning. Development of strategies for reducing the psychological distance and increasing interaction between participants in e-Learning courses is very important. The need for communication and interaction can be analyzed from two primary perspectives, learner-to-learner and learner-to-instructor. Thompson, (2000) also discusses the importance of social presence in e-Learning. Social presence is defined as “the degree to which an individual is perceived or experienced as a “real” person.” Thompson goes on to suggest that the instructor ability

to create a high level of social presence significantly contributes to instructional effectiveness and learner satisfaction. Additionally, social presence can impact motivation and learning. The integration of real-time discussions and chats will help to better facilitate learner-to-learner and instructor-to-learner communication.

2.3.3 Learning Environment

Technology-based learning methodologies require a focus on the learners' environment. The ease with which the leaner can navigate through the learning environment affects the amount of learning that occurs as well as the learners' level of satisfaction with the course. A web-based course that is difficult to navigate is less likely to be satisfactory to users. According to Thomas (2000), success in technology-based learning programme is based on an orientation to the learner not the instructor. A strong focus on the learner and the learning environment is a shift from traditional instructional design and development techniques. When designing e-Learning courses, lecturers should consider the following questions:

i) What is the theoretical approach to learning that guides the design of the learning environment?

ii) Does the learning environment support opportunities for student groups to discuss and work with the material?

iii) Is the learning environment well-organized? Is it easy to navigate? Are there clear pathways to locating necessary information? If there are different parts, are the functions and uses of each clearly identified?

iv) Are there different ways to use the environment, including the possibility to make choices about the kinds and levels of learner control?

v) Are a variety of perspectives presented for the concepts taught? Are students encouraged to critically evaluate information regardless of whether that information is presented as images, sounds, or text?

vi) Within the structure of the learning environment, are opportunities provided for student to build their own links between different types of information?

2.3.4 Interface Design

Online education and training is one of the most promising delivery methodologies associated with e-Learning. Organizations stand to gain many benefits associated with e-Learning. Decreased travel costs, just-in-time learning and higher retention through personalized learning are just a few of the potential benefits, (Urdan & Weggen, 2000). However, when delivering training via e-Learning, there are some special design concerns. Selecting a delivery technique or combination of techniques is of the most important of these concerns. e-Learning delivery techniques fall into one of the two categories, synchronous or asynchronous. Synchronous course delivery is real-time, instructor led on-line learning, in which all learners are logged on simultaneously and communicate directly with each other. Examples include virtual classrooms, audio/video conferencing, and two-way live satellite broadcast lectures (Urdan & Weggen, 2000). Asynchronous course delivery is a learning event in which learners cannot communicate without time delay. Examples include self-paced courses over the internet or CD-ROM, streamed audio/video web presentations, online chats and discussion groups, e-mail, and video tapped classes (Urdan & Weggen, 2000). User interface design is important whether delivering training synchronously or asynchronously. User interface design refers to the overall look and feel of the programme that allows learner to access information (Hall, 1997). Identifying what

navigational tools are most user-friendly and where to place information are concerns associated with the design of the user interface.

2.3.5 Measuring Learner Achievement

The goal of any learning activity is for learning to take place. A common way to measure the effectiveness of instruction is to measure learner achievement. Measuring learner achievement in e-Learning environments requires special attention. Chute (1999) relayed the strategies and procedures used to assess the traditional trainee needs to be modified to fit the e-Learning environment. In a study of asynchronous e-Learning, Neal & Ingram (1999) also indicated that there are special issues related to obtaining online feedback. A key aspect of some e-Learning applications, such as CD-ROM and web-based applications is that it allows for personalized instruction. Instructors can be informed about different learners' instructional objectives (Brogan, 2000). Learner achievement may be based on different learning objectives. For example, one learner's objective may be to learn in order to pass a test, while another is simply trying to refresh basic memory, yet another learner may want to learn how to do a new task on the job. The type of objective must be considered when developing measurement and assessment approaches. Hudspeth (1997) suggests that "data to judge learner progress can be derived from responses to: direct questions, directions to demonstrate, integrate, or otherwise show learning; project outcomes; and a variety of guided opportunities." Quizzes, examinations, team and individual projects, as well as written assignments, can all be used in e-Learning courses.

Section 2.3 identified various features associated with e-Learning, for example online interaction and asynchronous learner – learner interaction. However this section didn't address other features associated with e-Learning. These features include; ease of

access to online facilities, online evaluation and aspects of e-evaluation, accuracy of information exchange via e-Learning, reliability and durability of ICT, completion of courses on time, lecturer-lecturer interactivity and ease of access to computer facilities, hence these gaps have been addressed in this study in chapter four, section 4.2.

2.4 Global Issues in e-Learning

This section aimed at addressing research question number six, "What are the barriers that are faced or likely to be faced by public universities in Kenya in dissemination of e-courses?. This was geared towards identifying the global barriers towards adoption and implementation of e-Learning.

Around the world, e-Learning is becoming popular, especially among higher education institutions (universities). Many highly ranked universities have either already deployed e-Learning systems that are fully operational, or they are in a process of deployment where e-Learning-based and non e-Learning-based educational environments co-exist. It is also possible to find virtual universities (Barron, 2000c).

The world is transforming into a global village with the rapid development of information and communication technology, (Wegner, 1997). The ability to compete globally is dependent on the innovation, the skill and the knowledge of a learning organization and its people. Globalizing corporate training is crucial to the success of global business strategies. When institutions move training into a global arena, the biggest challenges are the worldwide variations in social, cultural, political and economic circumstances (Wellins & Rioux, 2000). Different languages, education systems, learning/teaching styles, government regulations, and infrastructure are examples of these variations. To adapt training to multicultural settings requires a new paradigm that includes an understanding of the deeper psychology of culture and the unique differences that culture bring to a global workplace. The four global e-Learning issues are: Cultural, social differences, language and technological issues. First, culture

definitions and dimensions of cultural variation were reviewed. Individualism and collectivism was used as a framework to discuss cultural differences. Interaction and communication styles and learning/teaching styles were used to discuss concrete cultural differences. Instructional design paradigms, social issues such as education, political, and religious differences, language and technological issues in global e-Learning were also reviewed (Kemper, 1998). These factors pose both benefits and challenges which impact differently in the implementation of e-Learning.

This section stated global challenges in general as cultural, social differences, language and technological issues. However the section didn't address constraints especially from both the demand and supply sides. In addition specific barriers were not addressed for instance; high costs involved in implementation, lack of interest among users, poor management of computers and lack of clear e-learning policy. Consequently, these gaps have been addressed in this study in chapter four, section 4.5.

2.5 Organizational Culture

This section was also aimed at addressing research question number six, "What are the barriers that are faced or likely to be faced by public universities in Kenya in dissemination of e-courses?.

Organizational culture is critical to the fruitful inception, growth and success of e-Learning in any organization. Kotter and Hesket, (1992) posit that it is helpful to think of organizational culture as having two levels that differ in terms of their visibility and their resistance to change. At the deeper and less visible level, Kotter & Hesket (1992) state that culture refers to values that are shared by people in a group and that tend to persist over time. At the more visible level, culture represents the behaviour patterns or style of an organization that employees are automatically encouraged to follow by their fellow employees. These assumptions encompass an organization's basic philosophy and worldview, and they shape the way the environment and all other events are

perceived and interpreted. Values, behaviour and assumptions combined with organizational leadership nurture the bond and identity that unite the members of organizations.

This section didn't address all the barriers related to implementation of e-Learning especially in higher education institutions hence this study addressed these gaps in chapter four, section 4.5. The section also failed to give the possible suggestions of overcoming this organizational culture constraint which leads to resistance to change and rebellion to adoption of new methods and technologies. Therefore these gaps have been addressed in this study in chapter four, section 4.6.

2.6 Economics of e-Learning

This section aimed at addressing research question number seven, "What are the costs involved in setting up and maintaining e-learning hardware and software and costs involved in development, production, storage and maintenance of the course modules?

From an economic perspective, e-Learning is characterised by profound changes that modify the behaviour of all economic agents. The changing trends explain an economic change that can be framed within a wide context, that is the emergence of the knowledge based economy. The development of this new scenario in education is characterised by rapid knowledge creation and easy access to knowledge, conditions that generate greater efficiency, quality and equity (Foray, 2004). The evidence for the advent of a knowledge-based economy is seen in the increase and improvement of knowledge-intensive activities throughout all industries of the economy more than in the continuous expansion of a specialized productive sector (Eliasson, 1990). The key differences in economic dynamics from the economies of earlier periods can be identified in the quality improvement of the production factors through a process based on the creation of new knowledge and ideas and their incorporation in physical and human capital. In general terms, this transformation process is based on a technological

revolution that is the digitalisation process. It is built upon a dynamics of spatial and temporal market expansion that is globalisation and it feeds back according to the changes of the patterns of demand of families and the society. This process has a clear through-line that is the intangible value of the economic activity that, in other words, is the progressive consolidation of a new knowledge-based economy. ICT is not the only causal factor in the global knowledge economy but it is clear that with ICT the knowledge- based economy has found a suitable technological base because there has been a clear interrelation between the upsurge of knowledge-intensive activities and the production and diffusion of ICT (Foray, 2004).. Digital technologies are now consolidated as one of the necessary instruments to develop network activities and increase knowledge in the economic sphere. The complex interaction between the emergence of digital technologies and their production is profoundly transforming education output. ICT has become a key component of this economic transformation, with the rise of a new production sector that extends its synergetic effects not only to other branches of activity, but also to all other economic activities.

ICT is the technical paradigm on which the current dynamics of the industrial revolution is based. A consensus has emerged that the diffusion and the productive use of ICT through its effects on knowledge creation and transfer across industries can be situated at the material basis of the educational expansion. The main driving forces behind this are a combination of the speed of technological change and product improvement in semi conductors and the continuing fall in their prices. Falling IT prices have provided important economic incentives for the effective diffusion of digital technologies among the different industries in the economy. This rate of price decline is a key component of capital costs, and it can be explained by the impact of rapidly growing stocks of computers, communication equipment and software. This

leads to the following main conclusions, first, in terms of output, gross output growth, as well as intermediate input growth and value-added growth can be explained by a set of relatively small industries that produce information and communication technology, which are, computers and office equipment, electronic components, communication equipment and computer services and service industries (Eliasson, 1990).

Second, in terms of capital services, the majority of industries have responded to declines in relative prices of capital which is a direct externality from ICT-producing industries and have shifted their investment patterns to ICT assets, a fact that is showed by the faster growth in ICT assets than in non- ICT assets, and by the growing share of ICT capital in total capital services; the rapid acceleration of ICT capital services is a widespread phenomenon that has benefited almost every industry, especially those within the ICT using sector.

Third, in terms of labour, the productivity growth has been accompanied by major changes in the allocation and composition of the workforce since there is a positive trend in labour quality which is explained by the rise in average levels of educational attainment. The age profile of workers has also changed, with young workers receiving premium rates closer today to the more experienced workers than in the past. This empirical finding is consistent with the hypothesis of a skill-biased technical change and the existence of complementarities between ICT inputs and young workers. Therefore, these results show the effects of the ICT revolution on labour markets. There is a link between productive uses of digital technologies and labour composition in particular ICT-producing and ICT-using industries show an increasing demand for ICT skills, which has been associated with expansion of the education industry (Vilaseca, 2004).

The amount of money and effort that has to be spent on e-learning is high. In addition to the initial e-learning system installation costs, there are ongoing maintenance, management and content development costs. This section didn't specifically address costs involved in development, production, maintenance, storage and delivery of e-Learning courses and materials including transmission. Consequently these gaps of the various costs were addressed in this study in chapter four, section 4.3.

2.7 Strategic Importance of e-Learning

This section was meant to address research question numbers eight, "Which are the strategies and interventions that can be applied to improve dissemination of course modules via e-Learning in Kenyan public universities?

The present and projected needs of educational organizations amidst today's global trends, communicate the viability and strategic value of e-Learning. This section addresses the strategic importance of e-Learning. Urdan & Wegen (2000) identified the knowledge-based economy, the paradigm shift in the way education is viewed and delivered, and huge knowledge gaps as significant trends that have given rise to e-Learning. The increase in complexity and velocity of the work environment brought about by technological changes are major issues that have fueled the demand for e-Learning. Mcrea (2000) presented the shift from the industrial to the knowledge era, rapid technological change, the ever shortening product developmental cycles, lack of skilled personnel, enterprise resource planning, and migration towards a value chain integration and the extended enterprise as being prominent contributors to the e-Learning value chain. Information technology is driving change everywhere. Thus, every executive, in every industry, must embrace the pace and dynamics of the information technology industry. Jobs, business processes, companies, and even entire industries face elimination or digital transformation. This means that customers will be

gaining both tangible (quality and cost) and intangible benefits (information, control, relationships) while they contribute more value to the system. Digital knowledge reduces the time and financial costs of information and coordination. It is economically feasible for large and diverse sets of people to have the information they need to make safe decisions in near real time. As companies digitally transform their businesses, knowledge and training become rapidly obsolete, just-in-time training becomes a basic survival need, and identification of cost-effective ways of reaching a diverse global workforce becomes critical. Flexible access to life-long learning is highly desired. Mcrea (2000) add that managing organizational competency, providing employees with competency roadmaps, distributing latent knowledge within the organization, aligning business objectives and learning outcomes, and extending learning to value chain partners are bottom line e-business issues. Along with the e-business forces, Urdan & Weggen (2000) relate that there are several factors that facilitate the strategic importance of e-Learning. Internet access, for example, is more demanded both at home and work. Advances in digital technologies have and continue to enrich the interactivity and media content of the web. Increasing bandwidth and better delivery platforms make e-Learning feasible and attractive. Technology standards, which facilitate compatibility and usability of e-Learning products, are emerging.

2.7.1 Strategies for improving implementation of e-Learning

This section discusses various strategies for improving application of e-Learning in dissemination of course modules.

2.7.1.1. Blending

The movement to blend classroom approaches with e-Learning is growing. Instructional designers for e-Learning courses are finding that blending, or live e-Learning, is often done to enhance the quality of the learning experience. Blending

refers to an online learning course that is held at a specific time (Hall, 2000). Many components of blending are synonymous with those discussed earlier in the Collaborative Technologies section. Instead of viewing e-Learning from a polarized spectrum of either web-based training or instructor-led training, the various training alternatives now allow for subtler options. Decisions can be based on the cost of bringing learners together, which parts of learning are best served by classroom vs self-instruction, and what is needed to ensure that individuals complete the course.

2.7.7.2 Authoring Tools

Authoring tools provide a way to create content. Varieties of different methods exist to author the content used in e-Learning and vary in their approach and degree of difficulty. Many of these have been touched on earlier in the delivery systems component, such as HTML. The development of training and performance support in HTML and its derivatives using traditional tools is efficient and easy, compared to the development of computer-based training on CD-ROM (Curtin, 1997). Many authoring tools are available and frequently used in e-Learning content creation such as Macromedia Authorware and Dreamweaver among others. Some provide simple features and offer drag and drop interfaces for designing content. Others require programming in HTML, Java, or other languages (retrieved September 2009, from http://www.elearningmag.com/issues/may00/cover.htm).

2.7.7.3 Training and Learning Management Systems

Training Managements Systems (TMS) sometimes referred to as Learning Management Systems (LMS), form the infrastructure of an e-Learning system. TMS are a dynamic platform that supports the tracking of users (learners), assessing performance, deployment of content, providing administrative functions such as access to user records, as well as environments (McCrea, 2000; Domingo, 1999).

The Learning management system (LMS) software application is a web-based technology used to plan, implement, and assess a specific learning process. Typically, LMS provides an instructor with a way to create and deliver content, monitor student participation, and assess student performance. It may also provide students with the ability to use interactive features such as threaded discussions, video conferencing, and discussion forums.

LMS manages the delivery of self-paced, e-learning courses. The LMS enables one to publish courses and place them in an online catalog and/or assign courses to learners. Learners log into the LMS using a browser and launch courses (Dagron, 2001).

2.7.7.4 Portals

"Learning Portals are web sites that provide a combination of courses, collaboration and community. Initially set up with ecommerce for the individual purchaser with a credit card, most portals have plans to offer credits of some type for multiple registrations from a single organization" (retrieved December 2009, from http://www.internetconnect.net/~bhall/portals/). The most likely winning model for e-Learning portals will be the aggregators who create courses from multiple content creators. Around the different approaches, several strategies are being developed for implementing these various technologies into the online learning medium. Vendor solutions range from do-it-yourself content development to all-in-one turnkey packages. Training portals offer outsourced e-Learning solutions to businesses that do not have the expertise or resources to develop the programme themselves. As Hall (1999) mentions above, a given learning portal may have multiple content providers, and may in turn be a content provider for other portals. This again raises the issue of

inter-operability between these many providers. Portals can also be seen from a different perspective as representing the end user interface of the e-Learning system. The portal can function as an entry platform for the course content itself, as mentioned above, and for other features such as training management systems and authoring environments. It is important for the portal to be well-organized, easy to navigate, and personalized to the learner, if possible (McCrea et al, 2000).

Section 2.7 addressed strategies of improving dissemination of courses via e-Learning, for instance advancing digital technologies, enriching interactivity and media content of the web and increasing bandwidth and better delivery platforms to make e-Learning feasible and attractive. Other strategies addressed include improving dissemination of e-Learning course modules through blended learning, making use of various authoring tools to make the courses user friendly, application of Learning Management Systems (LMS) and portals in course delivery. Nevertheless the section didn't address the challenges faced by both the course developers and students in application of these e-Learning tools. Consequently these challenges have been identified in chapter four, section 4.5. In addition the section failed to address strategies that are related to higher education institutions. Therefore these strategies have been addressed in this study in chapter four, section 4.6.

2.8 Review of e-Learning Applications

This section reviews literature on e-Learning applications in various projects. These applications are in operation and are related to the research questions of this study, hence there was need to assess their experiences, successes and gaps. Additionally, it's the gaps which were found in the review of literature of these projects that this study endeavoured to address.

The review of literature on each of these projects aimed at addressing research questions numbers one, two, three, four, five, six and seven by evaluating hardware components applied in transmitting e-Learning course modules, software applied in transmitting e-Learning course modules, features of the hardware and software which are applied in course delivery via e-Learning, categories of staff that are involved in development and transmission of e-Learning course modules, student enrollment in e-Learning courses and the facilities they use to access e-courses, barriers that are faced or likely to be faced in dissemination of e-courses and the costs involved in setting up and maintaining e-learning hardware and software and costs involved in development, production, storage and maintenance of the course modules.

2.8.1 Kalafrica - An African- European Research Initiative on Technology for Learning (Technology Enhanced Learning (TEL) in Africa)

To support technology for learning in Africa, it is important to build a research base that has been generated by African research projects as well as being informed by worldwide research. Research is a form of inquiry which enables us to learn from experimentation.

Building research capacity in TEL involves developing a resource of: people who have research expertise in TEL, tools for carrying out research in TEL (e.g language, research instruments, and methodologies), tools for communicating the research (which include papers etc). Kalafrica aims to: Support African researchers in TEL with a particular focus on building a community of research students, discussion of key papers in the field, creating an on-line archive of relevant papers, peer group support for writing papers (for members of Kalafrica network) (Rutherford, 2001).

The project supports Ph.D students and peer learning through participation in peer learning activities, research and writing process. It enables the development of supervision and communication skills. In addition, peer learning practices create a professional and social community for the candidates. However, in order to enable the candidates' enculturation into the discipline, active engagement of the senior staff members and especially of the candidates' supervisors is required" (retrieved August 2009, from http://www.noe-kaleidoscope.org/group/kalafrica). There is a need to re-conceptualize postgraduate pedagogies both theoretically and in practice by supplementing individual supervision with more collaborative group-based approaches. Peer-learning activities are not only crucial to students' academic development but also their future working life" (Lucas, 2007). It is apparent that e-Learning components applied in TEL, features associated with e-learning in TEL and the constraints encountered were not addressed in the review of literature of this project, hence this study addressed them in chapter four, sections 4.1, 4.2 and 4.5 respectively.

2.8.2 E-Supervision: Experiences with MSc Supervision on a Distance Using Online Communication Tools (International Institute of Geo-information Science and Earth Observation (ITC)- Enschede, The Netherlands

International Institute for Postgraduate Training in the Netherlands is facilitating training for economically and technologically less developed countries. Its core activities involve education / training for diploma courses, postgraduate diploma courses, degree courses, short courses, refresher courses, joint education courses and distance education courses. ITC also promotes research and development through conducting training in research projects and Ph.D studies. The institute also conducts e-supervision which is defined as the supervision on a distance of M.Sc students during their individual research fieldwork and thesis writing period using online communication tools. e-supervision plays an important role in ITC's joint educational

programme. The M.Sc Course includes, International M.Sc course for Natural Resource Management and Sustainable Management of natural resources with the modern technology of geographic information systems (Weinstein, 2000).

In collaboration with ITC is Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi, Ghana and International Institute of Geo-information Science and Earth Observation (ITC) in Enschede, The Netherlands. M.Sc Supervision on a Distance involves ITC supervisor and KNUST supervisor, ITC supervisor and student, ICT infrastructure in Ghana, Digital Library and Blackboard® LMS. ITC supervisor and student include online chat, Skype®, e-mail and telephone. The students are trained on research, solving problems with software applications. The experience from the collaboration reveals difficulty in keeping in touch with their students online on a regular basis, insecurity about communications with the students and difficulty in visual explanation (Rowlands, 2003).

During fieldwork and thesis writing, supervision is conducted by one scientific staff member KNUST, one scientific staff member from ITC. ITC and KNUST supervisors are supposed to have regular online contact and keep each other informed about student's progress. Communication is mostly through e-mail. The experiences reveal very little online communication among ITC and KNUST supervising scientific staff and the roles and responsibilities of the two supervisors were not well-defined, leading to uncertainty and unbalanced supervision. Some possible explanations for this are most of the supervisors did not know each other, most ITC staff had never been in Ghana, research proposals prepared in ITC and KNUST supervisor to take over in Ghana and task division was not clear. Course coordinators for both ITC and KNUST were contacted in case of problems and important roles (Salmon, 2006).

There exists an ICT Centre with 200 computers with internet connections on the campus of KNUST, faculties and student guesthouses are equipped with internet facilities, there is the application of GIS Learning Management Software and students are advised to buy their own laptops. The experiences show that ICT facilities are relatively good, there was internet connection though very slow and unreliable and also there was the problem of daily power-cuts.

ITC Digital Library is a specialised scientific library on Remote Sensing and GIS (Geographical Information Sciences). It facilitates access to licensed electronic resources such as databases and electronic journals, photocopies of parts of books or journal articles. The experiences reveal very positive impact about the support and services of the ITC Digital Library. This is a Virtual Learning Environment Blackboard® for review of lectures and course material, data uploading (remote sensing data), communication with fellow students in Enschede, the Netherlands. The experiences indicate that access to Blackboard® was problematic and not all documents were available for external students. The conclusion is that communication is crucial for good e-Supervision between course coordinators, supervising staff (ITC and KNUST), students and staff and students and fellow students (Rutherford, 2001). It is evident that, in this project the e-Learning components applied and the constraints encountered were not addressed, hence this study addressed them in chapter four, sections 4.1 and 4.5 respectively.

2.8.3 The Development of a Sustainable e-Learning Project for Dispersed Communities in Rural Canada

The goal of this project is to provide educational opportunities for senior students in small rural high schools that are comparable to those expected by urban students in big high schools and also to ensure economies of scale in utilization of resources. The project is sustained through teaching in different and between electronically-linked sites, enhanced range of subjects for students, inter-institutional and intra-institutional collaboration, implications for teachers (e.g flexibility), implications for students (e.g goal setting), new teachers work in both traditional (closed) and networked (open) learning environments, virtual and actual classes and integration virtual and actual classes (Scholten, 2004). Cybercells (Actual and Virtual) are also applied in this project. A cybercell is a face-to-face group whose members extend their discussion to include virtual visitors. The cybercells are for pre-service high school teachers which facilitate open learning structures and digital intranets. They facilitate collaboration in learning circles to critique recent internship experiences, building shared realities for understanding, providing opportunities for teachers to discuss their work (and potentially collaborate), providing opportunities for students to discuss their work (and potentially collaborate), mutual understanding, knowledge-building, serve as digital structures (intranets) to complement physical structures (schools). Cybercells – link virtual and actual learning (Stevens & Stewart, 2005). It is clear that the e-Learning components applied and the constraints encountered were not addressed, hence this study addressed them in chapter four, sections 4.1 and 4.5 respectively.

2.8.4 Research Induction; Blended Learning Event in Uganda and Zambia:

The approach of the project is to build an online post-course discussion website using the Moodle Course Management System (CMS). Moodle is a computer-based system

designed to build online courses. It can be used as a learning platform for courses on any topic, it offers the possibility to run ***social*** courses (which can support discussion between participants), it uses two very powerful tools for such discussion: the discussion forum, and the online chat room.

Discussion forum refers to a forum like a message board for one's thoughts, and where readers of those thoughts can add their own thoughts in response to the message. One can go to the message board at a convenient time and put up a poster with the message one wants the intended audience to know about. However, the only people that will see the poster are those who choose to travel to the location where the poster is. This is why one should put the poster in the right place. For anything one posts in the discussion, others are free to respond to it. This is great for getting feedback on one's ideas. Messages to a discussion forum can be posted at any time and this is very convenient, because many times, our best ideas don't come to us at the most convenient times. Others can choose to read one's messages whenever it is convenient for them, and respond at a convenient time as well and readers can reflect and respond. Different discussion forums address different issues and every discussion forum has a descriptive title informing one of its contents, so one should make sure messages are posted to the appropriate forums. For online forums, the descriptive names of the forums should give one a fairly good idea of where one wants to spend time (Peté & Fregona, 2004).

Chat feature is like talking on the telephone, except, one *writes* what one wants to say, instead of talking. This can easily become a "conference call" in the sense that many people can be talking together at once. The main difference between forums and chats is that when chatting, the message recipient is there to "take the call" and as soon as one sends a message, the recipient sees it and replies to it. Once the chat is over, it is

over: *no record* of the conversation but depending on very specific settings, it may be possible to keep archives of past conversations. Remember, individual(s) wishing to "chat", must be accessing the discussion site at the *same time* in that you can be in your respective cities or countries, but you must be at the discussion site. To ensure the site provides insight on topics of interest, a post-course site idea is introduced midway through a two-week course and discussion includes types of issues the participants would like the site to address and use of discussion forums and online chats. The whole idea of a post-course discussion site was introduced to the participants as follows: a *news forum* (to be able to share news of general interest - upcoming seminars, topic-based and discussions), *a chat room* (to be able to chat with fellow students and lecturers). The site has been monitored since it was launched in November 2006, and the findings are: This initial attempt at keeping participants in touch, despite proximity, did not experience as much traffic as a discussion site would in an ideal case. On the positive side, participants were able to get over the initial hurdle of the fear of working with a web-based application. It is hoped that, this familiarization may incite the participants to venture into new areas, such as distance courses, which are increasing in popularity in African countries (Lucas, 2007). This section aimed at evaluating the e-Learning components applied, features associated with e-learning, benefits they experience and the constraints encountered in this project. It is found that the e-Learning components were not addressed, hence this study addressed them in chapter four, section 4.1.

2.8.5 Increasing Access and Reducing Costs: Consolidation and Management of the Bandwidth Consortium; African Virtual University

With increased access, universities can provide course and content delivery through e-Learning, research and collaboration at a national, regional, continent and across

continents, accessing electronic resources, academic management of courses, communication, providing Africa with the potential to actively engage and participate in building the knowledge economy (Shank, 2007).

Problems of internet in African universities include the limited bandwidth available at most African universities; almost never dedicated, frequent service outages and very slow speeds, cost of bandwidth is prohibitively high, limited access to fiber on the continent though fiber has had little or no impact on lowering bandwidth prices on the continent thus does not provide an immediate viable option. The challenges identified entail purchasing equipment, customs and clearance causing undue delays, integration with existing equipment, lack of proper/adequate bandwidth management, Local Area Networks redesign and implementation, payment of bandwidth recurring charges, VSAT licensing due to regulatory issues in some countries and maintenance and sustainability (Karon, 2000). This section aimed at evaluating the e-Learning components applied, features associated with e-learning, benefits they experience and the constraints encountered in this project. It was found that the e-Learning components were not addressed, hence this study addressed them in chapter four, section 4.1.

2.8.6 The Use of Low Cost Innovative Technologies to Support e-Learning Activities in Zambezia Province, Mozambique: Instituto Superior Politécnico E Universitário (ISPU)

Instituto Superior Politécnico e Universitário (ISPU), http://www.ispu.ac.mz, is a private higher education institute which came into being through the approval of the Mozambican Council of Cabinet Ministers in 1995 Decreto n 44/95, of 13th of September 1995, and is the property of the group IPS - Instituto Politécnico Superior Limitada (IPS LDA) which was formed on 1 September 1994, and was published in the Republic of Mozambique's Governmental Bulletin number 31- III Series, of July

1996. The main goal of the project is to deploy a computer network to the ISPU and a secondary school in Quelimane. The Institutions involved are: Instituto Superior Politécnico e Universitário hereinafter (ISPU), Instituto Médio Politécnico, hereinafter (IMEP) and Patrice Lumumba Secondary School (Wolfe, 2000).

At ISPU and IMEP the actual network was covering both institutions with an aerial UTP cable linking the two buildings. A small switch was put in between the two buildings to act as repeater. Technically, it is never recommended to put an ethernet cable outdoors.

At ESPL there were no computers at all, they later received a donation of 26 computers. At each point, there has been installed full routers supporting wireless interfaces which can be configured either as access points or remote stations. These routers are implemented based on the router board hardware with the Mikrotik Router OS, both produced by MIKROTIK in Latvia (Kumar, (2006). This section aimed at evaluating the e-Learning components applied, features associated with e-learning, benefits they experience and the constraints encountered in this project. It was found that features associated with e-learning and the constraints encountered in this project were not addressed, hence this study addressed them in chapter four, sections 4.2 and 4.5 respectively.

2.8.7 TUT: Tshwane University of Technology (South Africa)

The goal of the e-Learning project in the University is professional development programme in Technology in HE through introducing technology in teaching and learning practices, computer technology, significant influence in growth of online learning to implement course management platforms in higher education and utilize

technology as a new method to enhance teaching and learning. The Strategies & Processes Utilized in TUT Programmes include various technologies; video, video conferencing, audio conferencing, e-testing, e-game and graphics. The software include WebCT (LMS), StudyMate, Respondus,Camtasia, Impatica, FrontPage, VTC and WIMBA. In the University, there was a shift from rote learning to a system where students are taught how to think, process information, evaluate, interactive communication and practice good organizational skills. An academic in this regard will be a facilitator of learning, including online (off-campus students or hybrid) and guide a student to find acceptable solutions to real life problems. A lecturer should create a favourable learning environment for effective online teaching and learning as well as for face- to-face contact students and design and develop learning material online and maintain the environment for students to acquire knowledge and construct it. The lecturer should service online and face-to-face contact students online, motivate them and train them on the WebCT Blackboard tools. Experienced and trained academics for web-based learning should act as mentors for inexperienced designers and instructors (Lucas, 2007). This section aimed at evaluating the e-Learning components applied, features associated with e-learning, benefits they experience and the constraints encountered in this project. It was found the constraints encountered in this project were not addressed, hence this study addressed them in chapter four, section 4.5.

2.8.8 Use of ICTs in University Education: Makerere University, Institute of Public Health, MPH Distance Program Structure, Uganda

The project applies blended learning including face-to-face sessions for introduction to learning materials, revisions and examinations. Self-directed learning includes paper-based materials, discussion forums (online) and assessments. ICTs are being used in preparing learning materials- Word processing, overview lectures – PowerPoint,

Projectors, knowledge exchange – Discussion Forums and Communication – E-mail and Mobile phones. The enabling factors are positive policies which include Government – Ministry of ICT and University – ICT policy and master plan. Manpower and infrastructure factors include recruitment of key staff, ICT focal person and instructional designers. Directorate of ICT Support entails training staff, offering expert services and guidance, providing bandwidth, hosting university intranet, universal access to computers by staff, internet in all offices and lecture rooms and internet at field training sites - act as regional hubs. The challenges include high bandwidth charges, frequent power cuts, irregular access to internet, high user fees in internet cafes, shortage of internet cafes, students move long distances to access internet, inequity in internet access; limited access in rural areas, fear of plagiarism – delayed transition from paper-based materials to CD Roms and high printing and photocopying costs. The successes of the project include MPH DE -Ranked among most competitive graduate programs, low program dropout rate (30%), student performance similar to MPH regular program, program now open to foreign students. It is concluded that ICTs can be used in resource poor settings to increase access to graduate education in that students can work as they study; minimising staff depletion and elimination of geographical barriers. Resource poor settings have unique challenges like access to internet is limited by power shortage and high bandwidth charges (Looijen, 2001). This section aimed at evaluating the e-Learning components applied, features associated with e-learning, benefits they experience and the constraints encountered in this project. It was found the constraints encountered in this project in implementing e-Learning were not addressed, hence this study addressed them in chapter four, section 4.5.

2.8.9 e-Learning in Higher Learning Institutions: A Case of Tanzania

The background of the project indicates that across the East African regions, it has experienced a phenomenal growth of schools. In Tanzania, enrolment ratio in PS/HL stand at 1:201 and for SC/HLI stands at 1:27 in year 2005. In year 2005/2006, enrolment at University was 50,000 in a university age population of 3.5 million. The enrolment into primary schools in Tanzania grew up to 85.3% in year 2006. Universities, capitalizing on this need, have put in place degree programmes in a hurry ignoring the basic consideration on quality. The objective and methodology of the project involves analyzing the challenges of e-Learning and examining how adaptive computing can enhance e-Learning through establishment of the acceptance of e-Learning, identifying factors that affect e-Learning at HLI and proposing improvement in adaptive computing to enhance e-Learning. The conclusions indicate that there are some factors which demoralize online students once they enroll in online course, failure is due to lack of knowledge on how to run e-Learning programme, in order to gain experience, e-Learning can be introduced and run parallel with traditional learning and seminars are important in e-Learning (Thorne, 2002). This section aimed at evaluating the e-Learning components applied, features associated with e-learning, benefits they experience and the constraints encountered in this project. It was found that, the constraints encountered in this project were addressed, nevertheless the e-Learning components applied, features associated with e-learning and benefits experienced in implementing e-Learning were not addressed, hence this study addressed them in chapter four, sections 4.1, 4.2 and 4.4 respectively.

2.8.10 Creating Sustainable Models: Digital Links and Computers for Schools Kenya

Digital Links International is a UK-registered charity working in 22 countries. Its aim is to bring meaningful and affordable technology to countries. It has helped in bringing 70,000 computers to schools and colleges and reaching almost 2 million young students, teachers and community leaders. Computers for Schools Kenya is a charitable NGO established in 2002. Its mission is to empower young Kenyans for life in a knowledge-based society by facilitating the development of ICT infrastructure and capacity. The strategic activities include development and maintenance of ICT infrastructure, capacity building through training and development of relevant software tools, participation in national policy formulation and implementation and establishing strategic linkages. The challenges to its sustainability are lack of strategic planning, poor infrastructure like electricity, high cost of ICT equipment, poor curricula, inadequate capacity in schools, in-country disparities, long-term hardware and maintenance solutions, funding, long-term skills development and community involvement (McCrea, Gay & Bacon, 2000). This section aimed at evaluating the e-Learning components applied, features associated with e-learning, benefits they experience and the constraints encountered in this project. It was identified that the project mostly concentrates with addressing e-Learning components applied and also proposing possible strategies and interventions that can be applied to improve dissemination of course modules via e-Learning. However features associated with e-learning and constraints encountered in implementation of e-Learning were not addressed hence this study addresses them in chapter four, sections 4.2 and 4.5 respectively.

2.8.11 CAD (Centre for Academic Development) e-Learning certificate University of Botswana (UB)

e-Learning at UB was introduced in 2002. It is defined as appropriate use of ICTs for advancing student-oriented, active, open and life-long teaching-learning processes. Its focus is on blended learning approach, it makes use of WebCT CE4.0 (move to CE6.0 began in 2007).

The CAD e-Learning certificate was introduced in 2003. The aim was to train academic staff embarking on e-Learning focusing on technical and pedagogical skills. The four areas covered are; e-Learning, Information and Computer skills, Multimedia Production and WebCT. It is offered mainly as half day on monthly basis and completion by attendance and application (evidence of application in Teaching & Learning) since 2004/2005. The predominant reasons to attend training are to; acquire technological skills, use e-Learning for teaching and obtain certificate. The favourite workshops include; Principles of Course Design, MS PowerPoint, Introduction to e-Learning, Management Information Techniques and Online Information Gathering (Salmon, 2006). This section aimed at evaluating the e-Learning components applied, features associated with e-learning, benefits they experience and the constraints encountered in this project. It was found that e-Learning components applied and constraints encountered were not addressed hence this study addresses them in chapter four, sections 4.1 and 4.5 respectively.

2.8.12 e-Learning project at the Ethiopian Civil Service College (ECSC) in Ethiopia

The available ICT infrastructure in the project includes ICT equipment, internet connectivity, durable system stability, maintenance system quality and application of technical standards, etc. The economy factor entails financial safety devices and resources efficiency and effectiveness. The organizational and administrative factor has

e-Learning favourable organisational structure and support from top management. The socio-cultural factor entails promotion of training/learning culture of self-study and acceptance promotion/support. The didactical factor includes qualification and commitment of educational personnel and integration in curricula, reusability (application of didactical standards). The reality at ECSC shows that it is equipped with VSAT equipment, Interactive Videoconferencing Services, High-Speed internet-Multimedia facilities, Broadband Internet & VC Connections (Scholten, 2004). The objectives of the e-Learning Project are to develop, implement and support three online courses in *Procurement, Human Resource Management & Computer Basics* and build the capacity of civil servants throughout the country. The project began in Jan-Feb 2006 after an international e-Learning advisor was recruited to coordinate and support the development and implementation of the e-Learning project. *(The recruitment was made based on agreement & Support by the Ethiopian Government, the World Bank and the German Development Service – DED).* The challenges initially faced are after 10 months when an interim statement showed that no progress in the development of the e-Learning courses. The reasons for the challenges were that for the host institution, it is the first time to work in an e-Learning project, the required personnel were not organized, the procurement of necessary software was very difficult and some staff were assigned to work with the advisor, but engaged in other tasks. The strategy put in place was e-Learning Project team members were formed drawn from different disciplines, project manager was assigned roles and roles were fixed for each development team. The subject matter experts and instructional designers, course editors and IT personnel were identified. Web Designer was hired on part time basis and the e-Learning advisor to provide overall assistance. e-Learning basic training was offered to team members and a work plan was drawn. Each two weeks the team held

meetings with the head of the college. The results indicate that the first draft of the storyboard of the courses were finalized, revision/editing of the storyboard has been conducted, the web designer made the first test in converting the materials to XML, the LMS made the first test in integrating the XML material with LMS, hiring and training of e-tutors was planned and conducted, equipment such as high capacity servers and PCs were procured and computer lab with 36 computers were set up. The conclusion emerged that the experience at the ECSC, in Ethiopia showed as mentioned in the beginning, that the Technology and Financial factor without the Organizational, Didactical and Human Resource cannot assure a sustainable e-Learning project. Therefore, top level management support is critical, pedagogy first, technology second approach is essential for success at didactical level. Human resource/staff level: an integration among subject matter experts, instructional designers, graphic/web designers, multimedia programmers, editors and LMS administrators is essential. Having clearly stated goals and job break down is critical and the challenge remains how to maintain it (Shank, 2007). This section aimed at evaluating the e-Learning components applied, features associated with e-learning, benefits they experience and the constraints encountered in this project. All these subjects have been addressed in this project though not exhaustively and are related to the ones identified in this study. However, this study has identified more features associated with e-Learning, benefits experienced and constraints encountered than the ones presented in this project as presented in chapter four, sections 4.2, 4.4 and 4.5 respectively.

2.9 e-Learning in public universities in Kenya

This section reviews e-Learning applications in public universities in Kenya. The review of literature on these universities aimed at evaluating the e-Learning components applied, features associated with e-learning, benefits experienced and constraints encountered in the implementation of e-Learning.

At the University of Nairobi (retrieved November 2008, from, http://www.uonbi.ac.ke), the oldest university in Kenya has an e-Learning platform – Wedusoft is in use to provide e-Learning courses within and off campus. There are also other software products that support the e-content development and automation process. Other environments that are available include TUSK (Tufts University Sciences Knowledge base) which is available for staff. In the same university, many of the staff who have been trained on e-Learning have now embarked on e-content development projects. In Moi University (retrieved November 2008, from http://www.mu.ac.ke), implementation of an open and distance learning (ODL) initiative to support government efforts in expanding access to university education is ongoing. In addition, the university is an active member of Kenya Education Network (KENET) whose mission is to improve connectivity among the institutions of higher learning in Kenya.

Maseno University (retrieved November 2008, from http://www.maseno.ac.ke) is planning to offer access to university education to a larger number of students who qualify but fail to join public universities through Joint Admissions Board (JAB), Maseno University has identified centres countrywide, which can be used as pilot centres for open, distance and electronic learning (ODEL) programmes.

Egerton University (retrieved August 2010, from http://www.egerton.ac.ke) plan is to start e-Learning in offering nursing course. The university fully understands that learners play a major role in constructing their own knowledge and developing their skills and hence to enhance their learning base. Kenyatta University (retrieved November 2008, from http://www.ku.ac.ke) has been offering open learning and school-based programmes since 2002. The university currently has eight open learning

centres countywide, namely, parklands campus, Mombasa, Nakuru, Kakamega, Kisumu, Garissa, Embu and Nyeri. The programmes range from diploma to postgraduate levels hence the university has been receiving overwhelming students' enrolments in the open prorammes. The university posts the reading materials to open learning students in form of module booklets and CDs. The university has also acquired e-Blackboard Learning Management System (BLMS) and the Moodle Course Learning Management System. Jomo Kenyatta University of Agriculture (retrieved July 2010, from http://www.jkuat.ac.ke) established the School of Learning in 2006. Among the objectives of the school is to improve the quality of education offered by the university and increase access to education by students who wish to join university courses. In Masinde Muliro University of Science and Technology (retrieved November 2008, from http://www.wust.ac.ke), ICT technologies have impacted on data/information collection, storage and dissemination, contributing to enhanced university growth.

This section aimed at addressing objectives one, two, four and five. Nevertheless this section revealed little information on e-Learning components applied, features associated with e-learning, benefits experienced and constraints encountered in the implementation of e-Learning, hence this study involved these seven public universities, where primary and secondary data is analyzed and presented in chapter four.

2.10 Summary

The literature reviewed showed that e-Learning has many setbacks in terms of skills and infrastructure which have a negative impact on supply of e-courses via e-Learning. e-Learning has a bearing on promoting human resource development by meeting the high social demand of education and training in a cost effective way which is a key path to attainment of the country's goal of being industrialized.

The literature reviewed showed that there are gaps in research and knowledge especially on ICT infrastructure, application, costing and maintenance, development and storage of e-courses especially in Kenyan public universities. In literature review, it was found that there is no comprehensive and actual documentation on the status of e-Learning in public universities. In addition, there is discrepancy on what is documented and publicized and what is actually going on the ground hence this study was set to bring out the actual status of e-Learning in public universities in Kenya in a bid to improve application of e-Learning as a course delivery method. In Nairobi University, Masinde Muliro University of Science and Technology, JKUAT, Moi University, Maseno University, Kenyatta University and Egerton University, there is inadequate documentation on status of e-Learning as a method of course delivery and therefore, this research aimed at investigating the actual state of e-Learning in Kenyan public universities and thus bridging this gap, and makes suggestions on how the situation can be improved.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, the research methodology that was applied to the study is presented. The chapter aims at describing research design, the locale, and the research instruments that were used in the study and how they were developed, refined and tested in the field. Piloting of data collection tools and analysis procedures are also described.

3.2 Research Design of the Study

Research design is the plan, structure and strategy of investigation conceived so as to obtain answers to research questions and to control variance (Kerlinger, 1986). This definition includes three important terms - plan, structure and strategy. The plan is the outline of the research scheme on which the researcher is to work. The structure of the research work is a more specific scheme and the strategy suggests how the research will be carried out i.e. methods to be used for the collection and analysis of data. Research design is the blueprint of research. It is the specification of methods and procedures for acquiring the information needed for solving the problem. The research design enables the researcher to arrive at certain meaningful conclusions at the end of proposed study.

This study adopted exploratory descriptive survey design. The purpose of exploratory studies is to explore some area more thoroughly in order to develop some specific hypothesis or prediction that can be tested in future research (Orodho, 2003). Descriptive studies are concerned with finding out “what is” (Borg & Gall, 1989). According to Mugenda and Mugenda (1999), descriptive study is probably the best method for social scientists and educators who are interested in collecting original data for the purpose of describing a population. Survey approach was employed since it enabled investigation to be made for tentative causal factors by collection and use of both quantitative and qualitative data. Survey approach is often used to assess thoughts,

opinions, and feelings (Mwanje, 2001). This study adopted exploratory descriptive survey design because with exploratory study this research was conducted into an issue (e-Learning) and there were few and no comprehensive earlier studies conducted in Kenya to refer to thus adopting exploratory study in order to focus on gaining insights and familiarity for later investigation. Secondly, this study adopted descriptive research in order to describe the e-Learning phenomena as it exists in public universities in Kenya. Finally, survey research was applied in order to explain what is happening in e-Learning situation in Public Universities in Kenya by assessing thoughts, opinions, and feelings. This study also adopted both qualitative and quantitative research paradigms. Quantitative relied exclusively on numerical or quantifiable data and qualitative relied on themes and words (Coffey, Holbrook & Atkinson, 1996). Each paradigm was best suited for certain research questions and in many cases a combination of the two approaches was superior to either.

3.3 The Target Population

The subjects of the study were derived from the seven public universities in Kenya. A survey of the following universities on status of e-Learning as course delivery method was conducted:

1. University of Nairobi
2. Masinde Muliro University of Science and Technology
3. Jomo Kenyatta University of Agriculture and Technology
4. Moi University
5. Maseno University
6. Egerton University
7. Kenyatta University

The target population from the seven public universities consisted of the ICT Managers/e-Learning Directors/Administrators, university e-Learning technicians and members of the academic/teaching staff as presented in table 3.1.

Table 3.1 Target population

Respondents category	Nairobi Univ	Moi Univ	JKUAT	Egerton Univ	Masinde Muliro Univ	Maseno Univ	Kenyatta Univ
ICT Managers/e-Learning Directors	2	2	2	2	2	2	2
University e-Learning Technicians	3	3	3	3	2	3	3
Members of the Academic /Teaching Staff	1,500	657	303	550	250	180	783

3.4 Sample Population and Sampling Procedure

The sample population constituted respondents from the seven public universities in Kenya. The subjects in the study consisted of ICT managers/e-Learning directors/administrators, e-Learning university technicians and members of the academic/teaching staff from the public universities in Kenya as shown in table 3.2. The researcher purposively sampled the e-learning directors from the total population of ICT managers/e-Learning directors/administrators. The researcher also purposively sampled the chief e-Learning technicians from the total population of e-learning technicians since a chief e-Learning technician is a key group in that category as Ogula (2005) states. A sample of 33% of both the ICT managers/e-Learning directors/administrators and e-learning technicians was investigated. A sample of 33% for these two categories of respondents was found sufficient since it is higher than the minimum recommended proportion of 10% of the total population. According to Gay (1992), sampling 10% of the population is acceptable for descriptive research but the sample size should be larger in correlational research and experimental research. For the members of the academic /teaching staff, a sample was selected from the total

population of all members of the academic /teaching Staff. A sample of 10% of the members of the academic /teaching staff was investigated. A sample population of 10% was found representative and sufficient to avoid bias in sampling and reduce standard error since the members of the target population which was sampled was homogenous, that is members of university academic staff (McClave, 2000, Kathuri, 1993). The researcher applied purposive sampling in sampling the members of the academic /teaching staff since there was a specific predefined group the researcher was seeking and that is, the e-Learning Departmental Course Coordinators. In purposive sampling, the population is sampled with a purpose in mind. There is usually a specific predefined group the researcher is seeking. Purposive sampling can be very useful for situations where the researcher needs to reach a targeted sample quickly and where sampling for proportionality is not the primary concern (May, 1993).

Table 3.2 presents the sample population from all the seven public universities comparing the three categories of respondents namely; ICT Managers/e-Learning Directors, University e-Learning Technicians and Members of the Academic /Teaching Staff.

Table 3.2 Sample size

Respondents category	Nairobi Univ	Moi Univ	JKUAT	Egerton Univ	Masinde Muliro Univ	Maseno Univ	Kenyatta Univ	Sample population
ICT Managers/e-Learning Directors	1	1	1	1	1	1	1	7
University e-Learning Technicians	1	1	1	1	1	1	1	7
Members of the Academic /Teaching Staff	150	66	30	55	25	18	78	422

3.5 Description of Instruments

In this research, a set of instruments were employed to collect data. The following instruments were used to collect the required data:

3.5.1 Questionnaires

Three sets of questionnaires were used to collect the required data. The questionnaires were designed for the university's ICT manager/e-Learning director, e-Learning technicians and teaching /academic staff. A questionnaire is a research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents. A questionnaire was used because it was less expensive and required less time to administer (William, 1990). The questionnaire consisted of open and multiple-choice questions. Ambiguity in framing of the questions was avoided after piloting. The investigator used the questionnaire to obtain factual data and opinions in a structural framework from the respondents (Nisbet, 1970). When using a questionnaire, the subjects feel a greater sense of anonymity. Large samples, covering large geographic areas, compensate for the expected loss of subjects and a greater amount of data over a broad range of topics may be collected. According to Kothari (2004), a questionnaire is a standardized research instrument used to collect data from respondents about a particular topic and in this research, the topic was e-Learning. Respondents completed the questionnaires and the researcher with the assistance of the research assistants collected them.

3.5.2 Interview

Interview was also conducted to help identify variables and relations directly from the respondents. The researcher wanted to know the application and practice of e-Learning components applied in the public universities in terms of university budget and expenditure. As already asserted by May (2003) the interview method yields rich sources of data on people's experiences, opinions, aspirations and feelings. According

to Mwanje (2001), this method is interactive and enables a researcher to cover the phenomenon under investigation in great depth. In an interview, the interviewer can observe the responses of the subject and questions may be clarified if they are misunderstood and there is a higher response and retention rate. Interview was conducted to the university's ICT manager/e-Learning director.

3.5.3 Direct Observation

Here, the researcher was a direct observer of the events on this study. The researcher participated in the use of the various e-Learning components and observing their various interface designs that enhance interactivity between the various categories of users and as well as viewing interactive compact discs. The direct observation schedule which was developed by the researcher was a check list to ascertain information given by respondents by observing the scenario on the ground. In direct observation the researcher doesn't typically try to become a participant in the context. However, the direct observer does strive to be as unobtrusive as possible so as not to bias the observations. Direct observation suggests a more detached perspective. The researcher is watching rather than taking part. According to William (1990), the researcher is observing certain sampled situations or people rather than trying to become immersed in the entire context and tends not to take as long as participant observation.

3.6 Document Analysis

Written material sources included published and unpublished documents on e-Learning from e-Learning departments, ICT sections, academic departments and faculties in the respective Public Universities in Kenya. Document analysis is content analysis of text documents. The analysis can be quantitative, qualitative or both. Typically, the major purpose of content analysis is to identify patterns in text. The goal is identification of themes or major ideas in a document or set of documents. The documents can be any kind of text including field notes, newspaper articles, technical papers or organizational

memos. Document analysis has the advantage of being unobtrusive and, depending on whether automated methods exist, it can be a relatively rapid method for analyzing large amounts of text (William, 1990).

3.7 Piloting

Piloting was conducted at Jomo Kenyatta University of Agriculture and Technology. The aim was to improve the research instruments in collecting the intended data. A pilot study was conducted to 22 respondents, the ICT manager, one e-Learning technician and 20 members of the teaching staff. The selected respondents involved in the pilot study were excluded in the actual study.

3.7.1 Validity of the Instruments

Validity is the degree to which the instrument measures what it purports to measure. Instrument validity is the degree to which an instrument is capable of gathering the anticipated information. To determine the validity of the items in the questionnaires and interview schedule, a pilot study was conducted on groups with similar characteristics to the subjects or research setting of Jomo Kenyatta University of Agriculture and Technology. The subjects included in the pilot study had similar characteristics in all respects to the target population as recommended by (Mulusa, 1990). Each item of the completed questionnaire and interview schedule was discussed with those involved in the pilot study respectively in order to find out difficult and ambiguity in the items and also established the confusing items. The researcher applied content validity to improve the validity of the questionnaires, interview schedule and observation schedule where experts' opinion was sought. This approach assumed that the instruments had a good detailed description of the content domain. Through the comments of the experienced researchers some items were modified and others disregarded.

3.7.2 Reliability of the Instruments

Reliability is the degree to which the instrument consistently measures what it purports to measure**.** Reliability of the research instruments was established and suggestions developed on how to improve them. A test must be valid in order for it to be reliable.

The split-half method was used to establish the coefficient of internal consistency of the questionnaire. According to Roscoe (1969), this method involves splitting the statements (items) of a test into two halves (odd and even numbered items). Then, the odd numbered and even numbered items are placed in two subtests and the scores of the two subtests are computed for each individual and correlated using the Pearson's Product Moment Correlation Coefficient formulae. The obtained value (r) however represents reliability of only half of the test. To obtain reliability of the whole test, the Spearman Brown Prophecy formulae stated below is applied:

Rx = 2r / 1+r where:

r is the reliability coefficient resulting from correlating scores of the odd and even numbered items for part of the test; and

Rx is the reliability of the original (whole) test.

Computations of specific coefficients of reliability of the three sets of questionnaires subjected to piloting are shown in the section below.

University ICT manager/e-Learning Director Questionnaire

The reliability of the total test using Spearman-Brown Prophecy formulae was given as:

total test = (2r (half test)/1+r (half test).

r is the reliability coefficient resulting from correlating scores of the odd and even numbered items for part of the test; and

Rx is the reliability of the original (whole) test.

Rx = 2r / 1+r

Rx=2x0.793/1+0.793

=1.586/1.793

=0.885

Academic /Teaching staff Questionnaire

Rx is the reliability of the original (whole) test.

Rx = 2r / 1+r

Rx=2x0.811/1+0.811

=1.622/1.811

=0.895

e-Learning Technicians Questionnaire

Rx is the reliability of the original (whole) test.

Rx = 2r / 1+r

Rx=2x0.757/1+0.757

=1.514/1.757

=0.861

Since reliability is usually interpreted like a regular correlation, the implication is that the closer the value obtained is to 1.00, the stronger the congruence of measurement. The questionnaire (Rx=0.885) for ICT managers / e-Learning directors, the questionnaire (Rx=0.895) for academic/teaching staff and the questionnaire (Rx=0.861) for e-Learning technicians were therefore considered reliable instruments since Rx value in the three sets of questionnaires is greater than 0.5 (William, 1990).

A test-retest method was used to determine reliability of the interview schedule. Test-retest involved administering the instrument first to a group with similar characteristics to the subjects or research setting. Then the instrument item was improved depending on the extent to which the items are suitable to gather the required information when

instruments are administered in the main study. This method ensured that the instrument gathered relatively the same information obtained in the first test when administered in the main study. This is due to the fact that ambiguous, difficult and unclear items could either be simplified or discarded altogether, or new items added to the instruments depending on the outcome of the first test.

Total number of items in the two tests was then scored separately and the scores summed up so that there was a total score for the first test and a total score for the second test. Pearson's Product Moment Correlation Coefficient formula ($r = \frac{\sum z_x z_y}{N}$) was then applied where z_x is the variable x converted into z scores and z_y is the variable y converted into z scores which was applied. The computed correlation coefficient obtained was 0.867. The interview schedule (r=0.867) was therefore considered a reliable instrument.

The observation schedule which was developed by the researcher was a check list to ascertain information given by respondents by observing the scenario on the ground. In contrast to other data collection methods, ideas are developed from observations rather than testing existing ones. In addition, observing enables a researcher to give a record of actual as opposed to reported or recalled information.

Inter-rater/observer technique is used to determine reliability of the observation schedule. This technique is used to assess the degree to which different raters or observers give consistent estimates of the same phenomenon or to determine the extent to which at least two raters are consistent in the way they rate or report their observations (Gay, Mills & Airasian, 2009). The two raters were the ICT manager and

one e-Learning technician from Jomo Kenyatta University of Agriculture and Technology.

3.8 Data Collection Procedure

The researcher collected a research permit from the National Council of Science and Technology which was presented to the institutions where data were collected. The questionnaires, interview schedules, review of documents and direct observation were used to collect the required data. The questionnaires were hand delivered to the respondents. The interview schedule was conducted in the various public universities to the respondents at a convenient time suggested by the respondents as the researcher collected back the questionnaires since those who participated in the interview also had one set of a questionnaire that is the e-Learning directors. During data collection the researcher was assisted by two research assistants who assisted in administering the questionnaires to the members of the academic staff. Direct observation was conducted by the researcher.

3.9 Method of Data Analysis

The investigator ensured that the instruments were double-checked for completeness. The raw data received from the field were categorized into information that answered the researcher's research questions. The information was summarized and statistics derived. The data were subjected to descriptive analyses encompassing a range of both qualitative and quantitative treatments. Qualitative analysis relies on reasons behind various aspects of responses (Kathuri, 1993). It simply investigates the why and how of decision making. Data for qualitative analysis comes mostly through text. Qualitative Analysis is the range of processes and procedures whereby the researcher move from the qualitative data that have been collected into some form of explanation, understanding or interpretation of the respondent's response and situations under investigation (William, 1990). Qualitative analysis is usually based on an interpretative

philosophy. The idea is to examine the meaningful and symbolic content of qualitative data. The process of qualitative analysis involves writing and the identification of themes. Quantitative analysis relies exclusively on the analysis of numerical or quantifiable data. Quantitative analysis deals with information expressed as numbers, as opposed to words (Coffey, Holbrook & Atkinson, 1996). Quantitative data were presented by use of tables, percentages, frequencies and rating averages. Qualitative data were analyzed by establishing the categories and themes, relationships/patterns and conclusions in line with the study objectives (Van Dalen, 1962). In analysis of the cost of application of e-Learning in teaching and learning, the researcher applied the cost function by Rumble, (1986) where costs of development and production of e-Learning Courses, costs of maintenance of e-Learning courses in presentation, costs of e-Learning courses and materials storage and costs of e-Learning course and materials delivery including transmission were analyzed. Spreadsheets, SPSS computer applications and Survey Monkey online application were applied in data analysis. Descriptive analysis was used because it enabled the researcher to inspect the variables in their real world setting. Tabulation enabled the researcher to categorize the subjects in this research. The frequencies enhanced analysis of the continuous variables.

3.10 Conclusion

Any research requires a research strategy to be executed effectively. A research strategy in essence comprises the logical steps that a researcher takes to arrive successfully at the conclusion of an inquiry. The methodology in this research consisted of research instruments which were employed to collect data. The method of data analysis on the phenomena studied is also presented. The choice of a strategy is greatly influenced by the nature of the problem to be solved. The problem area and the problem statement formulated in this study determined the strategy used in this study, which consisted of an exploratory study.

CHAPTER FOUR
PRESENTATION, ANALYSIS, DISCUSSION AND INTERPRETATION OF RESEARCH FINDINGS

4.0 Introduction

The analysis of the collected data is presented and discussed in this chapter. This chapter is organized into six sections as per the six objectives in this study. The first section entails analysis, interpretation and discussion of the e-Learning components applied and status of e-Learning infrastructure in public universities in transmitting e-Learning course modules. The second section presents analysis, interpretation and discussion of the features that are associated with the current e-Learning in public universities in Kenya. The third section presents analysis of the costs involved in development, production, maintenance of e-Learning courses, storage and delivery including transmission of e-Learning courses and materials in public universities in Kenya. The fourth section presents analysis, interpretation and discussion of the benefits of e-learning course modules from both the demand and supply sides. The fifth section presents analysis, interpretation and discussion of the constraints faced by public universities in implementing e-Learning. The final section presents analysis, interpretation and discussion of the strategies and interventions that can be applied to improve dissemination of course modules via e-Learning in Kenyan public universities.

In this chapter data is presented both by tables and figures. According to Kothari (2004), academic writing in many subject areas requires the use of tables and figures to present data which should be integrated appropriately. Tables and figures can help make information available to your reader in an accessible way. They can be particularly useful for presenting detailed information of a statistical nature. Figures and graphs help in examining trends and make comparisons by visually displaying data.

4.1 e-Learning components applied and status of e-Learning infrastructure in public universities in Kenya

This section describes the status of e-Learning components applied in public universities in performing various e-Learning activities in respect to objective one of this study which aims at determining the e-Learning components applied and status of e-Learning infrastructure in public universities in Kenya.

4.1.1 Type of hardware and their features that are applied in public universities in transmitting e-Learning course modules.

Computer hardware refers to the collection of physical elements that comprise a computer system. These include the physical parts or components of a computer such as monitor, keyboard, Computer data storage devices, hard drive disk, mouse, printers, CPU (graphic cards, sound cards, memory, motherboard and chips) among others all of which are physical objects that one can actually touch.

This section facilitates in the answering research question number one, "Which hardware components do you apply in your institution in transmitting e-Learning course modules?"

The common hardware components applied in the practice of e-Learning in public universities are presented in table 4.1

Table 4.1: Common network components applied in e-Learning

Network components applied in universities		
Answer Options	**Response Count**	**Response Percent**
Routers	7	100.0%
Bridges	6	85.7%
Hubs	6	85.7%
Satellite dishes	7	100.0%
Fibre Optic Connection	5	71.4%
Wireless cards	5	71.4%

Source: e-Learning Technicians Questionnaire

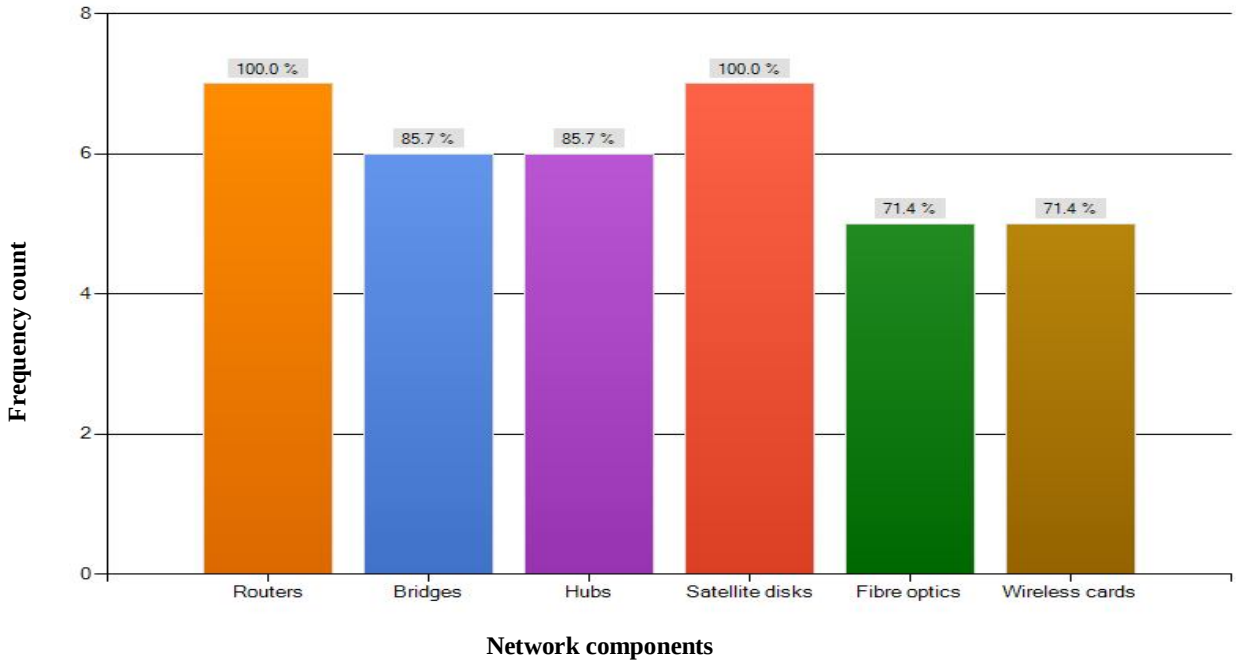


Figure 4.1: Common network components applied in e-Learning

Source: Table 4.1

From the information in Table 4.1 and Figure 4.1 above, it was found that several network components are applied in implementation of e-Learning in public universities in Kenya. Universities make use of routers, bridges, hubs, satellite dishes, fibre optic connections and wireless cards in their intranet and internet. Routers and satellite dishes are applied in all seven public universities. Bridges and hubs are applied in six public universities whereas fibre optic connection and wireless cards are applied in five public universities. The respondents also specified other components which are applied for example the projectors. These components enhance in accessing courses in the e-Learning portals. Examples of such portals are like Chisimba in case of University of Nairobi, Jomo Kenyatta University of Agriculture and Technology and Maseno University. Other e-Learning portals also applied in other universities are like Moodle Course Management System in the case of Kenyatta University.

From the information gathered by the researcher, universities make use of a variety of hardware in production, storage and distribution of the e-Learning courses. These hardware include computers which are Pentium 4 in version. The Pentium 4 microprocessor from Intel is a seventh-generation Central Processing Unit (CPU) targeted at the consumer market. These CPUs are usually connected together with monitors for display.

The monitors are usually Cathode Ray Tubes (CRTs) for display or Thin Film Transistor (TFT) monitors also called flat panel displays which use thin-film transistor technology for the ultimate Liquid Crystal Display (LCD). This applies to all universities as indicated by the e-Learning technicians from the respective seven public universities.

Public universities also make use of the LCD projectors to display images, text and diagrams on screen. This facilitates good visual access of information during teaching and presentations with ease.

Another hardware applied in implementation of e-Learning in public universities is a router, a device that forwards data packets along networks. A router is connected to at least two networks, commonly two LANs or WANs or a LAN and its ISP network. Routers are located at gateways, the places where two or more networks connect.

Hubs are also applied to facilitate the networking of multiple computers in the office easier. It is the common connection point for devices in a network. Hubs are commonly used to connect segments of a LAN. A hub contains multiple ports. When a packet

arrives at one port, it is copied to the other ports so that all segments of the LAN can see all packets.

Switches are devices that filter and forward packets between LAN segments in a network. Switches operate at the data link layer (layer 2) and sometimes the network layer (layer 3) of the OSI Reference Model and therefore, support any packet protocol. LANs that use switches to join segments are called switched LANs. A switch, however, keeps a record of the MAC addresses of all the devices connected to it. With this information, a switch can identify which system is sitting on which port. So when a frame is received, it knows exactly which port to send it to, without significantly increasing network response times.

4.1.2 Common software and techniques applied in implementation of e-Learning in Kenyan Public universities

Software is the untouchable part of a computer system. Software exists as ideas, application, concepts, and symbols, but it has no substance. A combination of hardware and software forms a usable computing system. This section facilitates in answering research question number two, “Which software is applied in transmitting e-Learning course modules in your institution?”

The common software applied in the practice of e-Learning are presented in table 4.2 and figure 4.2.

Table 4.2: Common software and techniques applied in implementation e-Leaning

Common software and techniques applied in implementation of e-Learning in universities		
Answer Options	**Response Count**	**Response Percent**
Word-processing	7	100.0%
Spreadsheets	7	100.0%
Databases	7	100.0%
Computer Based Statistical Packages	7	100.0%
Internet and E-Mail	7	100.0%
Learning Management Systems and Electronic blackboards	6	85.7%
Computer conferencing	2	28.6%
Computer Based Assessment	1	14.3%
Computer file Transfer	0	0.0%
Satellites discs	3	42.9%
Teleconferencing / Tele Classrooms	0	0.0%
Interactive CD ROMs	6	85.7%
VSAT	4	57.1%
Video tapes	7	100.0%
Audio cassettes	5	71.4%
Streaming Audio & video	5	71.4%
Audio conferencing	1	14.3%
Video Conferencing	2	28.6%
	n	7

Source: e-Learning Director's Questionnaire

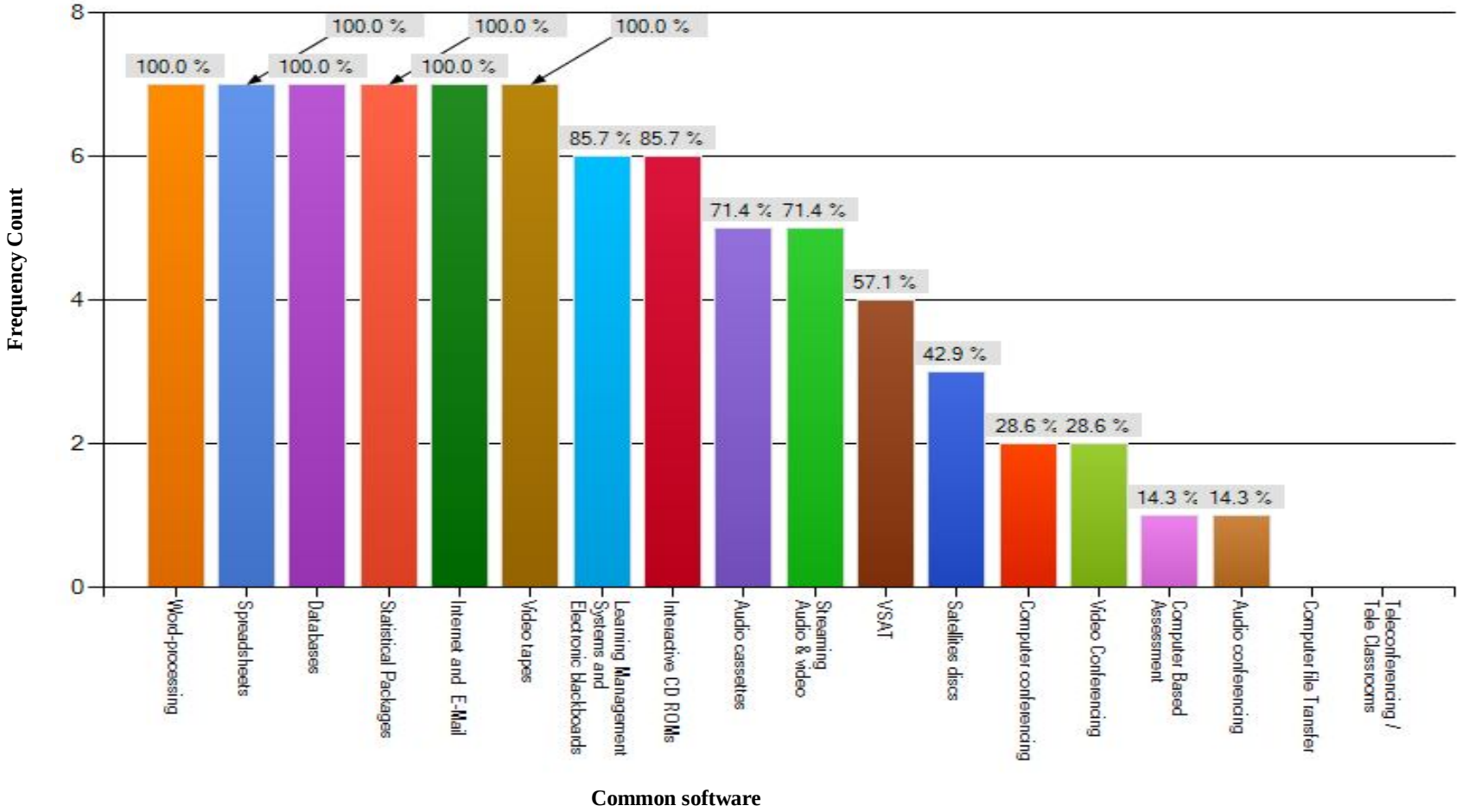


Figure 4.2: Common software applied in implementation of e-Learning in Kenyan Public universities

Source: Table 4.2

Table 4.2 and Figure 4.2 show the common software applied in implementation of e-Learning in public universities in Kenya. Information in this section was gotten from e-Learning directors and was based on sample population (n) of 7 and the response rate was 7 (100%). The identified software include the word processors, spreadsheets, database packages, statistical packages, video tape content and internet and e-mail which constitute 100 percent application in the universities. Other software applied in implementation of e-Learning in universities use learning management systems and this comprises mostly of the campus portals either open source or purchased software, content in the interactive CD ROMs, audio cassettes and streaming audio and video software. It was found that computer conferencing, computer based assessment, audio conferencing and video conferencing are also applied at low levels of usage comprising of 2 (28.6%), 1 (14.3%), 1 (1.4.3%) and 2 (28.6%) respectively. It was also found that Computer file Transfer and Teleconferencing / Tele Classrooms are not applied in public universities in Kenya. Other software identified and specified which are applied in e-Learning in public universities in Kenya include e-Learning author-ware (exe) for facilitating editing of information in the university portals and online interactive quiz (Hot pot) for assisting in creation of questions.

4.2 Features Associated with the Current e-Learning in Public Universities in Kenya

The following section describes the current features that define e-Learning in the current situation in public universities in Kenya. This section facilitates in answering research question number three, “What are the features of the hardware and software, which are applied in course delivery via e-Learning in your university?”

4.2.1 Current acceptance and implementation of e-Learning in the universities

This section presents the features or benefits that are associated with e-Learning and those that can be obtained from the development of new e-Learning strategies. Those features are presented in table 4.3 and figures 4.3 and 4.4. These features were also rated differently by the respondents from the seven public universities which are also reflected in table 4.3 and described in discussion of table 4.3 and figures 4.3 and 4.4.

Table 4.3: Current acceptance and Implementation of e-Learning in the University

Current acceptance and Implementation of e-Learning in the universities						
	Very Low	**Low**	**Average**	**Good**	**High**	**Rating Average**
Weighted Value	**1**	**2**	**3**	**4**	**5**	
Features rated in the Likert Scale						
Ease of access to computer facilities	42.9% (3) Maseno Univ, MMUST, Egerton Univ	0.0% (0)	14.3% (1) Moi Univ	42.9% (3) KU, JKUAT, UoN	0.0% (0)	2.57
Availability of ICT infrastructure	0.0% (0)	28.6% (2) MMUST, Moi Univ	28.6% (2) Maseno Univ, Egerton Univ	42.9% (3) KU, JKUAT, UoN	0.0% (0)	3.14
Lecturers and students satisfaction	0.0% (0)	57.1% (4) KU, Maseno Univ, MMUST, Egerton Univ	28.6% (2) JKUAT, UoN	14.3% (1) Moi Univ	0.0% (0)	2.57
Efficient skills to use in e-Learning platforms	28.6% (2) MMUST, Egerton Univ	57.1% (4) KU, Maseno Univ, Moi Univ, JKUAT	0.0% (0)	14.3% (1) UoN	0.0% (0)	2
Interactivity between lecturers and students	28.6% (2) MMUST, Egerton Univ	28.6% (2) Maseno Univ, Moi Univ	28.6% (2) KU, JKUAT	14.3% (1) UoN	0.0% (0)	2.29
Good evaluation through e-Learning platforms	28.6% (2) Maseno Univ, Egerton Univ	42.9% (3) Moi Univ, MMUST,KU	14.3% (1) UoN	14.3% (1) JKUAT	0.0% (0)	2.14
Completion of courses on time	57.1% (4) Moi Univ, MMUST, Maseno Univ, Egerton Univ	14.3% (1) KU	14.3% (1) UoN	14.3% (1) JKUAT	0.0% (0)	1.86
					n	7

Source: e-Learning Director's Questionnaire

Key:

1. Figures appearing in brackets alongside response percent represent the response count
2. Rating average is based on the response count, weighted value and "n" (See appendix IX)

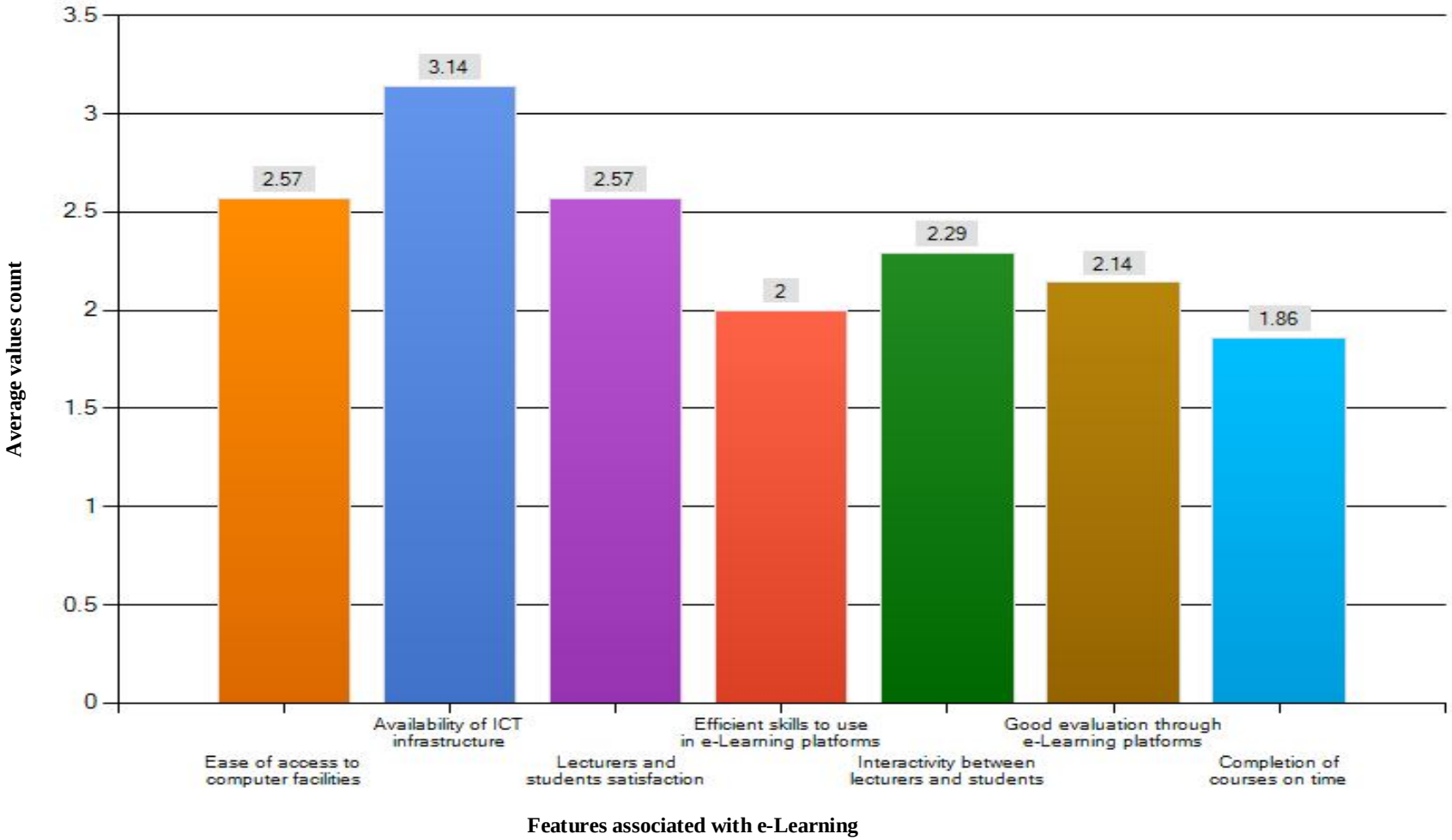


Figure 4.3: Average values of the current acceptance and implementation of e-Learning in Public universities in Kenya

Source: Table 4.3

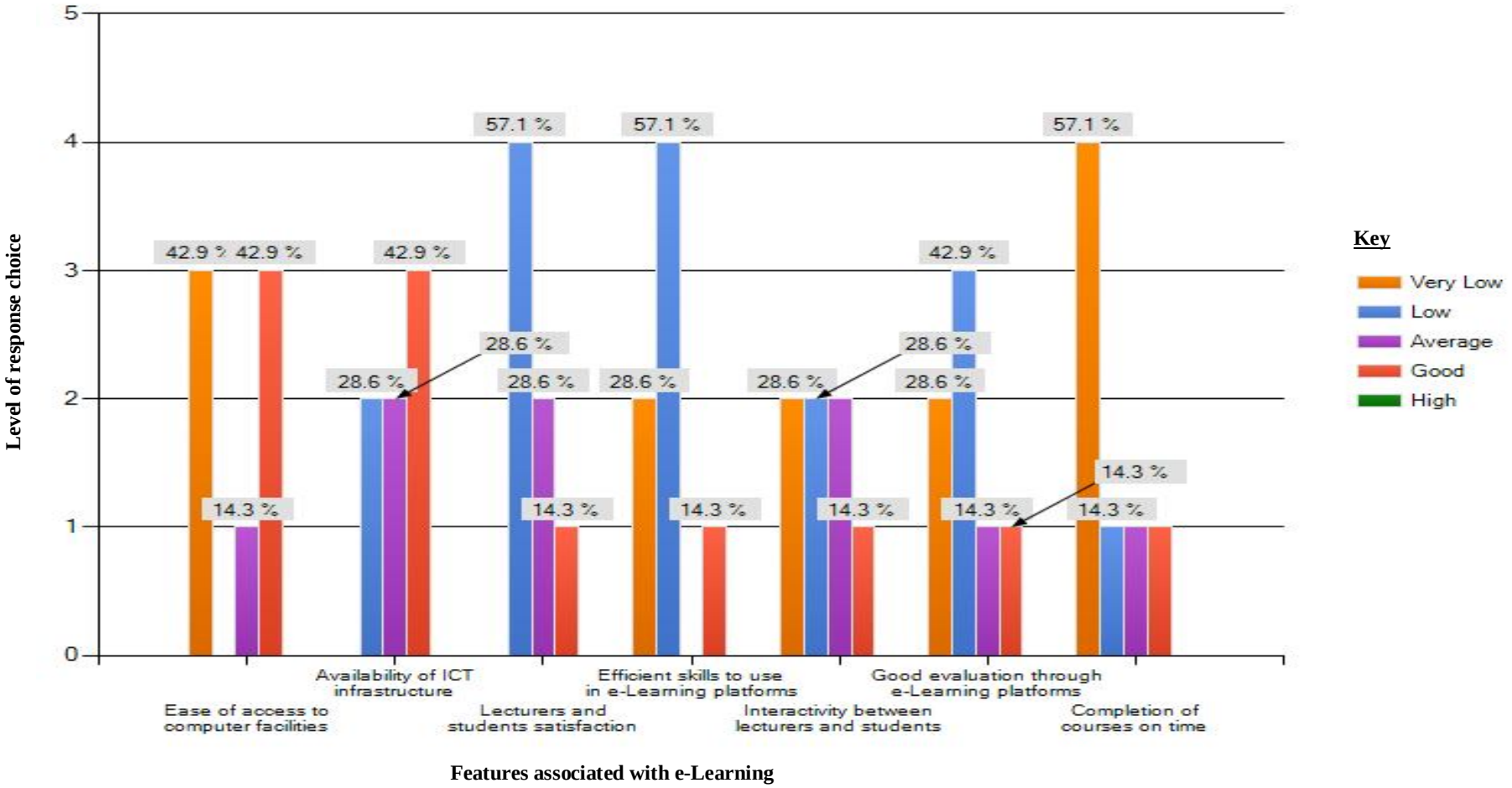


Figure 4.4: Response choices of the current acceptance and implementation of e-Learning in the public universities

Source: Table 4.3

As shown in Table 4.3 and illustrated in figures 4.3 and 4.4 on the current acceptance and implementation of e-Learning in public universities, various parameters were identified and rated in the likert scale. This information was gotten from e-Learning directors and was based on sample population (n) of 7 and the response rate was 7 (100%). The rated parameters are; ease of access to computer facilities, availability of ICT infrastructure, lecturers and students' satisfaction, efficient skills to use in e-Learning platforms, interactivity between lecturers and students, good evaluation through e-Learning platforms and completion of courses on time. Availability of ICT infrastructure parameter had the highest rating average of 3.14 and completion of courses on time having the lowest rating average of 1.86.

With regard to specific universities in terms of ease of access to computer facilities, Kenyatta University, Jomo Kenyatta University of Agriculture and Technology and University of Nairobi were rated good in the five point likert scale which was 3 (42.9% of n), Moi university was rated average which was 1 (14.3% of n) and Maseno University, Masinde Muliro University of Science and Technology and Egerton University were rated very low which was 3 (42.9% of n). In terms of availability of ICT infrastructure, Kenyatta University, Jomo Kenyatta University of Agriculture and Technology and University of Nairobi were rated good in the five point likert scale which was 3 (42.9% of n), Maseno University and Egerton University were rated average which constituted of 2 (28.6% of n) and Masinde Muliro University of Science and Technology and Moi university were rate low which constituted of 2 (28.6% of n). The other parameter which was rated was lecturers and students satisfaction where Moi university was rated good which comprised of 1 (14.3% of n), University of Nairobi and Jomo Kenyatta University of Agriculture and Technology were rated average which was 2 (28.6% of n) and the other four public universities namely Kenyatta University, Maseno University, Masinde Muliro University of Science and Technology and Egerton university were rated low which constituted of 4 (57.1% of n). In terms of efficient skills to use e-Learning platforms, University of Nairobi was rated good which constituted of 1 (14.3% of

n), Kenyatta University, Maseno University, Moi University and Jomo Kenyatta University of Agriculture and Technology were rated low which was 4 (57.1% of n) and Masinde Muliro University of Science and Technology and Egerton university were rated very low which was 2 (28.6% of n). Interactivity between lecturers and students was another parameter which was measured in the five point likert scale where University of Nairobi was rated good which comprised of 1 (14.3% of n), Kenyatta University and Jomo Kenyatta University of Agriculture and Technology were rated average which was 2 (28.6% of n), Maseno University and Moi university were rated low which constituted of 2 (28.6% of n) and Masinde Muliro University of Science and Technology and Egerton University were rated very low which constituted of 2 (28.6% of n). In terms of good evaluation through e-Learning platforms, Jomo Kenyatta University of Agriculture and Technology and University of Nairobi were rated good and average respectively which constituted of 1 (14.3% of n) for each university whereas Moi university, Masinde Muliro University of Science and Technology and Kenyatta University were rated low which was 3 (42.9% of n) and Maseno University and Egerton University were rated very low which constituted 2 (28.6% of n). In this category of current acceptance and implementation of e-Learning in public universities, the last parameter which was rated was completion of courses on time where Jomo Kenyatta University of Agriculture and Technology, University of Nairobi and Kenyatta University were rated good, average and low respectively which constituted of 1 (14.3% of n) for each university whereas all the other four public universities were rated very low which constituted 4 (57.1% of n). None of the universities scored five points (rated high) in the five point likert scale.

4.2.2: Utilization of e-Learning features in course delivery

This section presents the features or benefits that are associated with utilization of e-Learning features in course delivery and those that can be obtained from the development of new e-Learning strategies. Those features are presented in table 4.4 and figures 4.5 and 4.6. These features were

also rated differently on the likert scale by the respondents from the seven public universities as indicated in table 4.4 and also described in the discussion of table 4.4 and figures 4.5 and 4.6.

Table 4.4: Utilization of e-Learning

	Very Low	Low	Average	Good	High	Rating Average
Weighted value	**1**	**2**	**3**	**4**	**5**	
Features rated in the likert scale						
Efficiency	14.3% (1) Egerton Univ	28.6% (2) MMUST, Maseno Univ	28.6% (2) JKUAT, Moi Univ	28.6% (2) KU, UoN	0.0% (0)	2.71
Effectiveness	14.3% (1) Maseno Univ	42.9% (3) Moi Univ, Egerton Univ, MMUST	14.3% (1) KU	28.6% (2) UoN, JKUAT	0.0% (0)	2.57
Accuracy in information exchange	28.6% (2) Egerton Univ, Maseno Univ	14.3% (1) MMUST	14.3% (1) Moi Univ	14.3% (1) JKUAT	28.6% (2) KU, UoN	3
Lecturer – lecturer interaction	28.6% (2) Egerton Univ, Maseno Univ	28.6% (2) MMUST, KU	42.9% (3) Moi Univ, JKUAT, UoN	0.0% (0)	0.0% (0)	2.14
Lecturer – students interaction	28.6% (2) MMUST, Maseno Univ	42.9% (3) JKUAT, Moi Univ, Egerton Univ	0.0% (0)	28.6% (2) KU, UoN	0.0% (0)	2.29
Student – student interaction	28.6% (2) Egerton Univ, Moi Univ	28.6% (2) MMUST, Maseno Univ	0.0% (0)	14.3% (1) JKUAT	28.6% (2) KU, UoN	2.86

Discussion forums	28.6% (2) MMUST, Egerton Univ	14.3% (1) Maseno Univ	28.6% (2) UoN, Moi Univ	14.3% (1) KU	14.3% (1) JKUAT	2.71
Chat forums	28.6% (2) Maseno Univ, Moi Univ	14.3% (1) Egerton Univ	14.3% (1) MMUST	14.3% (1) KU	28.6% (2) UoN, JKUAT	3
					n	7

Source: e-Learning Director's Questionnaire

Key:
1. Figures appearing in brackets alongside response percent represent the response count
2. Rating average is based on the response count, weighted value and "n" (See Appendix IX)

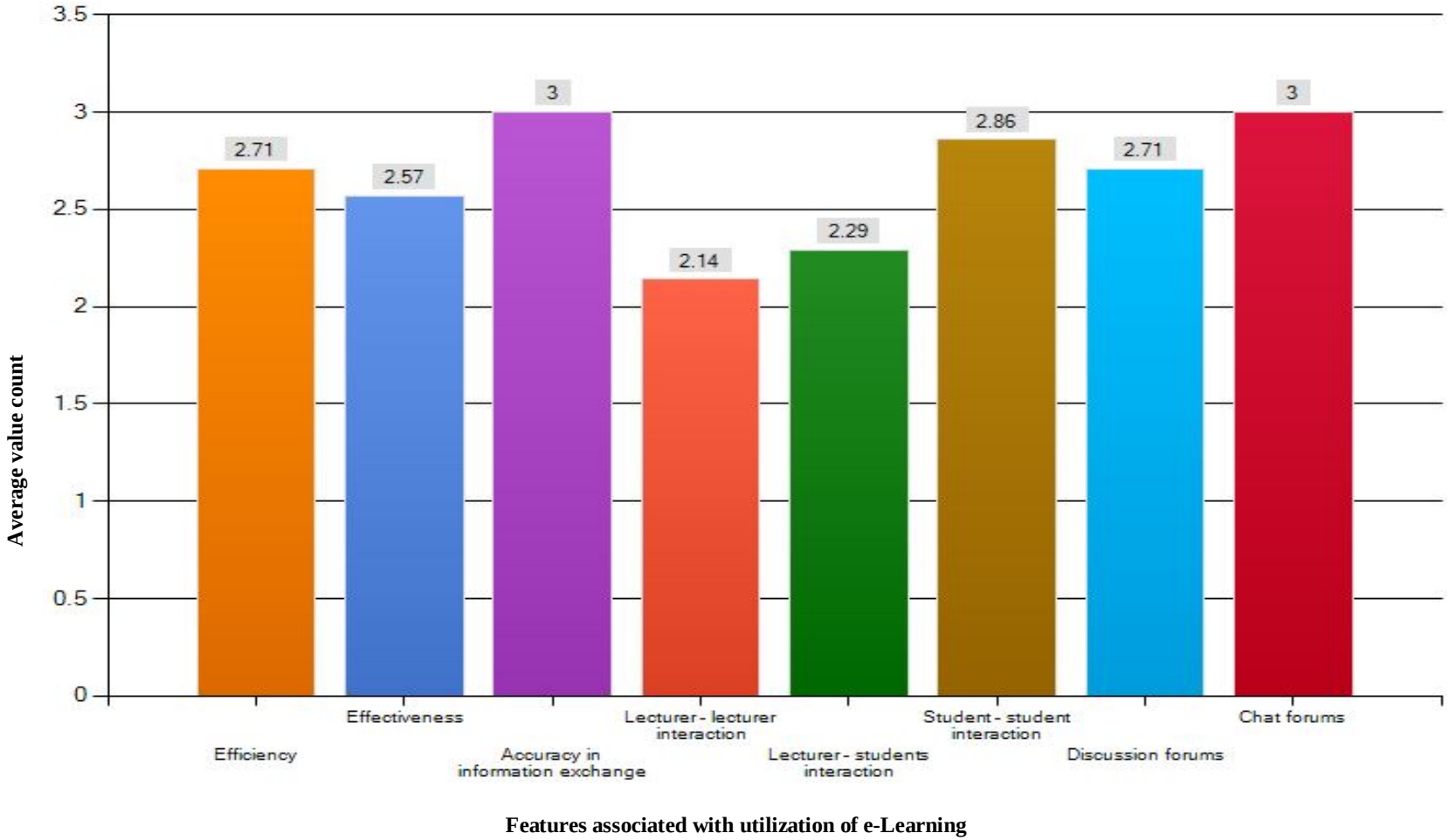


Figure 4.5: Average values of the level of utilization of e-Learning features in course delivery

Source: Table 4.4

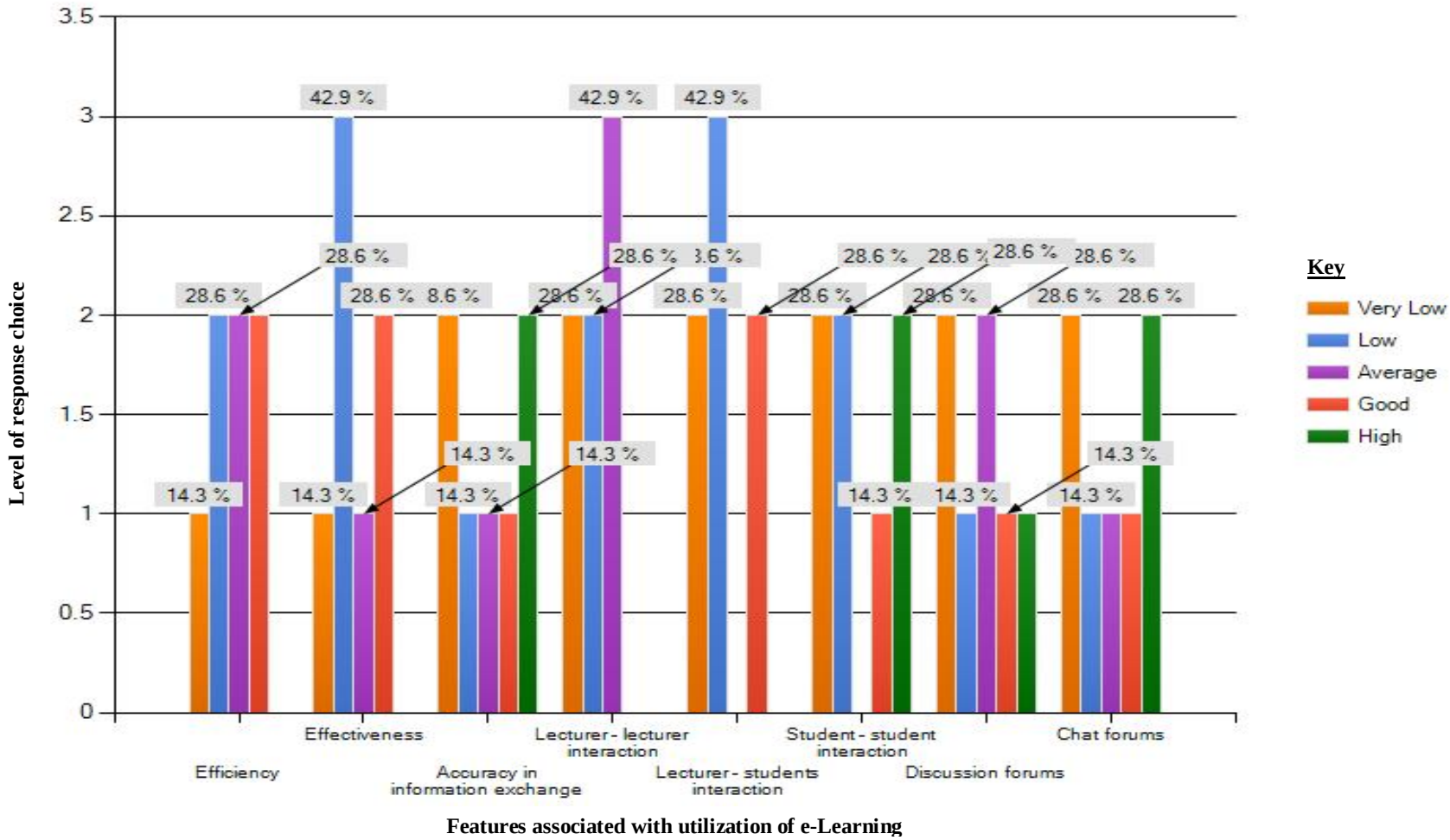


Figure 4.6: Response choices of the level of utilization of e-Learning features in course delivery

Source: Table 4.4

As shown in Table 4.4 and illustrated in Figures 4.5 and 4.6 on utilization of e-Learning features in course delivery in public universities, various parameters were identified and rated in the five point likert scale. This feedback was gotten from e-Learning directors and was based on sample population (n) of 7 and the response rate was 7 (100%).The parameters which were rated are; efficiency, effectiveness, accuracy in information exchange, lecturer – lecturer interaction, Lecturer – students interaction, student – student interaction, discussion forums and chat forums. These parameters had different rating averages on the likert scale. Accuracy in information exchange and chat forums have the highest rating average of 3.0 and lecturer – lecturer interaction has the lowest rating average of 2.14.

With regard to specific universities in terms of efficiency in utilization of e-Learning features in course delivery Kenyatta University and University of Nairobi were rated good which was 2 (28.6% of n), Jomo Kenyatta University of Agriculture and Technology and Moi University were rated average which constituted of 2 (28.6% of n), Masinde Muliro University of Science and Technology and Maseno University were rated low which was 2 (28.6% of n) whereas Egerton University was rated very low which was 1 (14.3% of n). On effectiveness in utilization of e-Learning features in course delivery, University of Nairobi and Jomo Kenyatta University of Agriculture and Technology were rated good which was 2 (28.6% of n), Kenyatta University was rated average comprising of 1 (14.3% of n), Moi University, Egerton University and Masinde Muliro University of Science and Technology were rated low which was 3 (42.9% of n) and finally Maseno University was rated very low which encompassed of 1 (14.3% of n). In terms of accuracy in information exchange Kenyatta University and University of Nairobi were rated high which was 2 (28.6% of n), Jomo Kenyatta University of Agriculture and Technology and Moi University were rated good and average respectively which was 1 (14.3% of n) for each university, Masinde Muliro University of Science and Technology was rated low constituting of 1 (14.3% of n) whereas Egerton University and Maseno University were rated very low which was 2 (28.6% of n). On

lecturer –lecturer interaction, Moi University, Jomo Kenyatta University of Agriculture and Technology and University of Nairobi were rated average which was 3 (42.9% of n), Masinde Muliro University of Science and Technology and Kenyatta University were rated low which constituted of 2 (28.6% of n) whereas Egerton University and Maseno University were rated very low which was 2 (28.6% of n). In respect to lecturer – students interaction, Kenyatta University and University of Nairobi were rated good which was 2 (28.6% of n). Jomo Kenyatta University of Agriculture and Technology, Moi University and Egerton University were rated low which was 3 (42.9% of n). Finally Masinde Muliro University of Science and Technology and Maseno University were rated very low which was 2 (28.6% of n).With regard to student –student interaction, Kenyatta University and University of Nairobi were rated high which constituted of 2 (28.6% of n), Jomo Kenyatta University of Agriculture and Technology was rated good which was 1 (14.3% of n), Masinde Muliro University of Science and Technology and Maseno University were rated low which was 2 (28.6% of n) while Egerton University and Moi University were rated very low constituting of 2 (28.6% of n). On participation of lecturers and students in the discussion forums, Jomo Kenyatta University of Agriculture and Technology was rated high which was 1 (14.3% of n), Kenyatta University was rated good which comprised of 1 (14.3% of n), University of Nairobi and Moi University were rated average which was 2 (28.6% of n). Maseno University was rated low which was 1 (14.3% of n) whereas Masinde Muliro University of Science and Technology and Egerton University were rated very low which consisted of 2 (28.6% of n). With regard to participation of lecturers and students in the chat forums University of Nairobi and Jomo Kenyatta University of Agriculture and Technology were rated high which encompassed of 2 (28.6% of n), Kenyatta University was rated good which encompassed of 1 (14.3% of n), Masinde Muliro University of Science and Technology was rated average which was 1 (14.3% of n). Egerton University was rated low which comprised of 1 (14.3% of n). Maseno University and Moi university were rated very low which was 2 (28.6% of n). It is evident that some parameters rated

under utilization of e-Learning features in course delivery scored five points (rated high) in the likert scale, these are accuracy in information exchange, student-student interaction and participation of lecturers and students in the discussion and chat forums.

4.2.3 Maintenance of e-Learning features in Public Universities in Kenya

This section indicates the features or benefits that are associated with maintenance of e-Learning features and those that can be obtained from the development of new e-Learning strategies. Those features are presented in table 4.5 and figure 4.7 and 4.8. These features were scored on a likert scale differently by respondents from the various public universities as indicated in table 4.5 and also described in the discussion of table 4.5 and figures 4.7 and 4.8.

Table 4.5: Maintenance of e-Learning features

	Very Low	Low	Average	Good	High	Rating Average
Weighted Value	**1**	**2**	**3**	**4**	**5**	
Features rated in the Likert Scale						
Adaptability to changes and innovations to e-Learning	14.3% (1) Egerton Univ	14.3% (1) Maseno Univ	28.6% (2) MMUST, Moi Univ	28.6% (2) UoN, JKUAT	14.3% (1) KU	3.14
Training opportunities	14.3% (1) JKUAT	0.0% (0)	28.6% (2) Moi Univ, Maseno Univ	28.6% (2) MMUST, Egerton Univ	28.6% (2) KU, UoN	3.57
Reliability of ICT	0.0% (0)	14.3% (1) Maseno Univ	42.9% (3) Egerton Univ, MMUST, Moi Univ	14.3% (1) KU	28.6% (2) JKUAT, UoN	3.57
Durability of ICT	0.0% (0)	14.3% (1) Maseno Univ	42.9% (3) Egerton Univ, MMUST, Moi Univ	0.0% (0)	42.9% (3) JKUAT, UoN, KU	3.71
					n	7

Source: e-Learning Director's Questionnaire

Key:
1. Figures appearing in brackets alongside response percent represent the response count
2. Rating average is based on the response count, weighted value and "n" (See Appendix IX)

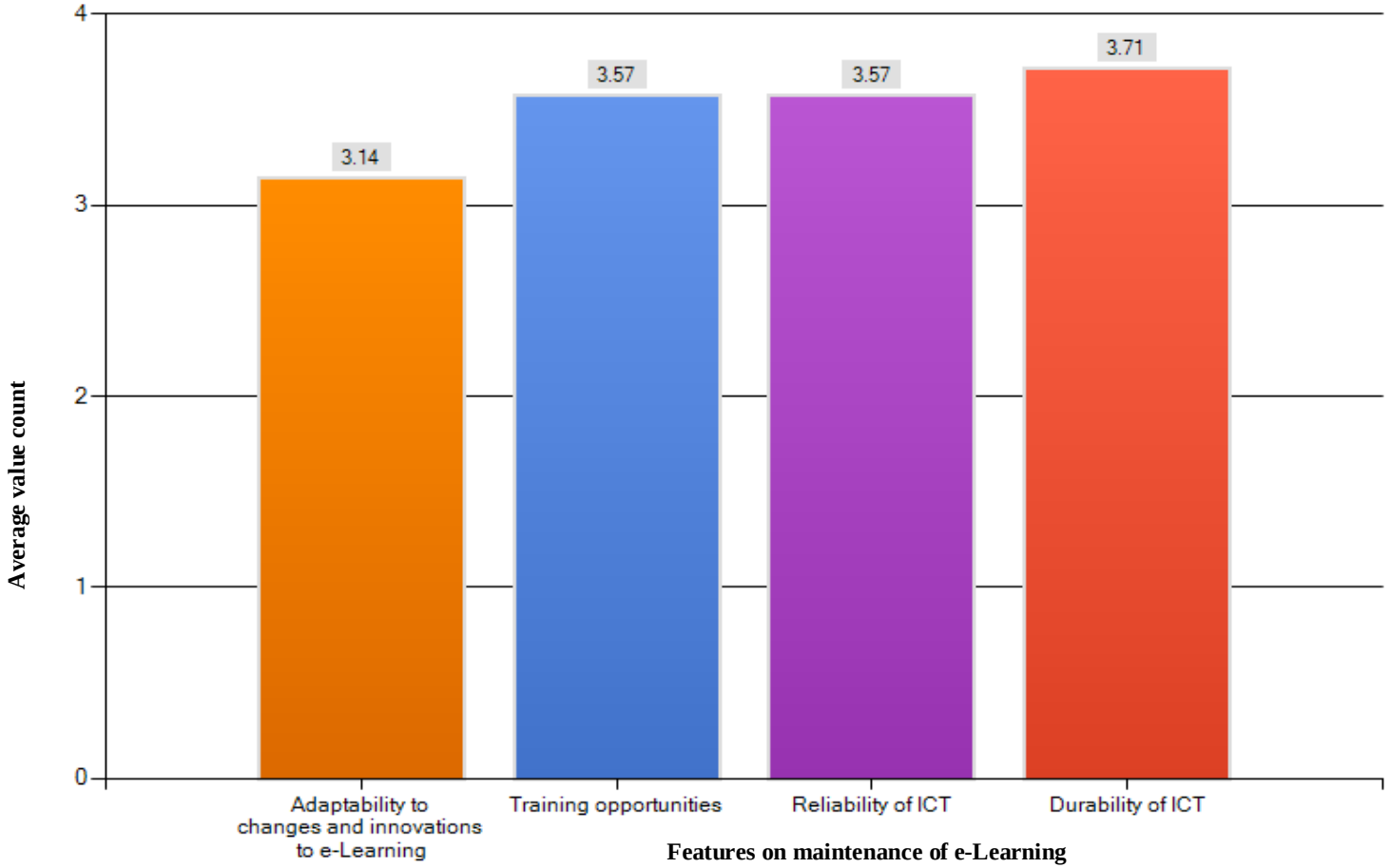


Figure 4.7: Average values of maintenance of e-Learning features

Source: Table 4.5

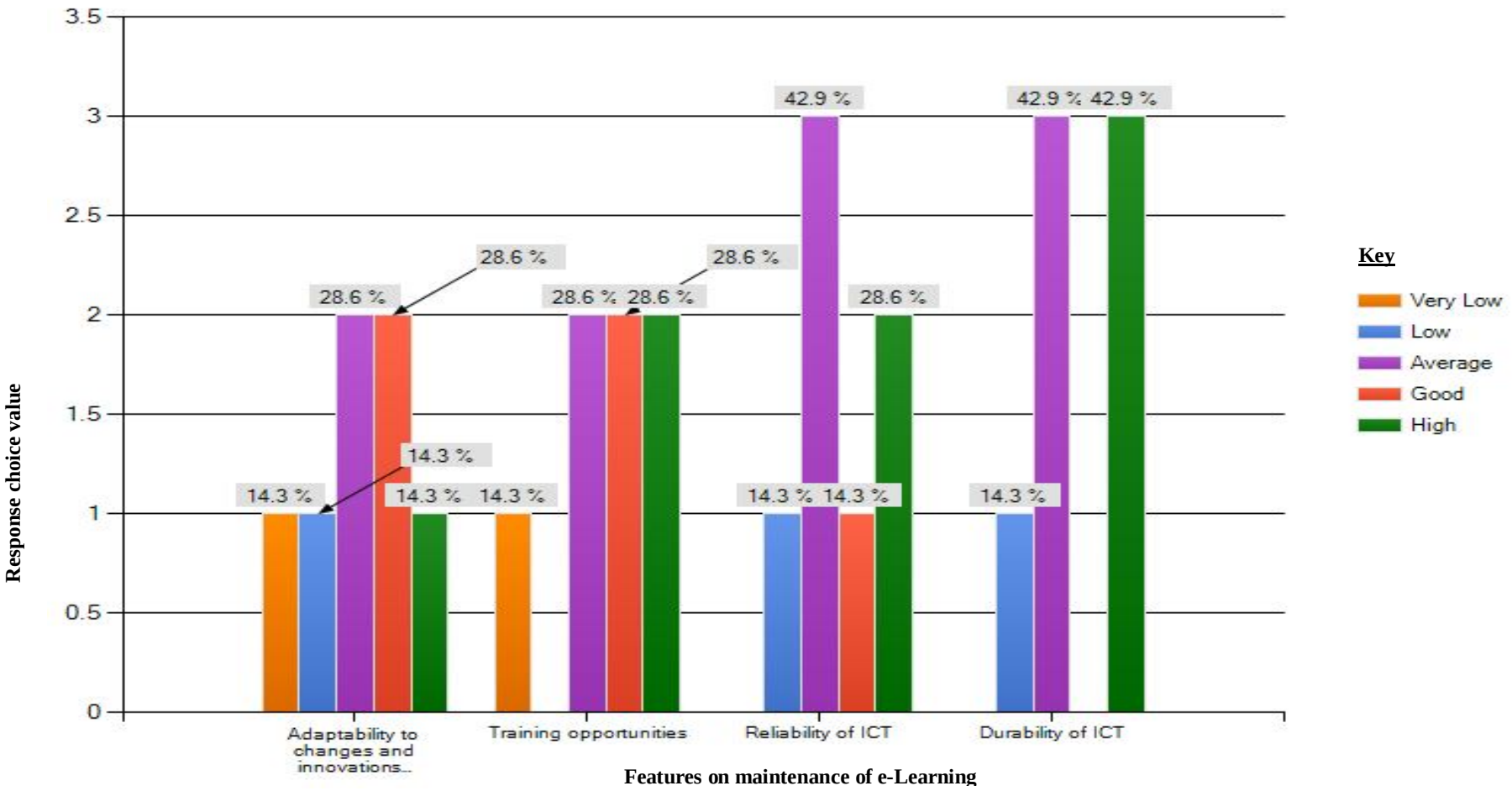


Figure 4.8: Response choices of maintenance of e-Learning features

Source: Table 4.5

As shown in Table 4.5 and illustrated in figures 4.7 and 4.8 on Maintenance of e-Learning features in course delivery in public universities, several parameters were scored differently on five point likert scale. This information was gotten from e-Learning directors and was based on sample population (n) of 7 and the response rate was 7 (100%).The rated parameters are; adaptability to changes and innovations to e-Learning, training opportunities, reliability of ICT and durability of ICT. These parameters were identified as having different rating averages. Durability of ICT had the highest rating average of 3.71 and adaptability to changes and innovations to e-Learning had the lowest rating average of 3.14.

Regarding specific universities in terms of adaptability to changes and innovations to e-Learning, Kenyatta University was rated high which was 1 (14.3% of n). University of Nairobi and Jomo Kenyatta University of Agriculture and Technology were rated good which consisted of 2 (28.6% of n), Masinde Muliro University of Science and Technology and Moi University were rated average in the five point likert scale which encompassed of 2 (28.6% of n) whereas Maseno University and Egerton University were rated low and very low respectively which encompassed of 1 (14.3% of n) for each university. In terms of training opportunities, Kenyatta University and University of Nairobi were rated high which was 2 (28.6% of n), Masinde Muliro University of Science and Technology and Egerton University were rated good which was 2 (28.6% of n), Moi University and Maseno University were rated average which consisted of 2 (28.6% of n). Finally Jomo Kenyatta University of Agriculture and Technology was rated very low which was 1 (14.3% of n). The other parameter which was scored was reliability of ICT where Jomo Kenyatta University of Agriculture and Technology and University of Nairobi were rated high encompassing of 2 (28.6% of n), Kenyatta University was rated good which was 1 (14.3% of n), Egerton University, Masinde Muliro University of Science and Technology and Moi University were rated average which was 3 (42.9% of n) whereas Maseno University was rated low consisting of 1 (14.3% of n). The final parameter which was scored in this section was durability of ICT where

Jomo Kenyatta University of Agriculture and Technology, University of Nairobi and Kenyatta University were rated high which was 3 (42.9% of n), Egerton University, Masinde Muliro University of Science and Technology and Moi University were rated average which encompassed of 3 (42.9% of n) whereas Maseno University was rated low which was 1 (14.3% of n).

4.2.4: Exploitation of e-Learning features

This section presents the features or benefits that are associated with exploitation of e-Learning features and those that can be obtained from the development of new e-Learning strategies. Those features are presented in table 4.6 and figures 4.9 and 4.10. These features were scored differently in the likert scale by respondents from the various public universities as indicated in table 4.6 and as described in the discussion of table 4.6 and figures 4.9 and 4.10.

Table 4.6: Exploitation of e-Learning features

	Very Low (1)	Low (2)	Average (3)	Good (4)	High (5)	Rating Average
Weighted value	**1**	**2**	**3**	**4**	**5**	
Features rated in the likert scale						
Reduced reliance on paper work	14.3% (1) UoN	14.3% (1) JKUAT	14.3% (1) Egerton Univ	14.3% (1) MMUST	42.9% (3) KU, Moi Univ, Maseno Univ	3.57
Reduced operational cost	14.3% (1) Moi Univ	14.3% (1) Maseno Univ	14.3% (1) MMUST	14.3% (1) KU	42.9% (3) UoN, Egerton Univ, JKUAT	3.57
Advantage of new e-Learning	0.0% (0)	0.0% (0)	14.3% (1) Moi Univ	42.9% (3) UoN, Egerton Univ, JKUAT	42.9% (3) KU, MMUST, Maseno Univ	4.29
Service to staff & students	0.0% (0)	0.0% (0)	14.3% (1) Moi Univ	57.1% (4) Egerton Univ, MMUST, UoN, Maseno Univ	28.6% (2) JKUAT, KU	4.14
Competitive advantage	0.0% (0)	0.0% (0)	28.6% (2) Egerton Univ, JKUAT	42.9% (3) MMUST, UoN, Maseno Univ	28.6% (2) KU, Moi Univ	4.00
					n	7

Source: e-Learning Director's Questionnaire

Key:
1. Figures appearing in brackets alongside response percent represent the response count
2. Rating average is based on the response count, weighted value and "n" (See Appendix IX)

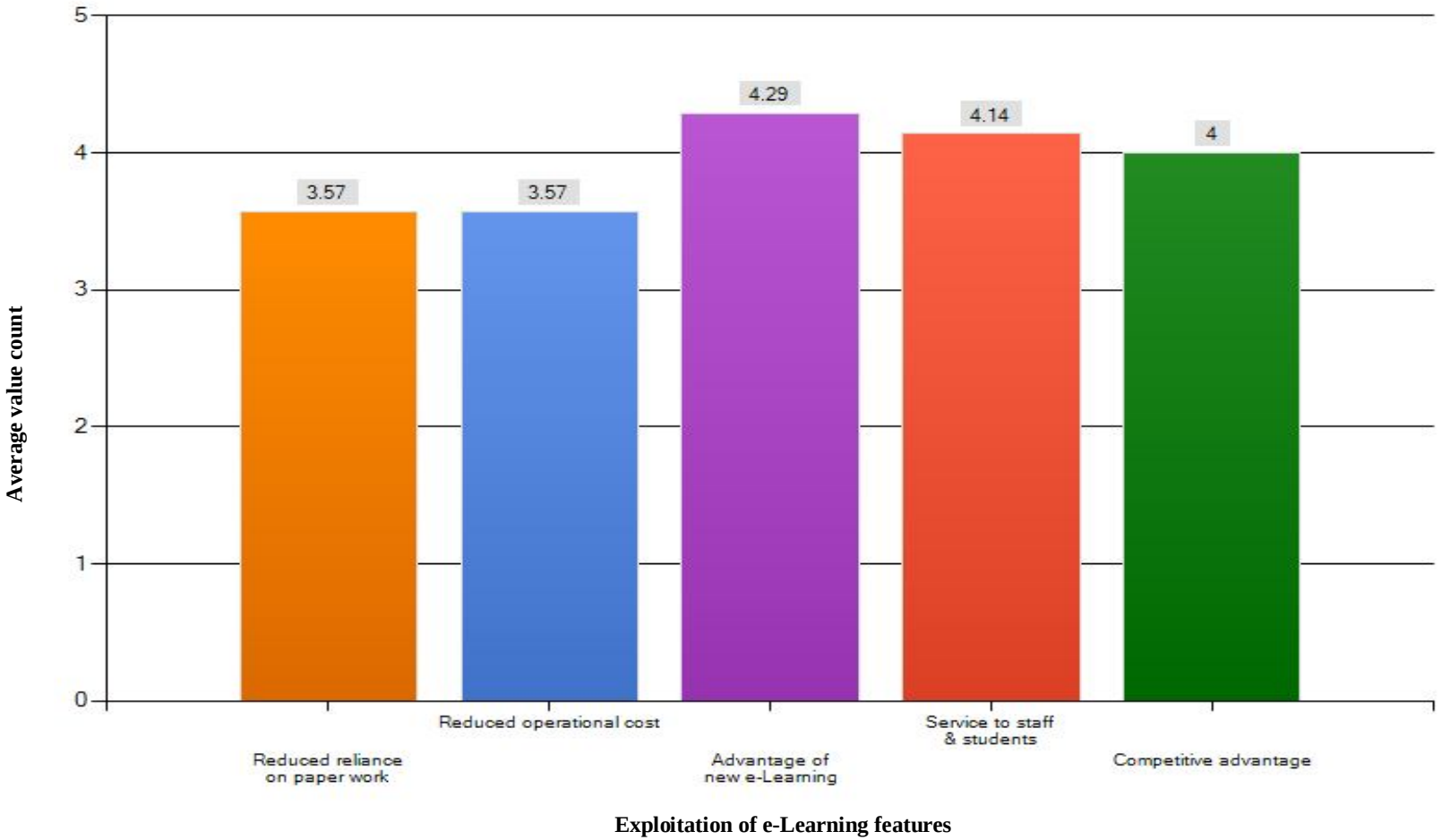


Figure 4.9: Average values of the level of exploitation of e-Learning features

Source: Table 4.6

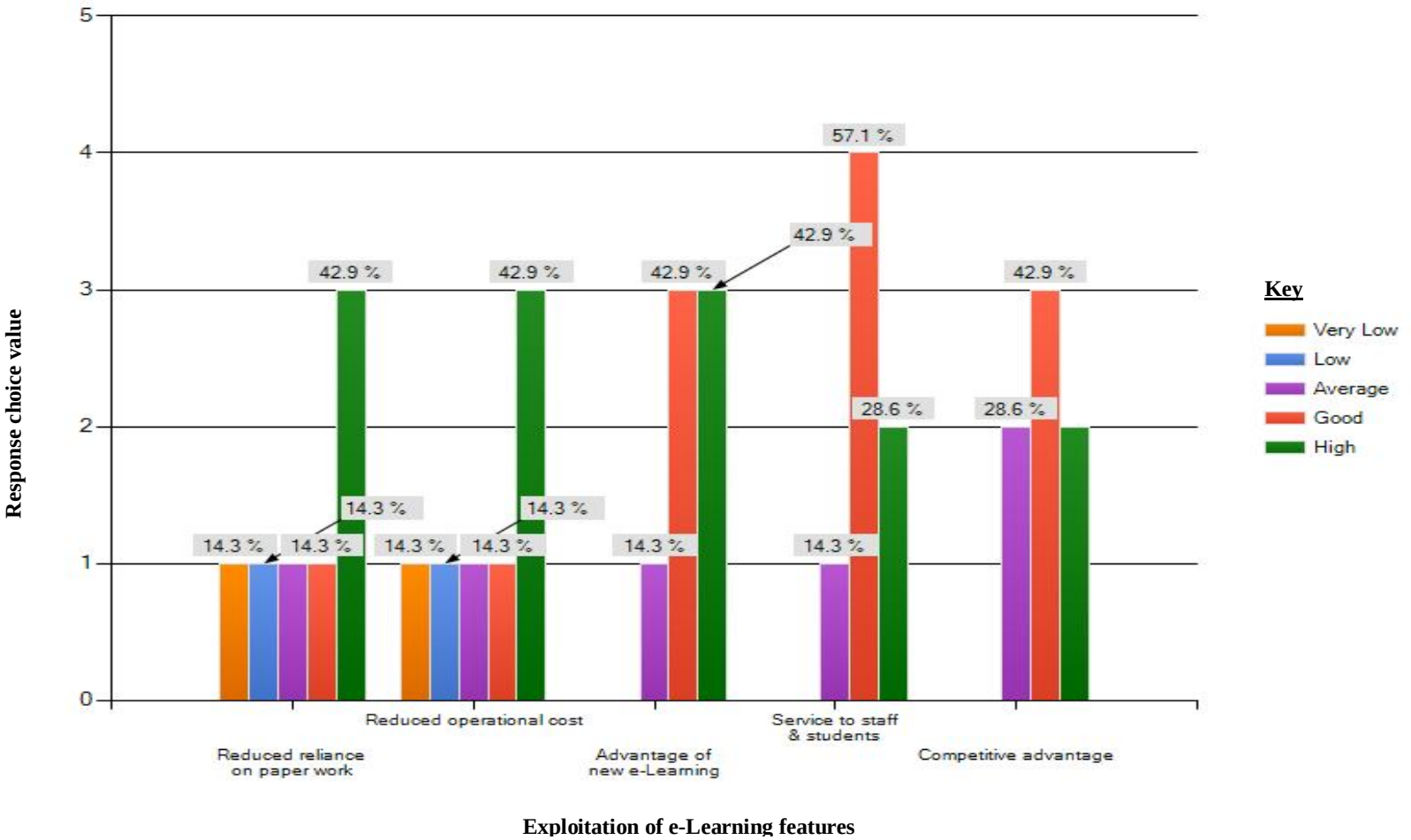


Figure 4.10: Response choices of the level of exploitation of e-Learning

Source: Table 4.6

As shown in Table 4.6 and illustrated in figures 4.9 and 4.10 on exploitation of e-Learning features in course delivery in public universities, several features were scored in the likert scale. Data in this section was gotten from e-Learning directors and was based on sample population (n) of 7 and the response rate was 7 (100%). The exploitation features which were scored are; reduced reliance on paper work, reduced operational cost, advantage of new e-Learning, service to staff and students and competitive advantage. These parameters were identified as having different rating averages. Advantage of new e-Learning had the highest rating average of 4.29 and both reduced operational cost and reduced reliance on paper work had the lowest rating averages of 3.57.

In this category of exploitation of e-Learning features, five parameters were scored differently by respondents from the various public universities as exemplified in the following section. In relation to reduced reliance on paper work, Kenyatta University, Moi University and Maseno University were rated high which was 3 (42.9% of n), Masinde Muliro University of Science and Technology, Egerton University, Jomo Kenyatta University of Agriculture and Technology, and University of Nairobi were rated good, average, low, and very low, respectively which consisted of 1 (14.3% of n) for each university. In terms of reduced operational cost, University of Nairobi, Egerton University and Jomo Kenyatta University of Agriculture and Technology were rated high which constituted of 3 (42.9% of n), whereas Kenyatta University, Masinde Muliro University of Science and Technology, Maseno University and Moi University were rated good, average, low and very low respectively which consisted of 1 (14.3% of n) for each university. The third parameter which was scored was advantage of new e-Learning where Kenyatta University, Masinde Muliro University of Science and Technology and Maseno University were rated high which was 3 (42.9% of n), University of Nairobi, Egerton University and Jomo Kenyatta University of Agriculture and Technology were rated good which consisted of 3 (42.9% of n) and Moi University was rated average which was 1 (14.3% of n). In terms of service to staff & students, Jomo Kenyatta University of Agriculture and Technology and Kenyatta University were rated high which

encompassed of 2 (28.6% of n), Egerton University, Masinde Muliro University of Science and Technology, University of Nairobi and Maseno University were rated good which encompassed of 4 (57.1% of n) and Moi University was rated average comprising of 1 (14.3% of n). The final parameter which was scored was competitive advantage where Kenyatta University and Moi University were rated high which was 2 (28.6% of n), Masinde Muliro University of Science and Technology, University of Nairobi and Maseno University were rated good which consisted of 3 (42.9% of n) and Egerton University and Jomo Kenyatta University of Agriculture and Technology were rated average which was 2 (28.6% of n).

4.2.5: Lecturer's response to e-Learning duties and tasks

This section facilitates in answering research question number four, "What categories of staff are involved in development and transmission of the e-Learning course modules?" Table 4.7 and figure 4.11 shows lecturers' response to e-Learning duties and tasks.

Table 4.7: Lecturer's response to e-Learning duties and tasks

Answer Options	Response Count	Response Percent
Very good	0	0.0%
Good	1	14.3%
Average	2	28.6%
Below average	4	57.1%
poor	0	0.0%
	n	**7**

Source: e-Learning Director's Questionnaire

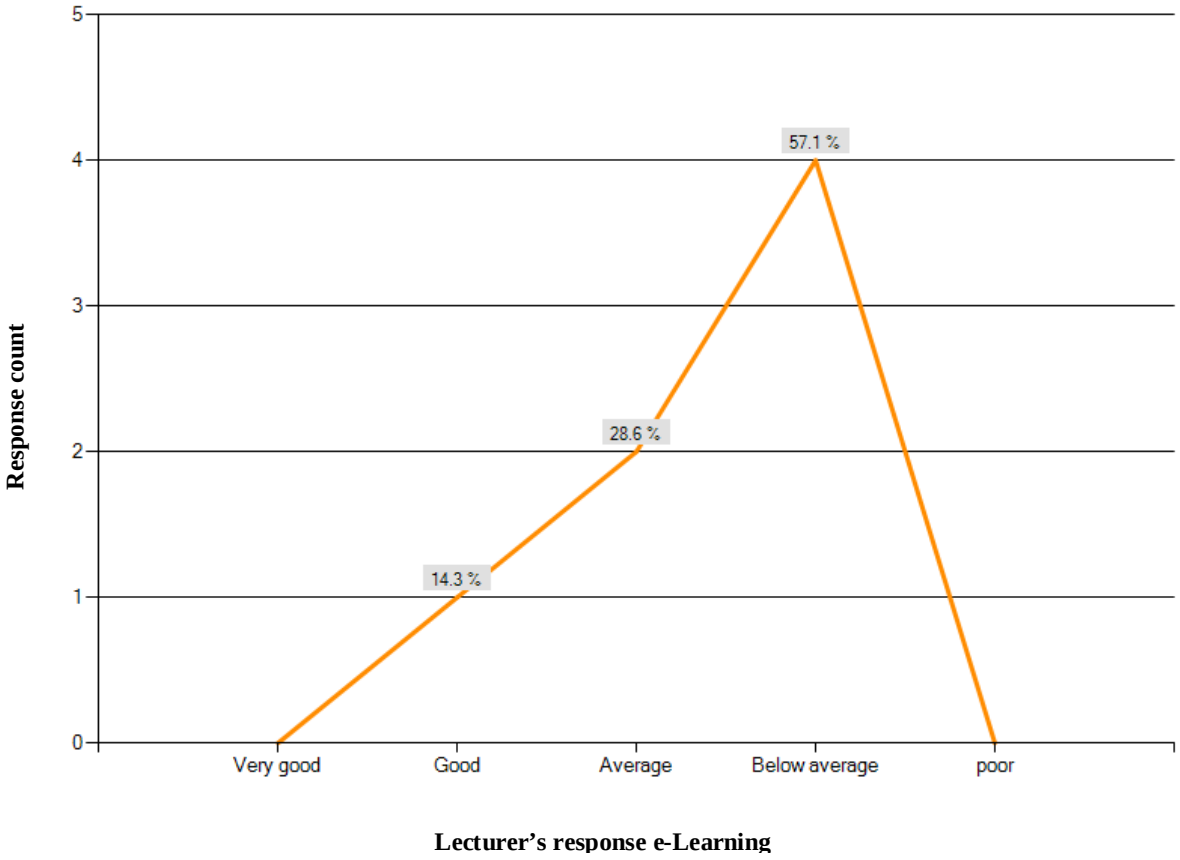


Figure 4.11: Lecturer's response to e-Learning duties and tasks

Source: Table 4.7

As shown in Table 4.7 and illustrated in figure 4.11 on lecturers response to e-Learning duties and tasks in course delivery in public universities the following parameters which are very good, good, average, below average and poor were identified as having different response counts and response percents. From the information gotten, it shows that majority of lecturers' response to e-Learning duties and tasks was below average with none being in the very good and poor categories. The below average category constituted of 4 (57.1%), good category constituted of 1 (14.3%), average category constituted of 2 (28.6%) whereas very good and poor constituted 0.0%. In terms of respondents' judgment on lecturer's response to e-Learning as per specific universities response counts; Moi University was rated good, Kenyatta University and University of Nairobi were rated average and all the other four universities were rated below average. This judgment was influenced

by the way lecturers automate their teaching notes, respond to e-Learning training, uploading econtent to the Universities' Learning Management Systems and participation in other e-Learning activities.

4.2.5.1 Level of Academic Staff Computer training and response to e-Learning duties and activities

This section seeks to present findings on the level of computer training of the members of academic staff and their response to e-Learning duties and activities. Table 4.8 displays numbers of the members of academic staff from the various public universities who have undertaken training in e-Learning platforms. That table forms the basis for cross tabulation with level of training in computer applications of the academic staff, training in designing e-Learning courses, rating of students' response to e-Learning and remuneration status for developing e-Learning courses.

Table 4.8: Academic staff who had undertaken training in e-Learning platforms applied in the respective public universities

Institution	Yes	Response Percent
UoN	53	33.1%
Maseno	4	2.5%
Kenyatta	37	23.1%
Moi	25	15.6%
MMUST	8	5.0%
Egerton	22	13.8%
JKUAT	11	6.9%
		100%

Source: Academic staff questionnaire

Figure 4.12 shows results after a cross tabulation of the members of academic staff who had undertaken training in e-Learning platforms and thereafter went ahead to apply the skills in their respective universities. These members of academic staff had initially undertaken courses in computer training where 63 (39.4%) had attained the elementary level (Certificate and below), 45

(32.3%) had attained intermediate level (College diploma) and 52 (28.4%) had attained advanced level (university degree) as presented in figure 4.12. This information reveals that there is a relationship between individual level of computer training and utilization of e-Learning.

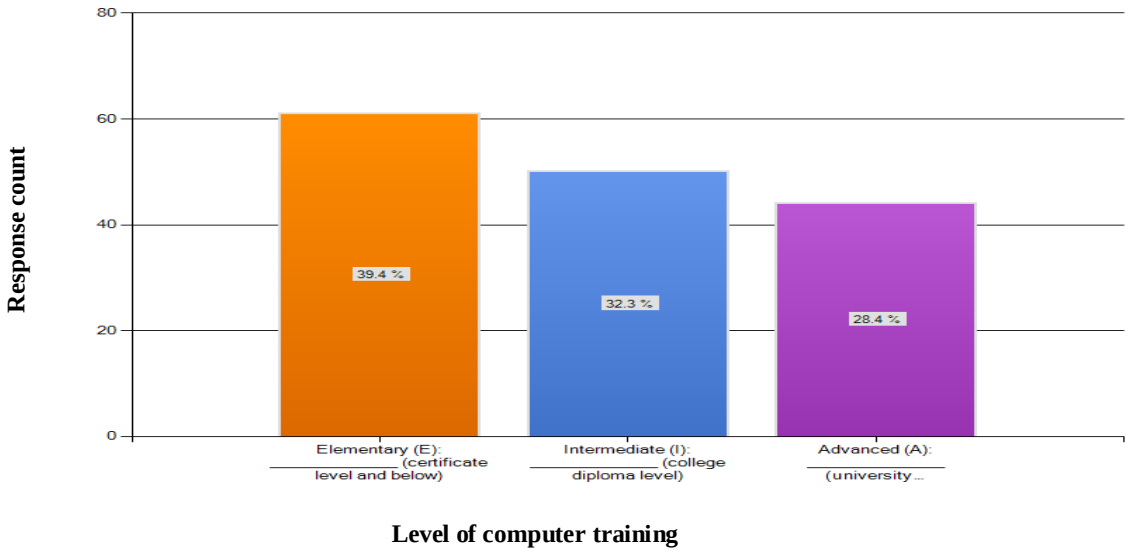


Figure 4.12: Cross tabulation of academic Staff who had undertaken training in e-Learning platforms applied in the respective public universities and the level of computer training in computer applications

Figure 4.13 shows findings of members of academic staff who had undertaken training in e-Learning platforms and hence went further to undertake training in designing e-Learning courses. It was found that 109 (68.1%) of those who had undertaken a course in e-Learning also undertook courses in designing e-Learning courses but 51 (31.9%) didn't. This shows the level of aspiration towards adoption of e-Learning.

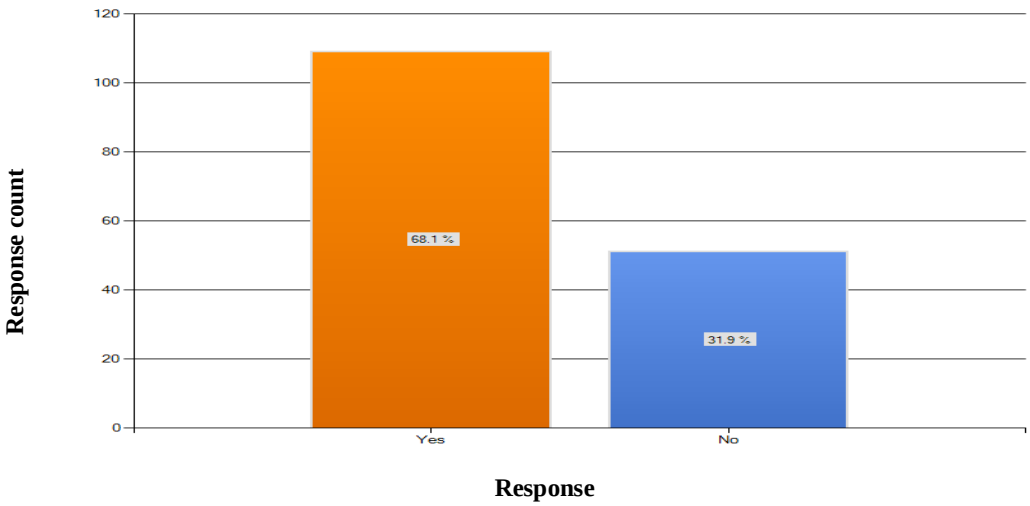


Figure 4.13: Cross tabulation of academic staff who had undertaken training in e-Learning platforms applied in the respective public universities and also undertook training in designing e-Learning courses

In figure 4.14, results on rating of students response to e-Learning by members of academic staff who had undertaken training in e-Learning platforms is shown. From the lecturers who undertaken training in e-Learning platforms, 32 (20%) considered students response to e-Learning as very good, 112 (70%) rated students' response as good and 16 (10%) rated students' response as average. This information shows that lecturers who are trained in e-Learning are able to motivate their students to adopt and utilize e-Learning.

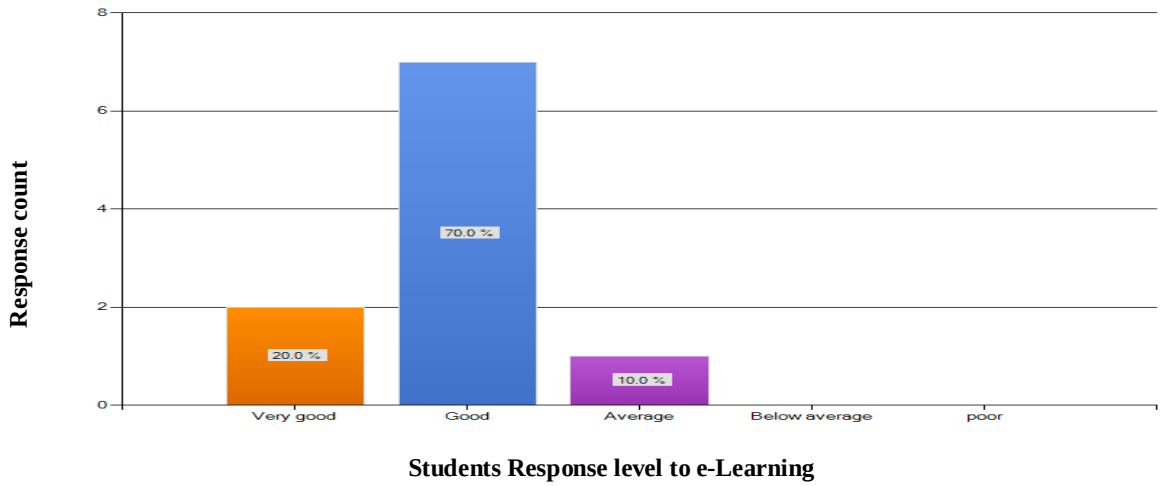


Figure 4.14: Cross tabulation of academic staff who had undertaken training in e-Learning platforms applied in the respective public universities and their rating on student' response to e-Learning

Figure 4.15 show results on whether members of academic are remunerated for developing e-Learning courses. The members of academic staff who had undertaken training in e-Learning platforms applied in the respective public universities, 27 (16.7%) claimed to be remunerated for developing e-learning courses and 133 (83.3%) claimed not to be remunerated for developing e-courses. This would give an explanation on why lecturers' response to e-learning duties and tasks is low in public universities in Kenya as also reflected in Table 4.7 and Figure 4.11.

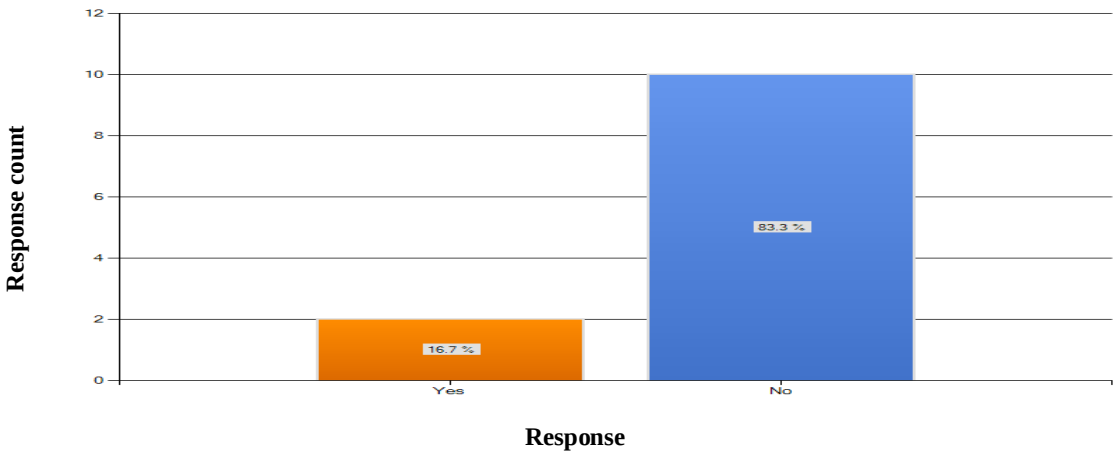


Figure 4.15: Cross tabulation of academic staff who had undertaken training in e-Learning platforms applied in the respective public universities and whether they are remunerated for developing e-courses

This discussion summarizes section 4.2.5.1 on the level of computer training and response to e-Learning duties and activities. From the information in Table 4.8, it is shown that 53 (33.1%), 4 (2.5%), 37 (23.1%), 25 (15.6%), 8 (5.0%), 22 (13.8%) and 11 (6.9%) members of academic staff from University of Nairobi, Maseno University, Kenyatta University, Moi University, Masinde Muliro University of Science and Technology, Egerton University and Jomo Kenyatta University of Agriculture and Technology respectively have undertaken training in the e-Learning platforms applied in their respective public universities. This number of members of academic staff who had undertaken training in e-Learning were 160 (38.5%) of the total responses from the category of teaching/academic staff responses of 416 (100%) responses.

From the responses after cross tabulation of the members of academic staff who had taken training in e-Learning platforms applied in the respective and their level of computer training in computer

applications, 63 (39.4%) of them were of elementary level (Certificate and below), 52 (32.3%) of intermediate level (College diploma) and 45 (28.4%) of advanced (University degree and above) in terms of the level of computer applications training. This is as shown in Figure 4.12.

It was also identified that out of all the members of the academic staff who have undertaken training in e-Learning platforms,109 (68.1%) have undertaken training in designing e-Learning courses and 51 (31.9%) have not as shown in Figure 4.13. According to the views of the academic staff who had undertaken training in the e-Learning platforms, they rated very good, good, and average as 32 (20.0%), 112 (70.0%) and 10 (10.0%) respectively on student' response to e-Learning as shown in Figure 4.14. When they were asked whether they are remunerated for developing e-courses, 27 (16.7%) and 133 (83.3%) responded yes and no respectively as shown in Figure 4.15 and this may be one of the reasons why the members of the academic staff are reluctant to make use of e-Learning in course delivery in public universities in Kenya.

4.2.6: Present level of e-Learning application in the universities

This section highlights present level of e-Learning as viewed by respondents from different public universities. The present level of e-Learning application is scored as much higher, higher, average (same as other public universities), lower, much lower and is presented in table 4.9 and figure 4.16.

Table 4.9: Present level of e-Learning application in the universities

Answer Options	Response Count	Response Percent
Much higher	0	0.0%
Higher	0	0.0%
Average (same as others public universities)	3	42.9%
Lower	3	42.9%
Much lower	1	14.3%
	n	**7**

Source: e-Learning Director Questionnaire

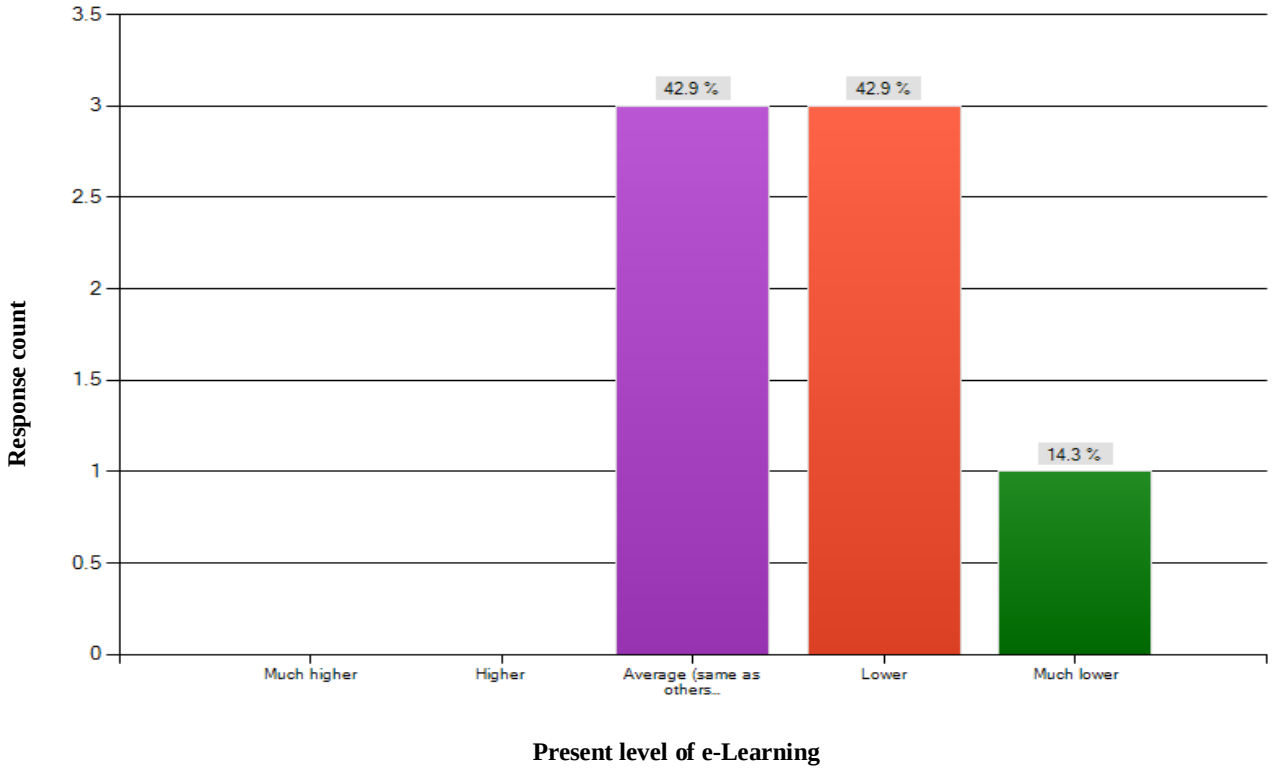


Figure 4.16: Present level of e-Learning application in the public universities in Kenya

Source: Table 4.9

As shown in Table 4.9 and illustrated in Figure 4.16 on present level of e-Learning application in course delivery in public universities, the following rating levels which are much higher, higher, average (same as others public universities), lower and much lower were identified as having different response counts and response percentages. From the information obtained it shows that majority of the respondents estimated present level of e-Learning to lie at the average level (same as other public universities) and lower levels constituting of 3 (42.9%) in each level. The estimate score for the much lower level consisted of 1 (14.3%). Much higher and higher levels were rated 0.0% indicating that none of the universities lies on those levels. In terms of respondents' judgment on present level of e-Learning application in public universities as per the specific universities response counts; Moi University, Kenyatta University and University of Nairobi were rated average, Jomo Kenyatta University of Agriculture and Technology, Masinde Muliro University of Science and Technology and Maseno University were rated lower and Egerton University was rated

much lower. This judgment was influenced by the level of participation of lecturers and students in e-Learning activities.

4.2.7: User requirements and preconditions set and available in public universities in Kenya

This section facilitates answering the research question number three, "What are the features of the hardware and software, which are applied in course delivery via e-Learning?" Table 4.10 shows various features of hardware and software and their state in public universities. This section is necessary since it shows the status of hardware and software in public universities in Kenya.

Table 4.10: User requirements and preconditions set and available in public universities in Kenya

User requirements and preconditions	Yes	No	Response Count
Network is available when required and where necessary	100.0% (7)	0.0% (0)	7
Network facilitates extensions and variations to the network	100.0% (7)	0.0% (0)	7
Network facilitates adaptability of network components	100.0% (7)	0.0% (0)	7
Network indicates speed at which data/info is transmitted	100.0% (7)	0.0% (0)	7
Network is consistent with respect to correctness, completeness, timeliness and authorization while in use	100.0% (7)	0.0% (0)	7
Networks protects data/info from loss	100.0% (7)	0.0% (0)	7
IPP facilitates development, utilization, exploitation and maintenance of networks in the university	100.0% (7)	0.0% (0)	7
e-Learning activities are centralized in the university to maintain control	83.3% (5)	16.7% (1)	6
e-Learning activities are de-centralized to distribute resources and personnel	28.6% (2)	71.4% (5)	7
Network components are concentrated for control and security	100.0% (7)	0.0% (0)	7
Network components are de-concentrated for autonomy and control	28.6% (2)	71.4% (5)	7
Supported by university administration	100.0% (7)	0.0% (0)	7

Technical staff allocated	85.7% (6)	14.3% (1)	7
Safety of staff/equipment is assured for compensation for injury	100.0% (7)	0.0% (0)	7
Network components are standardized to improve services across the University	100.0% (7)	0.0% (0)	7
There is SLAs between network vendors and the University	85.7% (6)	14.3% (1)	7
The location of the university contributes to its communication infrastructure problems	42.9% (3)	57.1% (4)	7
LAN and Internet components are provided for local communication and access to WWW and Internet	100.0% (7)	0.0% (0)	7
There is upgraded hardware to the state-of-the-art	85.7% (6)	14.3% (1)	7
There is upgraded software to the state-of-the-art	85.7% (6)	14.3% (1)	7
Network components: There is upgraded network components to the state-of-the-art	85.7% (6)	14.3% (1)	7
New acquisitions of hardware are regular	100.0% (7)	0.0% (0)	7
New acquisitions of Software are regular	100.0% (7)	0.0% (0)	7
New acquisitions of Network components are regular	100.0% (7)	0.0% (0)	7
Choice of the automated tool is dictated by the need to use software that is simple, easy-to-use, cost-effective and commonly available in Kenya	85.7% (6)	14.3% (1)	7
		n	7

Source: e-Learning technicians' questionnaires

According to the information in Table 4.10, it was identified that network is available when required and where necessary, it facilitates extensions and variations to the network, it facilitates adaptability of network components, it indicates speed at which data/information is transmitted, it is consistent with respect to correctness, completeness, timeliness and authorization while in use and it protects data/information from loss. This was common in all the public universities. It was also identified that information policy and planning facilitates in development, utilization, exploitation

and maintenance of networks in the university. All the universities have their e-Learning activities centralized to maintain control and only two universities namely University of Nairobi and Jomo Kenyatta University of Agriculture and Technology have de-centralized e-Learning activities to distribute resources and personnel.

In regard to the concentration of network components, all the universities have concentrated them for control and security. Two universities have de-concentrated network components for autonomy and control. It was also identified that all universities provide financial resources and support by university administration in implementation of e-Learning. There is also proper personnel allocation in terms of technical staff and safety of staff and equipment is assured for compensation for injury in all the universities. Network components are standardized to improve services across the university and there are service level agreements (users, vendors) between network vendors and the universities. Local Area Network and Internet components are provided for local communication and access to WWW and Internet in all universities. It was identified that hardware, software, network components are upgraded to the state-of-the-art in all the universities and in other instances new hardware, software, network components are acquired regularly and this concurs with Forouzan (2003) in order to facilitate effective e-Learning implementation. Finally, the choice of the automated tool is dictated by the need to use software that is simple, easy-to-use, cost-effective and commonly available in Kenya.

In terms of user requirements and preconditions set and available in public universities in Kenya only the following user requirements and preconditions were not common in all the seven public universities:

a). e-Learning activities are centralized in the university to maintain control

b). e-Learning activities are de-centralized to distribute resources and personnel

c). Network components are de-concentrated for autonomy and control

d). Technical staff allocated

e). There is SLAs between network vendors and the University

f). The location of the university contributes to its communication infrastructure problems

g). There is upgraded hardware to the state-of-the-art

h). There is upgraded software to the state-of-the-art

i). There is upgraded network components to the state-of-the-art

j). Choice of the automated tool is dictated by the need to use software that is simple, easy-to-use, cost-effective and commonly available in Kenya

4.2.8: Students enrolled in e-Learning courses in public universities

This section facilitates answering research question number five, "What is the student enrollment in e-Learning courses and which facilities do they use to access e-courses?" This section is necessary since it shows to what extent e-Learning is being utilized by students in public universities in Kenya.

The information obtained from the administrators showed that in Moi university, there were about 400 students and university of Nairobi had about 300 enrolled in blended learning where instruction is conducted both via e-learning but also attend face-to-face lecture sessions. In Kenyatta University, most open learning students access information via e-Learning but also use printed modules and attend 4 hour tutorial sessions. The regular students in some departments access course outlines, assignments and lecture notes via the moodle e-Learning platform but they also attend face-to-face lecture sessions which are a characteristic of blended learning as it is postulated by Cox &Carr, (2006). The other universities didn't provide information on student enrolment in e-Learning. It is figured out that most students who access courses via e-Learning also attend face-to-face sessions, thus the conclusion is that public universities in Kenya don't transmit courses purely through e-Learning but what is in application is blended learning.

4.2.9: Roles of e-learning technicians in public universities

The information obtained from the e-learning technicians revealed the roles they perform in the public universities as described below. They assist the course lecturers in uploading of course content. Lecturers usually give them lecture notes and with the use of author ware like (exe), they customize the notes and upload them to the course management systems applied in the respective universities. They also assist in interacting with students by giving the students the lecturers' responses after lecturers have responded to the assignment activities given to the students. They also provide technical support, sensitization and end user training to both the lecturers and students and they do this by training on the interfaces of the learning management systems software applied in the universities.

e-Learning technicians are responsible for entering and managing students data and communicating important information to the students. They ensure the computers, e-Learning network and other e-Learning accessories (cables, wimax, routers, and switches) are working properly. They ensure that the e-learning platforms (moodle, chisimba, blackboard, interactive white boards) are accessible to both the students and lecturers. They are involved in upgrading, maintenance and customizing the e-Learning platforms. Another role of e-Learning technicians is ensuring the security of the e-learning platforms and content. They assign permissions to different categories of e-learning users as provided by the platforms interface and also assist and guide users when they face difficulties in application of the e-Learning platforms. They ensure that all computers are connected to the intranet or internet and prepare work plans and setting e-Learning targets for e-Learning application in course delivery. They allocate courses in the e-Learning platforms to both instructors and students and supervise conversion of courses to e-Learning content.

4.2.9.1: e-learning technician's role in maintenance of hardware, course content, infrastructure, network and software in public universities

From the information gathered, there are instances where external ICT technical staff are hired to assist in maintenance of the e-Learning hardware. The roles of e-Learning technicians in the universities are performing regular checkup, upgrading and troubleshooting of the hardware.

The e-content is maintained by training users on how to maintain their content. They also get support from ICT staff and other e-Learning staff to maintain the e-content. Regular review and updating of the e-content by the lecturers with the help of the technicians also facilitate in the maintenance.

e-Learning infrastructure is maintained by regular checkup and repair. There is also a tendency of using standard and durable infrastructure. Obsolete e-Learning equipment are regularly replaced with new ones and also upgraded to the current versions.

The systems administrator regularly monitors the performance of the network and also replacing the obsolete network components with new ones. Segmenting of the network into sub-nets per school and upgrading to new versions is another way of ensuring maintenance of the network. e-Learning software is usually upgraded with new versions whenever necessary. Systems administrator does regular fine tuning of the existing software to ensure its maintenance.

4.2.9.2: e-learning technician's role in ensuring security of course content, hardware, infrastructure, network and software in public universities

Security of e-content is ensured through use of user names passwords, use of firewalls and assigning different levels of permissions to the different users and this is by assigning different roles and privileges to students and lecturers. Password protection is also applied in ensuring

security of e-content. Regular back up and use of anti viruses is also another way of ensuring security of content.

Hardware security is ensured through physical security under lock and key with limited access by unauthorized users to the e-Learning laboratories. Use of clean power from uninterrupted power supply's to avoid damages due to power fluctuation is another way of ensuring security of the hardware. Control of access to the server room also ensures security. There is also monitoring of movement of portable hardware. e-Learning infrastructure security is maintained through acquisition of standard e-Learning equipment and limiting access to physical locations of e-learning infrastructure like routers.

Security of the e-Learning network is ensured through acquisition of standard network equipment like CISCO routers and switches. Ensuring proper network design also ensures security of the network. Firewalls are also applied to ensure security from external attacks to the network.

Software security is ensured through use of passwords. Running the e-Learning software in linux application platform which is virus free and stable also ensures security of the software. Assigning users limited level permissions and use of anti viruses is another way security of software is ensured as Thompson (2000) notes.

4.2.10: University administration support for e-Learning in public universities

In the University of Nairobi, Jomo Kenyatta University of Agriculture and Technology and Moi universities, the administration has set support offices in place. In other universities, the e-Learning departments have been set up by the administration as support offices for e-Learning activities. Administration supports e-Learning through approvals and allocation of finances to facilitate e-Learning training and other e-Learning activities. Employment of e-Learning staff and approval of purchase of e-Learning equipment is another way university administration supports e-learning in

public universities. They also support training of the personnel and foreseeing the adoption of e-Learning policies. In Masinde Muliro University of Science and Technology, the administration has established a school of open learning which promotes e-Learning in course delivery. The universities have also facilitated in setting up of e-Libraries like in Kenyatta University.

4.3 Costs involved in development, production, maintenance, presentation, storage, delivery and transmission of e-Learning courses and materials in public universities in Kenya

This section facilitates in answering the research question number seven, "What are the costs involved in setting up and maintaining e-learning hardware and software; costs involved in development, production, storage and maintenance of the course modules?"

Most of the research to date on the cost structure of e-Learning has concentrated on the development of general economic models which have attempted to identify the behaviour of costs in respect of the fundamental variables, particularly the number of courses and the number of students in e-Learning system.

One of such models was developed by staff at the British Open University and improved by Bates (1990) which was adopted as per this analysis.

T = $C_1\beta_1 + C_2\beta_2 + S\partial + f$

Where:

T = the total costs

C_1 = the number of courses in development

C_2 = the number of courses in presentation

S = the number of students (weighted course enrollments)

β_1 = the average cost of a course in development

β_2 = the average cost of a course in respect of revision, maintenance and replacement

∂ = the average delivery cost per student (weighted course enrollment)

f = institutional overhead costs (fixed)

4.3.1 Development and production of e-Learning Course

D = [$N_1\Delta_1 + N_2\Delta_2 + \ldots\ldots + N_n\Delta_n] + [(\theta+\varsigma)_{X1} + (\theta+\varsigma)_{X2} + \ldots\ldots + (\theta+\varsigma)_{Xn}]$

Where:

N = staff in any number of distinct categories 1,2,…,n

Δ = the average employment cost of a member of staff in a given category N

θ = the development cost per unit of output for any type of course or component X where the number of courses or components is 1,2,….,n

ς = the production cost per unit of output for any component or type of course X where the number of courses or components X1 is any number 1,2,….,n

a). The following costs were gotten from University of Nairobi where three e-Learning technicians/ course/graphic designers and two lecturers were involved in developing one course.

Thus development and production of one course was as follows, D = [(3 X 40,000) + (2 X 100,000)] + [(70,000 + 40,000)]

D = 120,000 +200,000 +70,000 + 40,000 = 430,000

(Amount is in Kenya Shillings)

b). The following costs were gotten from Moi University where two e-Learning technicians/ course/graphic designers and one lecturer were involved in developing one course.

Thus development and production of one course was as follows, D = [(2 X 35,000) + (2 X 100,000)] + [(40,000 + 40,000)]

D = 70,000 +200,000 +40,000 + 40,000 = 350,000

(Amount is in Kenya Shillings)

c). The following costs were gotten from Jomo Kenyatta University of Agriculture and Technology where one e-Learning technician/ course/graphic designer and two lecturers were involved in developing one course.

Thus development and production of one course was as follows, D = [(1 X 50,000) + (2 X 100,000)] + [(65,000 + 50,000)]

D = 50,000 +200,000 +65,000 + 50,000 = 365,000

(Amount is in Kenya Shillings)

d). The following costs were gotten from Kenyatta University where one e-Learning technician/ course/graphic designer and two lecturers were involved in developing one course.

Thus development and production of one course was as follows, D = [(1 X 50,000) + (2 X 100,000)] + [(100,000 + 50,000)]

D = 50,000 +200,000 +100,000 + 50,000 = 400,000

(Amount is in Kenya Shillings)

These production and development costs were directly gotten from the respondents from the respective universities and substituted in the formula. The average production and development cost is Kenya Shillings 386,250. The range in these production and development costs is Kenya Shillings 80,000, meaning that there is no great variation in terms of these costs. This variation of costs can be attributed to the type and brand of the equipments each university applies and also individual institutional procurement procedures and choice of suppliers.

4.3.2 Maintenance of e-Learning courses

$$\mathbf{M} = [N_1\Delta_1 + \ldots\ldots + N_n\Delta_n] + \mu_{X1} + \ldots\ldots + \mu_{Xn}$$

Where:

N = staff in any number of the discreet categories 1,2,…,n

Δ = the average employment cost of a member of staff in category N

μ = a standard budget for maintenance for any course or component X where the number of such courses or components is 1, 2,…., n

a). The following costs were gotten from University of Nairobi where two e-Learning technicians/ course/graphic designers and one lecturer were involved in maintenance of one course.

Thus the cost of maintenance of one course was as follows, M = [(2 X 40,000) + (1 X 100,000)] + 20,000

=200,000

(Amount is in Kenya Shillings)

b). The following costs were gotten from Moi University where two e-Learning technicians/ course/graphic designers and one lecturer were involved in maintenance of one course

Thus the cost of maintenance of one course was as follows, M = [(2 X 35,000) + (1 X 100,000)] + 10,000

=180,000

(Amount is in Kenya Shillings)

c). The following costs were gotten from Jomo Kenyatta University of Agriculture and Technology where one e-Learning technician/ course/graphic designer and one lecturer were involved in maintenance of one course.

Thus the cost of maintenance of one course was as follows, M = [(2 X 50,000) + (1 X 100,000)] + 20,000

=220,000

(Amount is in Kenya Shillings)

d). The following costs were gotten from Kenyatta University where one e-Learning technician/ course/graphic designer and one lecturer were involved in maintenance of one course.

Thus the cost of maintenance of one course was as follows, M = [(1 X 50,000) + (1 X 100,000)] + 10,000

=160,000

(Amount is in Kenya Shillings)

These maintenance of e-Leaning courses costs were directly gotten from the respondents from the respective universities and substituted in the formula. The average maintenance of e-Leaning course cost in the universities is Kenya Shillings 190,000. The range in these maintenance of e-Leaning course costs from the universities is Kenya Shillings 60,000, meaning that there is no great deviation in terms of these costs. This variation of costs can be attributed to the type and brand of the equipments each university applies and also individual institutional procurement procedures and choice of suppliers.

4.3.3 e-Learning course and materials storage

$$S = (X_1\Omega_1 + \ldots\ldots\ldots + X_n\Omega_n) + (\sigma_{X1} + \ldots\ldots\ldots + \sigma_{Xn})$$

Where:

X = the number of components of any particular media X where the number of media X is any number 1,2, ……,n

Ω = the variable cost of storage of any component 1,2,….,n

σ = the fixed cost of storage of any component 1,2,….,n

a). The following costs for e-Learning course and materials storage were gotten from University of Nairobi where interactive CD-ROM disc**,** CD-R and CD-RW disc**,** DVD-R, DVD+R, DVD-RW, and DVD+RW disc**,** Jump drive and USB flash drive**,** Internal and External Hard drive and Servers are used for storage purposes.

Thus the storage cost was as follows for one course, S = (1 X 5,000) + (1 X 20,000) + (1 X 500) + (1 X 100,000)

=5,000 +20,000 + 500 + 100,000 = 125,500

(Amount is in Kenya Shillings)

b). The following costs for e-Learning course and materials storage were gotten from Moi University where interactive CD-ROM disc**,** CD-RW disc**,** DVD-R, and DVD+RW disc**,** Jump drive and USB flash drive**,** Internal and External Hard drive and Servers are used for storage purposes.

Thus the storage cost was as follows for one course, S = (1 X 3,000) + (1 X 10,000) + (1 X 500) + (1 X 80,000)

=3,000 +10,000 + 500 + 80,000 = 93,500

(Amount is in Kenya Shillings)

c). The following costs for e-Learning course and materials storage were gotten from Jomo Kenyatta University of Agriculture and Technology where CD Roms, Internal computer hard disks, External hard disks and Servers are used for storage purposes.

Thus the storage cost was as follows for one course, S = (1 X 5,000) + (1 X 10,000) + (1 X 500) + (1 X 120,000)

=5,000 +10,000 + 500 + 120,000 = 135,500

(Amount is in Kenya Shillings)

d). The following costs for e-Learning course and materials storage were gotten from Kenyatta University where CD Roms, Internal computer hard disks, External hard disks and Servers are used for storage purposes.

Thus the storage cost was as follows for one course, S = (1 X 5,000) + (1 X 35,000) + (1 X 500) + (1 X 120,000)

=5,000 +35,000 + 500 + 120,000 = 160,500

(Amount is in Kenya Shillings)

These storage costs of courses were directly gotten from the respondents from the respective universities and substituted in the formula. The average storage cost is Kenya Shillings 128,750. The range in the course storage costs in the universities is Kenya Shillings 67,000, implying that there is no great variation in these costs. This difference in these course storage costs can be attributed to institutional choice of procurement decisions and choice of suppliers and also quality and manufacturers of the equipments used.

4.3.4 e-Learning course and materials delivery including transmission

$$\mathbf{H} = (X_1\partial_1 + \ldots\ldots\ldots + X_n\partial_n) + (W_{X1} + \ldots\ldots\ldots + W_{Xn})$$

Where:

X = the number of components of any particular media X where the number of media X is any number 1,2,….,n

∂ = the average cost of delivery or transmission of media X

W = the fixed cost of delivering or transmitting media X where the number of media X is any number 1,2,…..,n

a). The following costs for e-Learning course delivery and transmission were gotten from University of Nairobi where interactive CD Roms are given to students and internet connectivity via ISPs and fibre optic cables is provided to students and lecturers.

Thus course delivery and transmission was as follows for one course, H = (1 X 500) + (1 X 60,000)] + [(1 X 500) + (1 X 100,000)]

=500 + 60,000 + 500 + 100,000 = 161,000

(Amount is in Kenya Shillings)

b). The following costs for e-Learning course delivery and transmission were gotten from Moi University where interactive CD Roms are given to students and internet connectivity via ISPs and fibre optic cables is provided to students and lecturers.

Thus course delivery and transmission was as follows for one course, H = (1 X 500) + (1 X 40,000)] + [(1 X 500) + (1 X 80,000)]

=500 + 40,000 + 500 + 80,000 = 121,000

(Amount is in Kenya Shillings)

c). The following costs for e-Learning course delivery and transmission were gotten from Jomo Kenyatta University of Agriculture and Technology where interactive CD Roms are given to students and internet connectivity via ISPs and fibre optic cables is provided to students and lecturers.

Thus course delivery and transmission was as follows for one course, H = (1 X 500) + (1 X 50,000)] + [(1 X 500) + (1 X 100,000)]

=500 + 50,000 + 500 + 100,000 = 151,000

(Amount is in Kenya Shillings)

c). The following costs for e-Learning course delivery and transmission were gotten from Kenyatta University where interactive CD Roms are given to students and internet connectivity via ISPs and fibre optic cables is provided to students and lecturers.

Thus course delivery and transmission was as follows for one course, H = (1 X 500) + (1 X 60,000)] + [(1 X 500) + (1 X 120,000)]

=500 + 60,000 + 500 + 120,000 = 181,000

(Amount is in Kenya Shillings)

These delivery and transmission costs of courses were directly gotten from the respondents from the respective universities and substituted in the formula. The average delivery and transmission cost is Kenya Shillings 153,500. The range in the costs of delivery and transmission between the universities is Kenya Shillings 60,000, implying that there is no great deviation in terms of delivery and transmission costs. This difference in these delivery and transmission costs can be attributed to institutional choice of procurement decisions and choice of suppliers and also quality and manufacturers of the equipments used in delivery and transmission.

It is noted that the costs stated above are monthly costs for development and production of e-Learning Course, maintenance of e-Learning courses, e-Learning course and material storage and e-Learning course and materials delivery including transmission. It further mentioned that the category of staff involved in each category of activity are not the same staff that participate in the next category of activity, i.e there are different staff involved in development and production of e-Learning Course from the ones that are involved in maintenance of e-Learning courses in presentation. If the same category of staff were involved in all the categories of activities, then the average employment cost of a member of staff in a certain category could not have been repeated.

On the part of the media put into account is only the Compact disk and use of the university portal via internet. These costs were gotten from the respondents from the universities namely University of Nairobi, Moi University, Jomo Kenyatta University of Agriculture and Technology and Kenyatta University. Other universities omitted filling in these costs, so it may not be advisable to make general conclusion for all the public universities using the above costs. Information from this section was gathered from the e-Learning administrators questionnaire and it endeavoured to answer the research question, "What are the costs involved in setting up and maintaining e-Learning hardware and software and costs involved in development, production, storage and maintenance of the course modules?'

4.4 Benefits of e-Learning from both the demand and supply sides

This section discusses the benefits of e-Learning as identified by the respondents from members of the academic/teaching staff category from public universities in Kenya. The response rate for this section was 363 (86%) members of academic/teaching staff category in the sample. The respondents highlighted that e-Learning is less expensive to deliver and is self-paced as Gotschall (2000) states. It provides consistent content, faster and works anywhere and at anytime for learners. The instructional materials are easily updated and permit the use of multimedia which leads to reinforced learning through the use of video, audio, quizzes and other forms of interaction. e-Learning can improve retention, provide immediate feedback and allows learners to customize learning materials to meet their individual needs as well as holding on-line discussions and reviewing and comparing their views on-line. It creates confidence due promotion of student centred learning.

e-Learning promotes enhanced learning experience and lecturers can update materials anywhere thus promoting flexibility in learning and this denotes that geographical separation between learners and instructors is not a barrier to learning unlike traditional conventional mode of learning. The respondents also noted that large number of students can be attended by one instructor at the

same time. This mode of learning also promotes interactivity by use of modern learning management systems interfaces. Blended learning enhances quality where a course should be delivered as face-to-face interaction and also on-line and thus a blended course. In this scenario the course instructor will then have to decide which parts should be on-line and which should be offline. A basic example of this is a situation where the instructor of a course of English as a second language reaches the conclusion that all audio-based activities (listening comprehension, oral expression) will take place in the classroom and all text-based activities will take place on-line (reading comprehension, essays writing). This kind of learning increases the options for greater quality and quantity of human interaction in a learning environment (Bates, 1990). Blended learning offers learners the opportunity to be both together and apart. A community of learners can interact at anytime and anywhere because of the benefits that computer-mediated educational tools provide. Blended learning provides a good mix of technologies and interactions, resulting in a socially supported, constructive, learning experience; this is especially significant given the profound effect that it could have on distance learning (Bolton, 1986).

Another advantage is that, through e-Learning one is able to deliver and access more content simultaneously. It is comprehensive in terms of more, up-to-date, current and relevant information exposure on-line and access to comprehensive reference materials in digital libraries. Information is sourced from different sources and is integrated. e-Learning provides an easy way to network with students separated by wide geographical areas. It is cost- effective in terms of space (Kumar, 2006).

The disadvantages of e-Learning identified by the respondents from the members of the academic/teaching staff category are described below. The number of respondents was 363 (86%) members of academic/teaching staff category in the study sample. Unmotivated learners or those with poor study habits may fall behind and lack of familiar structure and routine may take time getting used to e-Learning pedagogy as Vilaseca (2004) notes. Students may feel isolated or miss

social interaction sessions and instructors may not always be available on demand especially when students require them to be online. e-Learning may be slow or unreliable especially where internet connections are slow and frustrating and managing learning software can involve a learning curve. Through e-Learning some courses such as traditional hands-on courses can also be difficult to simulate.

4.5 Barriers that are faced by public universities in Kenya in dissemination of e-courses.

Course delivery via e-Learning is faced with various setbacks and impediments which this section aims at addressing. This section endeavours to answer research question number six, "What are the barriers that are faced or likely to be faced by public universities in Kenya in dissemination of e-courses?" The barriers/constraints that are faced by public universities in Kenya are presented in Table 4.11 below.

Table 4.11: Major constraints that presently face e-Learning application in course delivery

	Not Likely	Least Likely	Likely	More Likely	Most Likely	Rating Average
Weighted Value	**1**	**2**	**3**	**4**	**5**	
Barriers/Constraints rated on likert scale						
High cost of hardware & software	28.6% (2) UoN, JKUAT	14.3% (1) KU	14.3% (1) Moi Univ	28.6% (2) Maseno Univ, Egerton Univ	14.3% (1) MMUST	2.86
Poor communication and ICT infrastructure	14.3% (1) JKUAT	0.0% (0)	42.9% (3) KU, Moi Univ, UoN	28.6% (2) Maseno Univ, Egerton Univ	14.3% (1) MMUST	3.29
High cost of training	0.0% (0)	14.3% (1) KU	71.4% (5) UoN, JKUAT, MMUST, Maseno Univ, Egerton Univ	0.0% (0)	14.3% (1) Moi Univ	3.14
Lack of funds for ICT and training	0.0% (0)	14.3% (1) JKUAT	28.6% (2) KU, UoN	28.6% (2) MMUST, Moi Univ	28.6% (2) Maseno Univ, Egerton Univ	3.71
Little priority given to e-Learning by management	0.0% (0)	14.3% (1) KU	14.3% (1) JKUAT	42.9% (3) Egerton Univ, UoN, Moi Univ	28.6% (2) Maseno Univ, MMUST	3.86
Lack of physical security for computers	14.3% (1) Moi Univ	57.1% (4) UoN, KU, Maseno Univ, MMUST	28.6% (2) JKUAT, Egerton Univ	0.0% (0)	0.0% (0)	2.14
Lack of support and commitment by management	0.0% (0)	14.3% (1) KU	14.3% (1) MMUST	42.9% (3) JKUAT, Egerton Univ, UoN	28.6% (2) Maseno Univ, Moi Univ	3.86
Lack of interest by potential users	14.3% (1) Maseno Univ	14.3% (1) KU	42.9% (3) Egerton Univ, UoN, Moi Univ	28.6% (2) MMUST, JKUAT	0.0% (0)	2.86
Lack of confidence of management in users	14.3% (1) KU	28.6% (2) UoN, Egerton Univ	28.6% (2) MMUST, JKUAT	28.6% (2) Maseno Univ, Moi Univ	0.0% (0)	2.71

Uncaring and poor attitude	0.0% (0)	14.3% (1) MMUST	42.9% (3) JKUAT, KU, UoN	28.6% (2) Moi Univ, Egerton Univ	14.3% (1) Maseno Univ	3.43
Poor management of computers	0.0% (0)	57.1% (4) UoN, Egerton Univ, KU, JKUAT	42.9% (3) MMUST, Maseno Univ, Moi Univ	0.0% (0)	0.0% (0)	2.43
Institutional inertia (reluctance)	0.0% (0)	28.6% (2) MMUST, KU	14.3% (1) UoN	14.3% (1) JKUAT	42.9% (3) Maseno Univ, Moi Univ, Egerton Univ	3.71
Lack of clear e-Learning policy and plan	0.0% (0)	0.0% (0)	42.9% (3) UoN, Moi Univ, KU	28.6% (2) Egerton Univ, JKUAT	28.6% (2) MMUST, Maseno Univ	3.86
Poor remuneration for e-Learning course developers	14.3% (1) KU	0.0% (0)	57.1% (4) MMUST, UoN, Moi Univ, JKUAT	14.3% (1) Maseno Univ	14.3% (1) Egerton Univ	3.14
Wide geographical locations of campuses	28.6% (2) JKUAT, KU	42.9% (3) MMUST, Maseno Univ, Moi Univ	0.0% (0)	28.6% (2) UoN, Egerton Univ	0.0% (0)	2.29
					n	7

Source: e-Learning Directors questionnaire

Key:
1. Figures appearing in brackets alongside response percent represent the response count
2. Rating average is based on the response count, weighted value and "n" (See Appendix IX)

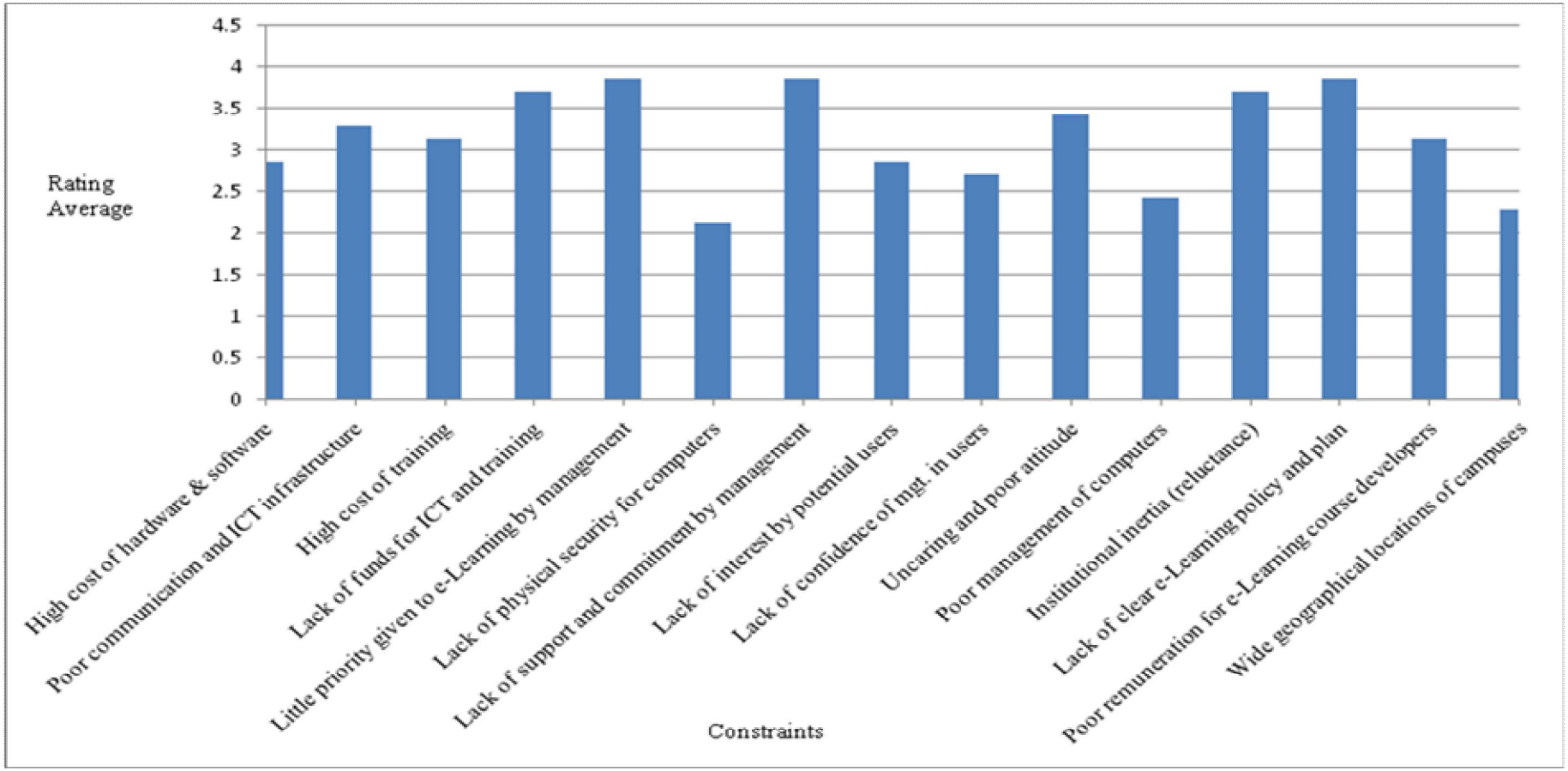


Figure 4.17: Average values of the major constraints that presently face e-Learning application in course delivery

Source: Table 4.11

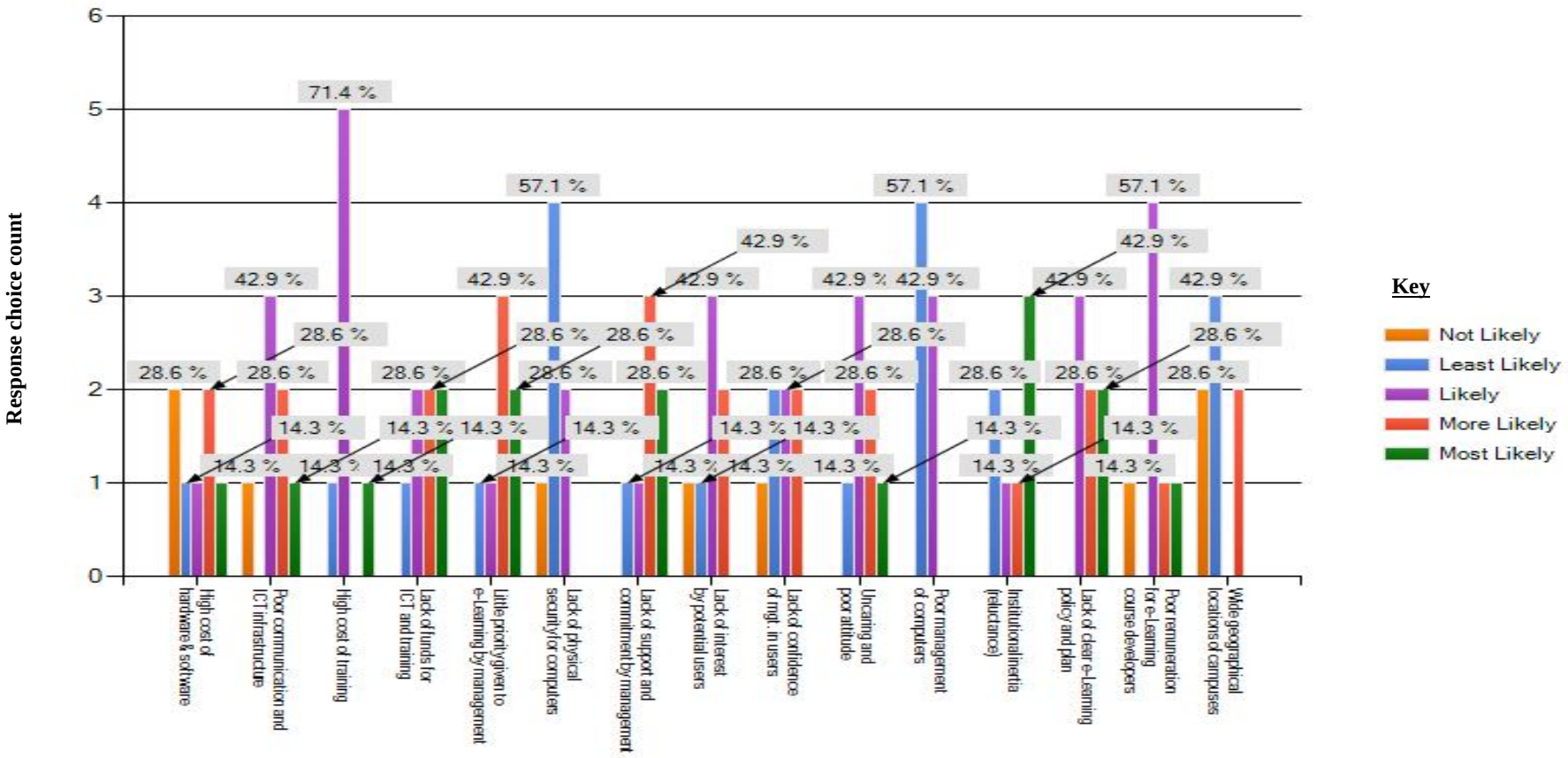


Figure 4.18: Response choices of the major constraints that presently face e-Learning application in course delivery

Source: Table 4.11

From the information in Table 4.11 and illustrated in figures 4.17 and 4.18 several major constraints were investigated that presently face e-Learning application in course delivery. This data was gotten from e-Learning directors and was based on sample population (n) of 7 and the response rate was 7 (100%). These major constraints investigated are high cost of hardware and software, poor communication and ICT infrastructure, high cost of training, lack of funds for ICT and training, little priority given to e-Learning by management, lack of physical security for computers, lack of support and commitment by management, lack of interest by potential users, lack of confidence of management in users, uncaring and poor attitude, poor management of computers, institutional inertia (reluctance), lack of clear e-Learning policy and plan, poor remuneration for e-Learning course developers and wide geographical locations of campuses. It was identified that little priority given to e-Learning by management, lack of support and commitment by management and lack of clear e-Learning policy and plan were rated highly with a common rating average of 3.86. They were followed by lack of funds for ICT and training and institutional inertia (reluctance) having a common rating average of 3.71. Uncaring and poor attitude, poor communication and ICT infrastructure, poor remuneration for e-Learning course developers and high cost of training were rated next with 3.43, 3.29 and 3.14 rating averages respectively. This implies that these are highest contributing constraints to application of e-Learning as a course delivery method in public universities in Kenya. The following constraints namely; lack of physical security for computers, wide geographical locations of campuses and poor management of computers were rated lower with 2.14, 2.29 and 2.43 rating averages respectively implying that they are constraints having lesser impediment in implementing e-Learning as course delivery method in public universities. In relation to the major constraints that presently face e-Learning application in course delivery, different universities scored them differently. The likert scale consisted of five levels of rating namely, not likely (1), least likely (2), likely (3), more likely (4) and most likely (5). In terms of high cost of hardware & software as one of the constraints,

Masinde Muliro University of Science and Technology considered it as a most likely constraint which was 1 (14.3% of n), Maseno University and Egerton University considered it as more likely which encompassed of 2 (28.6% of n), Moi University considered it a likely constraint which was 1 (14.3% of n) whereas Kenyatta University considered the constraint least likely which encompassed of 1 (14.3% of n). University of Nairobi and Jomo Kenyatta University of Agriculture and Technology considered it as not a constraint impeding implementation of e-Learning which was 2 (28.6% of n). The other constraint which was scored was poor communication and ICT infrastructure where Masinde Muliro University of Science and Technology viewed it as a most likely constraint that impedes implementation of e-Learning which comprised of 1 (14.3% of n), Maseno University and Egerton University rated it as more likely which encompassed of 2 (28.6% of n), Kenyatta University, Moi University and University of Nairobi rated it as a likely constraint constituting of 3 (42.9% of n). Jomo Kenyatta University of Agriculture and Technology viewed it as not a constraint which constituted of 1 (14.3% of n). In terms of high cost of training, Moi University found it as a most likely constraint which was 1 (14.3% of n), University of Nairobi, Jomo Kenyatta University of Agriculture and Technology, Masinde Muliro University of Science and Technology, Maseno University and Egerton University considered it as a likely constraint constituting of 5 (71.4% of n) whereas Kenyatta University found it as a least likely constraint which constituted of 1 (14.3% of n). Lack of funds for ICT and training was another constraint identified and viewed as a most likely constraint by both respondents of Maseno University and Egerton University comprising of 2 (28.6% of n). Masinde Muliro University of Science and Technology and Moi University viewed it as a more likely constraint constituting of 2 (28.6% of n), Kenyatta University and University of Nairobi rated it as a likely constraint which was 2 (28.6% of n) while Jomo Kenyatta University of Agriculture and Technology viewed it as a least likely constraint which constituted of 1 (14.3% of n). Little priority given to e-Learning by management was considered a more likely constraint by both Maseno

University and Masinde Muliro University of Science and Technology which consisted of 2 (28.6% of n). Egerton University, University of Nairobi and Moi University considered it as a more likely constraint which was 3 (42.9% of n) while Jomo Kenyatta University of Agriculture and Technology and Kenyatta University viewed it as a likely and least likely constraint impeding implementation of e-Learning respectively which was 1 (14.3% of n) for each university. Lack of physical security for computers was considered a likely constraint by both Jomo Kenyatta University of Agriculture and Technology and Egerton University which comprised of 2 (28.6% of n). It was also viewed as a least likely constraint by University of Nairobi, Kenyatta University, Maseno University and Masinde Muliro University of Science and Technology which was 4 (57.1% of n) whereas it was considered as a not likely constraint by Moi University which consisted of 1 (14.3% of n). Lack of support and commitment by management was viewed a most likely constraint by both Maseno University and Moi University which consisted of 2 (28.6% of n). Jomo Kenyatta University of Agriculture and Technology, Egerton University and University of Nairobi considered it as a more likely constraint which encompassed of 3 (42.9% of n) while Masinde Muliro University of Science and Technology and Kenyatta University viewed it as a likely and least likely constraint respectively which was 1 (14.3% of n) for each university. The other constraint which was scored by the various public universities was lack of interest by potential users which was considered a more likely factor by both Masinde Muliro University of Science and Technology and Jomo Kenyatta University of Agriculture and Technology which was 2 (28.6% of n). It was also considered a likely constraint by Egerton University, University of Nairobi and Moi University which consisted of 3 (42.9% of n) while Kenyatta University and Maseno University considered it as a least likely and a not likely constraint respectively which was 1 (14.3% of n) for each university. Lack of confidence of management in users was viewed as a more likely constraint by Maseno University and Moi University comprising of 2 (28.6% of n), it was considered a likely constraint by both Masinde Muliro University of Science and Technology

and Jomo Kenyatta University of Agriculture and Technology comprising of 2 (28.6% of n), it was viewed as a least likely constraint by both University of Nairobi and Egerton University which encompassed of 2 (28.6% of n) and finally it was rated as a not likely constraint by Kenyatta University which was 1 (14.3% of n). In terms of uncaring and poor attitude, Maseno University viewed it as a most likely constraint which consisted of 1 (14.3% of n), Moi University and Egerton University considered it as a more likely constraint which was 2 (28.6% of n) whereas Jomo Kenyatta University of Agriculture and Technology, Kenyatta University and University of Nairobi considered it as a likely impediment constituting of 3 (42.9% of n). Masinde Muliro University of Science and Technology viewed it as a least likely constraint which encompassed of 1 (14.3% of n). Poor management of computers was believed as a likely constraint by Masinde Muliro University of Science and Technology, Maseno University and Moi University which consisted of 3 (42.9% of n). It was considered a least likely constraint by all the other four public universities which encompassed of 4 (57.1% of n). Institutional inertia (reluctance) was deemed a most likely constraint by Maseno University, Moi University and Egerton University which was 3 (42.9% of n). It was also considered a more likely constraint by Jomo Kenyatta University of Agriculture and Technology which consisted of 1 (14.3% of n). University of Nairobi considered it as a likely impediment comprising of 1 (14.3% of n). Masinde Muliro University of Science and Technology and Kenyatta University viewed it as a least likely impediment which encompassed of 2 (28.6% of n). Lack of clear e-Learning policy and plan was another constraint which was scored by the public universities where Masinde Muliro University of Science and Technology and Maseno University viewed it as a most likely constraint encompassing of 2 (28.6% of n), Egerton University and Jomo Kenyatta University of Agriculture and Technology deemed it a more likely constraint encompassing of 2 (28.6% of n). All the other three universities viewed it as a likely constraint which consisted of 3 (42.9% of n). Poor remuneration for e-Learning course developers was considered as a most likely constraint by Egerton University which consisted of 1 (14.3% of n) and

a more likely constraint by Maseno University which was 1 (14.3% of n). It was also considered a likely constraint by Masinde Muliro University of Science and Technology, University of Nairobi, Moi University and Jomo Kenyatta University of Agriculture and Technology encompassing of 4 (57.1% of n). It was also observed as a not likely constraint by respondents from Kenyatta University which consisted of 1 (14.3% of n). The final constraint which was scored was wide geographical locations of campuses which was considered as a more likely constraint by both University of Nairobi and Egerton University encompassing of 2 (28.6% of n). Masinde Muliro University of Science and Technology, Maseno University and Moi University viewed it as a least likely constraint which consisted of 3 (42.9% of n) while Jomo Kenyatta University of Agriculture and Technology and Kenyatta University considered it as not a likely constraint constituting of 2 (28.6% of n). It is evident that specific universities scored the various constraints differently depending on their individual institutional challenges.

4.5.1 Problems faced by public universities in implementing e-Learning as course delivery method as specified from the supply side

This section seeks to answer the research question number six, "What are the barriers that are faced or likely to be faced by public universities in Kenya in dissemination of e-courses?"

The respondents from the category of e-Learning administrators outlined the following problems as relating to implementing e-Learning as course delivery method in public universities in Kenya: Poor connectivity and unreliable internet due to low bandwidth is a problem which was identified by 7 (100%) respondents in the category of e-Learning administrators. The other problem was the high cost of content digitization where graphics, simulations and streaming videos are to be created which was identified by 5 (71%) respondents in the same category of e-Learning administrators. They also identified the problem of lack of clear e-Learning policy and plan which needs to outline e-Learning plans and strategies which was identified by 6 (85%) respondents.

The category of academic/teaching staff respondents identified the following problems as relating to implementing e-Learning as course delivery method in public universities in Kenya: Lack of intellectual property rights was identified by 400 (95%) respondents from that category. Resistance by some lecturers to adapt to e-Learning was highlighted by 353(84%) respondents in the category of the members of the academic/teaching staff. Low computer literacy levels among lecturers and students was identified by 302 (72%) members of the academic staff. Negative attitude to e-Learning due to lack of understanding and sensitization on importance of e-Learning was another barrier identified by 377 (89%) respondents. High cost of internet connectivity when the members of the academic staff have to use the internet in their houses or outside the campus was another problem identified by 407 (96%) members of the academic/teaching staff. Poor and lack of e-Learning equipments was also identified by the academic staff as constituting a problem in implementation of e-Learning which was identified by 312 (73%). Other problems faced by e-Learning course developers includes lack of training on course development and design and lack of content ownership, which were identified by 400 (95%) respondents. These problems identified in this section coincide with what Peté & Fregona (2004) have identified in their book entitled "Creating virtual classroom: Distance learning with the internet". Similarly these problems coincides with what Porter (1997) identified in the online paper titled "Sustaining online learning during times of change through a multi-disciplinary community of practice".

4.5.2 Problems faced by public universities in implementing e-Learning as course delivery method as specified from the demand side

This section seeks to answer the research question number six, "What are the barriers that are faced or likely to be faced by public universities in Kenya in dissemination of e-courses?". The problems identified in this section are usually faced by students. The respondents in this section were the members of academic/teaching staff. Lack of electricity and power failure are major problems faced by students when accessing e-courses; this was identified by 322 (76%) respondents. Poor internet connectivity and unreliable internet were also identified as problems facing students; these

were identified by 402 (95%) respondents. Another problem identified was low computer literacy levels among students and thus lack the skills to navigate through the e-Learning platforms interfaces mentioned by 299 (71%) respondents. At times lecturers fail to make content available and thus students are unable to have access to the courses; identified by 253 (60%) respondents. Rural campuses are not connected with electricity and have poor e-facilities especially internet in the remote areas and thus students find it difficult to have access to the e-courses and this discourages them to appreciate e-Learning; identified by 417 (99%) respondents. Other students fail to appreciate the importance of e-Learning due to ignorance; identified by 321(76%) respondents. In the instances where the students have to travel long distances in order to access the e-courses, they find it costly in terms of transport and internet cost and unreliable network facilities; identified by 401 (95%) respondents. Students also lack guidance on e-Learning portals skills in rural areas; identified by 300 (71%) respondents. These problems identified in this section coincide with what Porter (1997) mentions in the online paper titled "Sustaining online learning during times of change through a multi-disciplinary community of practice".

4.6 Strategies and interventions that can be applied to improve dissemination of course modules via e-Learning in Kenyan public universities

This section aims at answering research question number eight, "Which are the strategies and interventions that can be applied to improve dissemination of course modules via e-Learning in Kenyan public universities?". This section is necessary since it will guide on how implementation and adoption of e-Learning in course delivery can be enhanced in public universities in Kenya

Table 4.12: Response on whether universities can do without e-Learning in the present times and in the future

Response Choice	Response Count	Response Percent
Yes	0	0.0%
No	7	100.0%
Not sure	0	0.0%
	n	7

Source: Administrators questionnaire

Table 4.12 shows that there was a response of 7 (100%) that public universities in Kenya cannot do without e-Learning both in present and future times. This shows that universities need to improve the implementation of e-Learning because of its importance and relevance.

4.6.1: Identified Strategies that the university should adopt in order to ensure sustained future e-Learning growth

This section presents administrators' proposed strategies that can enhance future e-Learning growth as presented in table 4.13.

Table 4.13: Identified strategies for future e-Learning growth

	Very Low	Low	Average	Good	High	Rating Average
Weighted value	**1**	**2**	**3**	**4**	**5**	
Strategies rated in the likert scale						
Devise a comprehensive e-Learning policy and plan	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	100.0% (7)	5.00
Invest significantly in e-Learning	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	100.0% (7)	5.00
Invest in staff training	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	100.0% (7)	5.00
Manage e-Learning more effectively	0.0% (0)	0.0% (0)	0.0% (0)	14.3% (1)	85.7% (6)	4.86
Re-orient staff in proper use of e-Learning platforms	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	100.0% (7)	5.00
					n	7

Source: e-Learning Directors questionnaire

Key:
1. Figures appearing in brackets alongside response percent represent the response count
2. Rating average is based on the response count, weighted value and "n" (See Appendix IX)

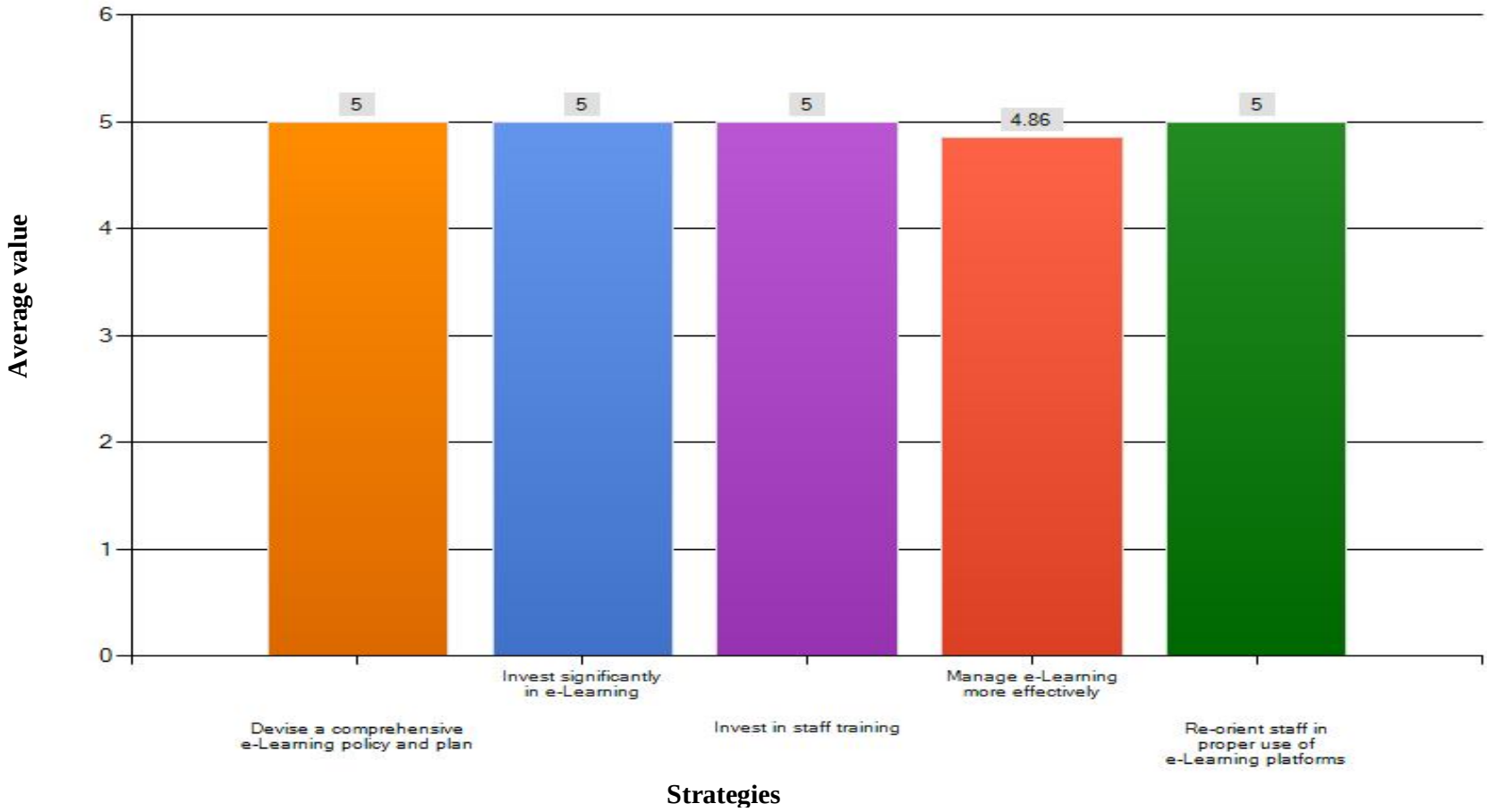


Figure 4.19: Average values on identified strategies that the university should adopt in order to ensure sustained future e-Learning growth

Source: Table 4.13

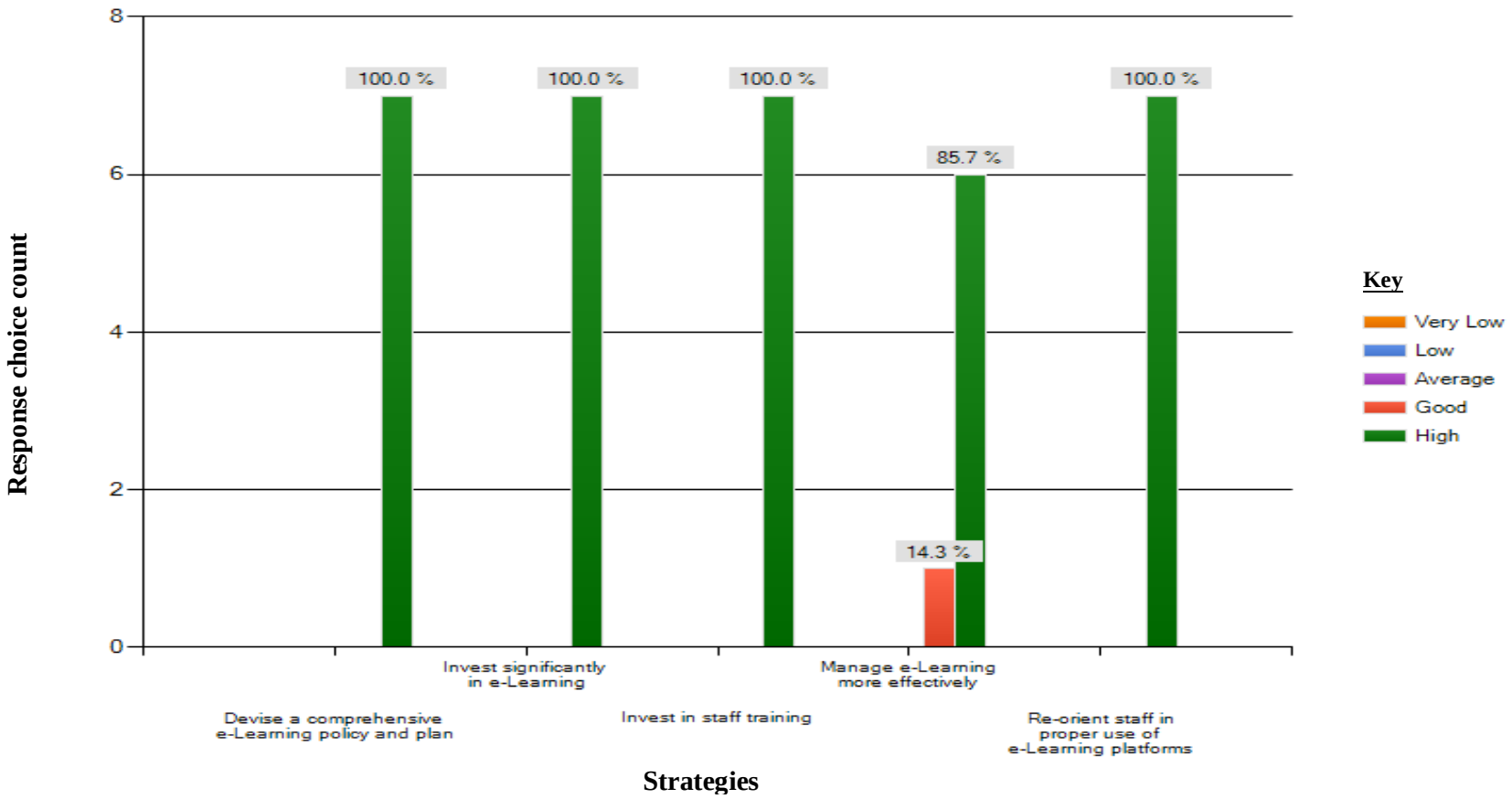


Figure 4.20: Response choices on identified strategies that the university should adopt in order to ensure sustained future e-Learning growth

Source: Table 4.13

From Table 4.13 and Figures 4.19 and 4.20, the strategies that were investigated are; devise a comprehensive e-Learning policy and plan, invest significantly in e-Learning, invest in staff training, manage e-Learning more effectively and re-orient staff in proper use of e-Learning platforms. Respondents rated them all as vital strategies in improving the implementation of e-Learning in Kenyan public universities. All had rating averages of 4.86 and 5 with devising a comprehensive e-Learning policy and plan, investing significantly in e-Learning, investing in staff training and re-orienting staff in proper use of e-Learning platforms having a rating average of 5 and managing e-Learning more effectively having a rating average 4.86.

Public universities in Kenya should devise a comprehensive e-Learning policy and plan which should give guidance on the implementation of e-Learning. The purposes of such a policy as outlined by the respondents are described in the following section. The policy and plan should define e-lecture, e-content utilization, e-examinations and intellectual property rights. The policy and plan should also provide guidelines in providing e-Learning services, provide guidelines in e-content development, provide guidelines in e-content delivery and use of e-Learning and guide on activities and priority placement in allocation of e-Learning funds. In addition, it was also revealed that the policy and plan should provide guidelines on future plans on e-Learning and show strategies on how to implement and sustain e-Learning in public universities in Kenya. These details about the contents of e-Learning policy and plan were identified by e-Learning directors.

4.6.2: Improving the situation of e-Learning from the management's side

This section describes the views on how the current situation of e-Learning can be improved from the management's side. The university management first should provide excellent terms of service for e-Learning staff and course developers. Universities should also include e-Learning in the performance targets of the universities. The lecturers who show good progress in e-Learning application and use should be rewarded. The respondents also highlighted that e-Learning should

be made compulsory in teaching in that the lecturers should ensure that they prioritize e-Learning as the course delivery method. More funding and resources should also be dedicated for training and other e-Learning related activities. Existing e-Learning infrastructure should also be improved and sensitize staff and students on e-Learning matters. Proper management should also be provided in computer use. The universities should also hire high qualified technical staff and in-service training and retraining should be provided to them due to the rapid technology changes and innovations. These were open views suggested by e-Learning directors.

4.6.3: Improving the situation of e-Learning from the user's side

This section describes the views on how the current situation of e-Learning can be improved from the user's side. Students with little computer literacy should undergo compulsory computer literacy training. e-Learning resource centres should be established in the main universities at the departmental level and also in the constituent regional campuses located all over the country where students can access content. Bandwidth should also be increased for effective accessibility of e-courses. Students should also be sensitized on the importance of e-Learning as an alternative course delivery method in order for them to change their attitude towards e-Learning. The students should also be encouraged to use more e-content.

4.7: Summary of Response Rates

This section provides information on the response rates. The response rate for the e-Learning directors/e-Learning administrators/ ICT managers respondents category was 7 (100%) in this study. This shows that all the e-Learning directors participated in responding to the research instruments administered in all the seven public universities.

The response rate for the e-Learning technicians was 7 (100%). This shows that all chief e-Learning technicians who were purposively sampled from the category of university e-Learning technicians respondents category completed the questionnaires in all the public universities.

The response rate for the members of the academic staff was 416 (98.57%) from all the public universities. This constitutes (35.3%), (4.1%), (18.5%), (16.3%), (6.0%), (12.7%) and (7.0%) respondents from University of Nairobi, Maseno University, Kenyatta University, Moi University, Masinde Muliro University of Science and Technology , Egerton university and Jomo Kenyatta University of Agriculture and Technology respectively. This high response rate is due to the reason that the researcher made use of research assistants who waited as the members of the academic staff completed the questionnaires.

4.8: Summary of the study findings

This section presents discussion of the study findings. This section was done in relation to the eight research questions in this study. From the analyzed data it was evident that public universities make use of a variety of hardware in production, storage and distribution of the e-Learning courses. This enhances performance in the various e-Learning activities effectively and efficiently as postulated by Shank (2007). Nevertheless there are more types of e-Learning hardware components that are not utilized in Public Universities in Kenya such as 'Smart interactive white board', 'personal audio player' for listening to audio recordings of lectures, 'personal digital assistant' for classroom and outdoor use and application of 'tablets' and 'smart phones'.

It was found that universities make use of a variety of software in design, production, storage and distribution of the e-Learning courses. These include e-Learning author-ware (exe) for facilitating editing of information in the portals and online interactive quiz (Hot pot) for assisting in creation of questions. Application of a variety of software also enhances performance in the various e-Learning activities effectively and efficiently as stated by Scholten (2004). However there are more types of e-Learning software that are not utilized in Public Universities in Kenya. Examples of software

that are not utilized in Public Universities in Kenya include 'evernote' which is a note-taking tool software , 'prezi' which is a presentation software, 'edmodo' which is an educational social learning network platform, 'audacity' which is an audio recorder/editing tool and 'adobe connect' which is a web conferencing software.

For the features of the hardware and software, which are applied in course delivery via e-Learning in public universities in Kenya, it was found that, the different features of hardware and software promote interactivity, ease of access of e-content, distribution of e-content, storage and maintenance of e-courses. These various features were found to be user friendly and thus motivating students and lecturers to embrace e-Learning (McCrea, 2000).

From the analyzed data it was also found that different categories of staff participate in design and implementation of e-Learning programmes. The staff performs different activities in e-Learning. These staff includes e-learning directors and administrators, lecturers, and e-Learning technicians. Participation of various categories of staff enhances the quality of e-Learning courses and enhanced learning by providing services and support for all stakeholders. This is built on principles of openness, dialogue and inclusiveness to promote excellence and innovation in e-Learning (Shank, 2007).

In terms of students enrollment in e-Learning courses, it was found that public universities embrace blended learning where students attend both face to face lessons and also access e-Learning materials via different platforms. A blended learning approach to instruction combines face-to-face classroom methods with computer-based/mediated activities, resulting in an integrated learning experience for students. Blended courses combine face-to-face and online methods to varying degrees, depending on the discipline, the size of the class, student demographics, and the preferences of the instructor. For example, a blended approach to a traditional, face-to-face course might mean that the class meets once per week instead of the usual lessons per week format.

Learning activities that otherwise would have taken place during classroom time such as lectures, an in-class debate, and a quiz on audio and visual material can be moved online with the help of different tools (Porter, 1997; Cox & Carr, 2006).

Various barriers that are faced or likely to be faced by public universities in Kenya in dissemination of e-courses were also identified. These barriers include high cost of hardware and software, poor communication and ICT infrastructure, high cost of training, lack of funds for ICT and training, little priority given to e-Learning by management, lack of physical security for computers, lack of support and commitment by management, lack of interest by potential users, lack of confidence of management in users, uncaring and poor attitude, poor management of computers, institutional inertia (reluctance), lack of clear e-Learning policy and plan, poor remuneration for e-Learning course developers and wide geographical locations of campuses. These barriers concurs with what Wanyembi (2002) identified in the study on "improving ICT in education in developing countries".

The costs involved in setting up and maintaining e-learning hardware and software and costs involved in production, development, storage and maintenance of the course modules was also calculated. The findings revealed that there was no great variation in these costs in the different public universities. Nevertheless these costs depend on the type and brand of the equipments applied in each university and individual institutional procurement procedures and choice of suppliers. Realistic e-Learning costing should involve all university stakeholders (Rumble, 2002).

Data on strategies and interventions that can be applied to improve dissemination of course modules via e-Learning was also analyzed. These strategies include devising a comprehensive e-Learning policy and plan, investing significantly in e-Learning, investing in staff training, management of e-Learning more effectively and re-orienting staff in proper use of e-Learning platforms. These strategies concur with what Moore (1994) postulates.

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter covers the summary, conclusions, recommendations and suggestions for further studies. The purpose of this study was to assess e-Learning as a course delivery method in public universities in Kenya. The study sought to analyze the current features of e-Learning in public universities in Kenya. The study also sought to establish costs involved in development, production and maintenance of e-Learning courses in presentation, storage and delivery including transmission of e-Learning courses and materials in public universities in Kenya; determine the benefits of e-Learning course modules from both the demand and supply sides; identify the constraints faced by the public universities in implementing e-Learning; and propose possible strategies and interventions that can be applied to improve dissemination of course modules via e-Learning in Kenyan public universities. To achieve this purpose, an e-Learning administrators' perception questionnaire and an interview schedule were administered and members of the academic staff and e-Learning technicians' questionnaires and an observation schedule were used for data collection.

Eight research questions were formulated and aimed at guiding and giving direction to this study. These questions were as follows:

1. Which hardware do you apply in your institution in transmitting e-Learning course modules?
2. Which software is applied in transmitting e-Learning course modules in your institution?
3. What are the features of the hardware and software, which are applied in course delivery via e-Learning?
4. What categories of staff are involved in development and transmission of the e-Learning course modules?

5. What is the student enrollment in e-Learning courses and which facilities do they use to access e-courses?
6. What are the barriers that are faced or likely to be faced by public universities in Kenya in dissemination of e-courses?
7. What are the costs involved in setting up and maintaining e-learning hardware and software and costs involved in production, development, storage and maintenance of the course modules?
8. Which are the strategies and interventions that can be applied to improve dissemination of course modules via e-Learning in Kenyan public universities?

5.2 Summary of the Study Findings

This study revealed the following research findings which are specifically stated in relation to the eight research questions. In terms of hardware applied in public universities in Kenya in transmission of e-Learning course modules it was identified that a variety of hardware in production, storage and distribution of the e-Learning courses are applied. These hardware include computers which are Pentium 4 in version. LCD projectors to display images, text and diagrams on a screen were also applied for facilitating good visual access of information during teaching and presentations. Other hardware applied in implementation of e-Learning in public universities include routers, hubs and switches.

The software applied in transmitting e-Learning course modules in public universities in Kenya include word processors, spreadsheets, database packages, statistical packages, video tape content and internet and email. Other software applied in implementation of e-Learning in universities make use of learning management systems and these comprise mostly of the campus portals either open source or purchased software, content in the interactive CD ROMs, audio cassettes and streaming audio and video software. It was found that Computer conferencing, Computer Based Assessment, Audio conferencing and Video Conferencing are also applied at low levels. Other

software specified which are applied in e-Learning are e-Learning author-ware (exe) for facilitating editing of information in the portals and online interactive quiz (Hot pot) for assisting in creation of questions. However it was found that Computer file Transfer and Teleconferencing / Tele Classrooms are not applied in the public universities in Kenya.

The features of the hardware and software identified in e-Learning in general , which are applied in course delivery revealed that they provide support to ease of access to learning content, interactivity between lecturers and students and support of evaluation through e-Learning platforms. They also support efficiency, effectiveness, accuracy in information exchange like lecturer – lecturer interaction, and student – student interaction. Other features identified revealed that there is adaptability to changes and innovations to e-Learning, training opportunities, reliability of ICT and durability of ICT. It was also identified that hardware, software, network components are upgraded to the state-of-the-art in all the universities and in other instances new hardware, software, network components are acquired regularly. Finally the choice of the automated tool is dictated by the need to use software that is simple, easy-to-use, cost-effective and commonly available in Kenya.

The categories of staff that are involved in development and transmission of the e-Learning course modules in public universities include lecturers who upload course content for students. The e-Learning technicians is another category of staff who are actively involved in e-Learning and their duties include; assisting the course lecturers in uploading of course content, customizing lecture notes and uploading them to the course management systems applied in the respective universities, coordinating interaction of students and lecturers by giving the students the lecturers responses after the lecturers have responded to the assignment activities given to the students and providing all technical support. University administration also support e-Learning for instance in the University of Nairobi, Jomo Kenyatta University of Agriculture and Technology and Moi universities. The administration has set support offices in different locations to support e-Learning.

In other universities the e-Learning departments have been set up by the administration as support offices for e-Learning activities. Administration supports e-Learning through approvals and allocation of finances to facilitate e-Learning training and other e-Learning activities. In Masinde Muliro University of Science and Technology the administration has established a school of open learning which promotes e-Learning in course delivery. The universities have also facilitated in setting up of e-Libraries.

Student enrollment in e-Learning courses showed that in Moi university there were about 400 students and university of Nairobi there were about 300 enrolled in blended learning where instruction is conducted both via e-Learning but the students also attend face to face lecture sessions. In Kenyatta University most open learning students' access information via e-Learning but also use printed modules and attend 4 hour tutorial sessions. The regular students in some departments access course outlines, assignments and lectures notes via the moodle e-Learning platform but they also attend face to face lecture sessions. The other universities didn't provide information on student enrolment in e-Learning but it can be deduced that most students who access courses via e-Learning also attend face to face sessions, thus public universities in Kenya don't transmit courses purely through e-Learning but what is in application is blended learning.

The barriers faced or likely to be faced by public universities in Kenya in dissemination of e-courses as identified include high cost of hardware & software, poor communication and ICT infrastructure, high cost of training, lack of funds for ICT and training, little priority given to e-Learning by management, lack of physical security for computers, lack of support and commitment by management, lack of interest by potential users, lack of confidence of management in users, uncaring and poor attitude, poor management of computers, institutional inertia (reluctance), lack of clear e-Learning policy and plan, poor remuneration for e-Learning course developers and wide geographical locations of campuses. e-Learning administrators outlined the following problems as

relating to implementing e-Learning as course delivery method in public universities in Kenya; poor connectivity and unreliable internet due to low bandwidth; high cost of content digitization where graphics, simulations and streaming videos are to be created and finally lack of comprehensive and clear e-Learning policy and plan which should outline e-Learning plans and strategies. It was found that several barriers are faced by public universities in implementation of e-Learning.

The average production and development cost in the universities is Kenya Shillings 386,250. The range in these production and development costs is Kenya Shillings 80,000, meaning that there no great variation in terms of these costs. This variation of costs can be attributed to the type and brand of the equipment each university applies and also individual institutional procurement procedures and choice of suppliers. Similarly maintenance costs of courses were directly gotten from the respondents from the respective universities and substituted in the formula. The average maintenance cost is Kenya Shillings 190,000. The range in these maintenance costs is Kenya Shillings 60,000 implying that there is no great variation in these costs. The average storage cost is Kenya Shillings 128,750. The range in the storage costs is Kenya Shillings 67,000, which implies that there no great deviation in the storage costs. The average delivery and transmission cost is Kenya Shillings 153,500. The range in the costs of delivery and transmission between the universities is Kenya Shillings 60,000, implying that there is no great variation in these costs.

The strategies and interventions that can be applied to improve dissemination of course modules via e-Learning in Kenyan public universities as identified include devising a comprehensive e-Learning policy and plan, invest significantly in e-Learning, invest in staff training, manage e-Learning more effectively and re-orient staff in proper use of e-Learning platforms. The e-Learning policy and plan should define e-lecture, e-content utilization, e-examinations and intellectual property rights. The policy and plan should also provide guidelines in providing e-Learning services, provide

guidelines in e-content development, provide guidelines in e-content delivery and use of e-Learning and guide on activities and priority placement in allocation of e-Learning funds. In addition it was also revealed that the policy and plan should provide guidelines on future plans on e-Learning and show strategies on how to implement and sustain e-Learning in public universities in Kenya

The university management should provide excellent terms of service for e-Learning staff and course developers. Universities should also include e-Learning in the performance targets of the universities. The lecturers who show good progress in e-Learning application and use should be rewarded. It was also highlighted that e-Learning should be made compulsory in teaching in that lecturers should prioritize e-Learning as the course delivery method. More funding and resources should also be dedicated for training and other e-Learning related activities. Existing e-Learning infrastructure should also be improved and sensitize staff and students on e-Learning matters. Proper management should also be provided in computer use. The universities should also hire high qualified technical staff and in service training and retraining should be provided to them due to the rapid technological changes and innovations. e-Learning administrators also outlined various ways under which e-Learning can be improved from the user's side. These strategies include compulsory computer literacy training to students with low computer skills among others.

5.3 Conclusions of the Study

The following conclusions have been drawn and specifically stated in relation to the eight research questions in this study. From the information gathered by the researcher, it was concluded that universities make use of a variety of hardware in production, storage and distribution of the e-Learning courses. This applies to all universities as indicated by the e-Learning technicians from the respective seven public universities. It was found that public universities endeavour to acquire the state of art hardware so as to be in line with changing technological trends.

In reference to the software applied, it was concluded that Public universities make use of a variety of software. Application of different types of software facilitates in performing and executing the many e-Learning activities in the universities.

The features of the hardware and software identified in e-Learning in general are applied in course delivery. The conclusion is that the hardware and software features are custom made and can fully support e-Learning activities in public universities.

Different categories of staff are involved in development and transmission of e-Learning course modules. In conclusion all staff participate in the various e-Learning activities and duties.
It was also concluded that, there are no students who undertake their courses purely via e-Learning. Public universities usually practice blended learning where instruction is conducted both via e-Learning but the students also attend face to face lecture sessions. Thus public universities in Kenya embark on transmitting courses through blended learning but not purely via e-Learning application.

It was also identified and concluded that there are several barriers that are faced or likely to be faced by public universities in Kenya in dissemination of e-courses. These barriers make adoption and implementation of e-Learning a challenge.

The costs involved in setting up and maintaining e-Learning hardware and software and costs involved in production, development, storage, maintenance and transmission of the e-Learning course modules were based on four public universities namely University of Nairobi, Moi University, Jomo Kenyatta University of Agriculture and Technology and Kenyatta University. The average production and development cost is Kenya Shillings 386,250. The average maintenance cost is Kenya Shillings 190,000. The average storage cost is Kenya Shillings 128,750. The average

delivery and transmission cost is Kenya Shillings 153,500. It was concluded that the overall costs variation involved in production, development, storage, maintenance and transmission of the e-Learning course modules is not significant. This variation may be attributed to institutional procurement procedures and choice of suppliers and manufacturers.

Finally, it was concluded that public universities need to adopt the various identified strategies to enhance e-Learning. These strategies include the following among others, provision of excellent terms of service for e-Learning staff and course developers, inclusion of e-Learning in the performance targets of the universities, e-Learning should be made compulsory in teaching that the lecturers should prioritize e-Learning as the course delivery method, more funding and resources should also be dedicated for training and other e-Learning related activities, improvement of existing e-Learning infrastructure and sensitize staff and students on e-Learning matters. Adoption of the various identified strategies would greatly enhance e-Learning application.

5.4 Recommendations of the Study

This study makes the following recommendations in relation to the eight research questions. It first recommends improvement of the existing e-Learning hardware and network components and setting up of new ones. These include computers, network setup, intranet and internet facilities. Adequate funds should be allocated to e-Learning for acquisition of the relevant hardware components and reliable connectivity. More so, there are disruptions in electricity supply from the national grid that are likely to affect the hardware components. This makes it necessary for the universities to install a number of automatic diesel generators as standby backup power supply units in key areas including computer laboratories.

In terms of software the study recommends acquisition of new and less expensive software which are user friendly designed with an easy interface to navigate through. This would enhance in

performing the various e-Learning activities effectively and efficiently. Allocation of adequate funds to e-Learning would also ensure that the universities would acquire more software and subscribe to more learning management systems with different course development and delivery interfaces.

Public universities should acquire hardware and software with features that promote interactivity, ease of access of e-content, easy distribution of e-content, storage and maintenance of e-courses. The features should be user friendly and motivating to students and lecturers in order for them to embrace e-Learning. The various hardware and software features must be analyzed in detail before procurement is made.

The categories of staff involved in development and transmission of the e-Learning course modules in the universities should be located in both e-Learning offices and departments. Universities should appoint competent staff to spearhead e-Learning adoption and implementation process. These staff should be experts in e-Learning who will be able to improve e-Learning application and adoption. These experts should be knowledgeable in software, learning management systems, hardware, course design and transmission. These experts should also be able to assess costs of e-Learning and ensure that utilization of e-Learning in the universities is cost-effective. e-Learning staff should also be regularly trained with the current skills so that they can endeavour adopting e-Learning technologies that are concurrent to global e-Learning. Improvement of the terms of service for e-Learning staff was another point suggested that would motivate them in order to diversify the technological search for the best state of the art technologies for e-Learning. The universities should also adopt an e-Learning training plan for both the lecturers and students in order for them to appreciate the importance of e-Learning. The lecturers should also be exposed to content development tools and sponsorship to attend e-Learning conferences. Content developers should be motivated and this would entail remuneration of lecturers who develop e-Learning

courses and payment for the hours they spend communicating/interacting with students via learning management systems or any other form of educational technology delivery methods. Payment of the hours spent communicating with students entails the costs incurred using the internet and any other connectivity charges.

Student enrollment in e-Learning courses should also be enhanced in order to cater for the ever increasing demand for higher education and overcome barriers posed by conventional learning. Students are the e-Learning content users and thus they should be motivated. Their motivation would be ignited first by ensuring that the students really appreciate the tangible benefits of e-Learning and that they are able to experience them. These benefits include flexible learning which allows students to make choices about their learning experiences based on their personal circumstances. This means that e-Learning students are much flexible with class schedules and attendance depending on their priorities. Students have the freedom to attend class at a time and place most convenient for them. Accessibility of course material is another benefit in that e-content is accessible to students 24 hours a day, 7 days a week. This allows students the ability to review lectures, notes, discussions and comments whenever needed. Use of technology by students, for example use of the internet for class attendance, information research, and communication with other students and faculty provides valuable experience with technology skills critical to education in the digital age.

A realistic and comprehensive policy and plan of e-Learning in the universities should be developed elaborating how barriers that are faced or likely to be faced by public universities in dissemination of e-courses can be tackled.

For e-Learning planners and developers to come up with realistic e-Learning cost analysis, all university stakeholders should be involved in setting up and maintaining e-learning in terms of

human resource, technical support, hardware and software requirements, production, development, storage and maintenance of the e-Learning course modules.

Strategies and interventions that can be applied to improve dissemination of course modules via e-Learning should be addressed inform of an e-Learning model that should specifically address e-Learning issues. Such a model should define all the aims and objectives of e-Learning application, the e-Learning application methodologies and remuneration aspects of e-Learning developers. Such methodologies could be for example re-structuring e-Learning coordination to be under ICT departments and considering re-location of the e-Learning servers to KENET offices. The model should distinctively delineate e-Learning as one of the strategies in the universities strategic plan. The e-Learning strategies identified and specified should be pragmatically implemented.

5.5 Suggestions for Further Research

The following further researches into e-Learning related issues are recommended:

i) The real issues including user/student requirements in utilization of e-Learning

ii) e-Learning system characteristics and complexity factors such as geographical locations

iii) Management of information systems.

iv) Relationships between adoption and implementation of e-Learning in regard to top management, e-Learning management, and management of information systems.

v) Improving the management processes and other e-Learning related issues.

vi) Ethical issues in e-Learning and information systems

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Appendices

Appendix I: Introduction Letter

Murage Michael Njagi
Department of Educational Management, Policy & Curriculum Studies, Kenyatta University
P.O. Box 43844, Nairobi

Dear Respondent

I am a postgraduate student of Kenyatta University. I would like to collaborate with you in identifying the status of e-Learning and how it can be improved in public universities in Kenya. I sincerely request for your support through filling the questionnaire provided to you. The information you will give will assist highly in the above goal, which would be very vital in understanding how e-Learning can be improved in public universities in Kenya. The information provided will be treated with a lot of confidentiality.

Your contribution and sincerity will be highly esteemed.

Yours truly,

Signed---------- Date----------

Murage Michael Njagi

Appendix II: University ICT Manager /e-Learning Director Questionnaire

Section A: Background information

1. Name of institution: _____
2. Current position: _____
3. Number of years served in the university: _____
4. Number of years using a computer in the university, if any: _____
5. Number of years using a computer network, if any: _____
6. Number of years using Learning Management System Software, if any: _____
7. Number of years using databases: _____
8. Please state institution, period and level of training in computers

   _____

   (If self-taught, please say

   so)_____

   _____

   Period of training: _____months/years (please delete as appropriate)

   Level of training: (please indicate with a tick where appropriate)

   Elementary (E): _____ (certificate level and below)

   Intermediate (I): _____ (college diploma level)

   Advanced (A): _____ (university degree and above)

12. Number of official hours spent on a computer per week, if any: _____
13. Of these please indicate the number of hours spent on the following application software and their competence levels:

S/W Application Package	Name of package	Version	No. of hours per week	Competence level (E, I, A)
Word-processing				
Spreadsheets				
Databases				
Statistical Packages				
Internet and E-Mail				
Learning Management Systems and Electronic blackboards				
Other(s)				
1.				
2.				
3.				
4.				
5				
6.				
7.				

14. Of these please indicate the ones which are applied in your institution and for what purposes and specify the persons who use them and their competency levels (please indicate in detail)

Item	Where/How applied	No. f hours per week	Competence level (E, I, A)
Computer conferencing			

Computer Based Assessment			
Computer file Transfer			
Learning Management Systems (LMS)	Specify the LMS		
	1.		
	2.		
	3.		
Facsimile			
E-Mail/Internet			
Satellites discs			
Teleconferencing / Tele Classrooms			
Videotex			
Interactive CD ROMs			
VSAT			
Video tapes			
Audio cassettes			
Streaming Audio & video			

Audio conferencing			
Video Conferencing			
Other(s)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			

15. In your view, state the advantages associated with e-Learning as course delivery method in your institution.

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

f) ----------

g) ----------

16. List the barriers faced by your institution in implementing e-Learning.

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

f) ----------

g) ----------

Section B: Development, desired features and benefits of e-Learning in the university

17. Information Policy and Planning

(i) Should a university in modern Kenya have an e-Learning Policy and Plan?

Disagree

Agree

What purpose(s) does such a policy and plan serve in your university?

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

(iii) What specific and practical proposals and strategies would you give to ensure that present and future e-Learning projects are sustained?

_____
_____
_____
_____

_____

_____

_____

_____

_____

18. Development and constraints

(i) Please give your assessment of the present level of e-Learning application in the university?

(Tick appropriately)

Much higher----------☐

Higher----------☐

Average (same as others public universities)---☐

Lower----------☐

Much lower----------☐

(iv) To what extent do you think that the following are major constraints that presently face e-Learning application in course delivery in the university? Use the 5-point Likert scale 1 (Not likely) to 5 (Most likely) to indicate in the boxes provided the likelihood of the constraint.

(1=Not likely, 2= Least likely, 3=Likely, 4=More likely, 5=Most likely)

- High cost of hardware & software---------- 1 2 3 4 5
- Poor communication and ICT infrastructure---------- 1 2 3 4 5
- High cost of training---------- 1 2 3 4 5
- Lack of funds for ICT and training---------- 1 2 3 4 5
- Little priority given to e-Learning by management-- 1 2 3 4 5
- Lack of physical security for computers---------- 1 2 3 4 5
- Lack of support and commitment by management--- 1 2 3 4 5
- Lack of interest by potential users---------- 1 2 3 4 5
- Lack of confidence of mgt. in users---------- 1 2 3 4 5
- Uncaring and poor attitude---------- 1 2 3 4 5
- Poor management of computers---------- 1 2 3 4 5
- Institutional inertia (reluctance)---------- 1 2 3 4 5
- Lack of clear e-Learning policy and plan---------- 1 2 3 4 5
- Poor remuneration for e-Learning course developers----- 1 2 3 4 5
- Wide geographical locations of campuses---------- 1 2 3 4 5

(v) List up to 5 significant steps that the university has taken to tackle problems facing e-Learning application in the university in the recent past.

_____

_____

_____

_____

_____

_____

_____

_____

(vi) Indicate in the spaces below how the situation can be improved from the users' side as well as from the university management's side:

From users' side:

_____
_____
_____
_____
_____
_____
_____
_____

From university management's side:

_____
_____
_____
_____
_____
_____
_____
_____

Section C: Current e-Learning

In questions 18 to 21, indicate the features or benefits you think are associated with the current e-Learning. For each category, use the 5-point Likert scale 1 (Very Low) to 5(High) ratings.

(1=Very low, 2=Low, 3=Average, 4=Good, 5=High)

19. Current acceptance and Implementation of e-Learning in the University:

- Ease of access to computer facilities---------- 1 2 3 4 5
- Availability of ICT infrastructure---------- 1 2 3 4 5
- Lecturers and students satisfaction---------- 1 2 3 4 5
- Efficient skills to use in e-Learning platforms---- 1 2 3 4 5
- Interactivity between lecturers and students------ 1 2 3 4 5
- Good evaluation through e-Learning platforms-- 1 2 3 4 5
- Completion of courses on time---------- 1 2 3 4 5

20. Utilization:

- Efficiency ---------- 1 2 3 4 5
- Effectiveness ---------- 1 2 3 4 5
- Accuracy in information exchange------ 1 2 3 4 5
- Lecturer – lecturer interaction---------- 1 2 3 4 5
- Lecturer – students interaction---------- 1 2 3 4 5
- Student – student interaction---------- 1 2 3 4 5
- Discussion forums---------- 1 2 3 4 5
- Chat forums---------- 1 2 3 4 5

21. Maintenance:

- Adaptability to changes and innovations to e-Learning-- 1 2 3 4 5
- Training opportunities---------- 1 2 3 4 5
- Reliability of ICT---------- 1 2 3 4 5
- Durability of ICT ---------- 1 2 3 4 5

22. Exploitation:

- Reduced reliance on paper work--- 1 2 3 4 5
- Reduced operational cost---------- 1 2 3 4 5
- Advantage of new e-Learning------ 1 2 3 4 5
- Service to staff & students---------- 1 2 3 4 5
- Competitive advantage---------- 1 2 3 4 5

23. In your view, can the university do without e-Learning in the present times and in the future? (Please tick appropriately).

Yes ☐

No ☐

Not sure ☐

24. If your answer to Question 21 above is 'No', what are the strategies that the university should adapt in order to ensure sustained future e-Learning growth?

Use the scale from 1 (Least agreed) to 5 (Strongly agreed), to make your choice by checking in the appropriate box. (1=Don't know, 2=Not agreed, 3=Least agreed, 4=Agreed, 5=Strongly agreed)

- Devise a comprehensive e-Learning policy and plan----- 1 2 3 4 5
- Invest significantly in e-Learning---------- 1 2 3 4 5
- Invest in staff training---------- 1 2 3 4 5
- Manage e-Learning more effectively---------- 1 2 3 4 5
- Re-orient staff in proper use of e-Learning platforms---- 1 2 3 4 5

Others (please specify)

a) _____

b) _____

c) _____

d) _____

e) _____

f) _____

g) _____

25. What specific and practical proposals would you give which will ensure that the present and future level of e-Learning service is maintained?

_____

_____

_____

_____

Section D: Costing

(i) Procurement, development and subscription of e-Learning software

a) What's the cost (price) of procuring (purchase), annual subscription or development of the e-Learning software applied in the university?)

SNo.	Name and version of the e-Learning software	Purchase Cost	Annual subscription cost (if subscribed from another company)	Development cost (if developed by the university
a)				
b)				
c)				
d)				
e)				
f)				

(ii) Procurement and subscription of e-Learning hardware

SNo.	Name and version of the e-Learning hardware	Purchase cost	Annual subscription cost (if subscribed from another company)
a)			
b)			
c)			
d)			
e)			
f)			

(iii) Procurement and subscription of e-Learning network.

SNo.	Name and version of the e-Learning network components	Purchase Cost	Annual Subscription cost (if subscribed from another company)
g)			
h)			
i)			
j)			
k)			
l)			

(iv) Costing development and production of e-Learning courses

a) Number of courses offered through e-Learning

i.----------

ii.----------

iii.----------

iv.----------

v.----------

vi.----------

vii.----------

viii.----------

ix.----------

x.Specify other Courses_____

_____

(You may attach a separate sheet of paper if necessary).

b) The average employment cost of a member of a staff in a given category----------

---

c) The development cost per unit of output for the type of course specified above.---------

---

d) The production cost per unit of output for the type of course specified above.----------

---

(v) Maintenance of e-courses in presentation

a) Number of staff in any number of discreet categories of the courses----------

---

b) The average employment cost of a member of a staff in the category specified above---

---

c) The standard budget for maintenance for each course specified above----------

---

(vi) Cost of storage

a) The cost of storage device and its components used for storage of a particular course---

---

b) The variable cost of storage device and its components----------
---

c) The fixed cost of storage of any component ----------

(vii) Cost of delivery

a) The number of storage devices and their components----------
---

b) The average cost of delivery or transmission----------
---

c) The fixed cost of delivering or transmitting a course----------
---

Section E: e-Learning courses

25. Who develops the e-Learning courses and which problems do the developers face? Are the developers the same e-Learning lecturers for the courses?----------
---
---

26. Do you have set guidelines on how to develop and structure the courses to make them more interactive? (please attach the set guidelines)
27. How many students are enrolled in e-Learning courses in the University?
28. How do lecturers respond to e-Learning duties and tasks? (Tick appropriately).

- Very good-------☐
- Good----------☐
- Average----------☐
- Below average--☐
- poor----------☐

29. Please state the advantages of e-Learning to students you have observed.

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

f) ----------

g) ----------

30. Do students usually have problems in accessing the e-Learning courses? Please state the problems you have observed.

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

f) ----------

g) ----------

33. How do university administration support e-Learning in the university?

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

f) ----------

g) ----------

15. Please make suggestions on how the current situation of e-Learning can be improved in the university.

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

f) ----------

End

Appendix III: Academic/Teaching Staff Questionnaire

1. Name of institution: _____

2. Department: _____

3. State the Level of training in Computer applications: (please indicate with a tick where appropriate)

   ☐ Elementary (E): _____ (certificate level and below)

   ☐ Intermediate (I): _____ (college diploma level)

   ☐ Advanced (A): _____ (university degree and above)

4. Number of courses you teach via e-Learning if any: _____

5. Number of students taking the course via e-Learning (fill them in the table below)

SNo	Course title	No. of students studying through e-Learning
a)		
b)		
c)		
d)		
e)		

6. Do the students who take your courses via e-Learning attend face to face sessions?

   ☐ Yes

   ☐ No

7. How do your students access courses via e-Learning? Describe below

---

---

8. What is the students' response to e-Learning? (Tick appropriately).

- Very good-------☐
- Good----------☐
- Average----------☐
- Below average--☐
- poor----------☐

10. What is the performance in examinations for the students who study via e-Learning? (Tick appropriately).

- Very good-------☐
- Good----------☐
- Average----------☐
- Below average--☐
- poor----------☐

10. By filling the table below describe how interactivity is ensured in your course.

SNo	Activity	e-Learning component applied and the feature in the component that performs the task
a)	Delivering course content to students	
b)	Conducting discussion forums and chat sessions	
c)	Administering of tests and exams	
	Specify other activities below	

d)		
e)		
f)		

11. Are you remunerated for developing e-courses? (Tick appropriately).

☐ Yes

☐ No

12. Are you remunerated for the hours you spend communicating with students via e-Learning platforms? (Tick appropriately).

☐ Yes

☐ No

Specify the rate per hour _____Ksh for a total_____ no. of hours per each unit taught via e- Learning until all course topics are completed in the unit.

13. Have you undertaken training in e-Learning platforms applied in your institution? (Tick appropriately).

☐ Yes

☐ No

14. Have you undertaken training in designing e-Learning courses? (Tick appropriately).

☐ Yes

☐ No

15. Please list the barriers you encounter while implementing e-Learning in your Department.

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

f) ----------

g) ----------

16. Please give suggestions on how e-Learning application in course delivery can be improved in your department.

h) ----------

i) ----------

j) ----------

k) ----------

l) ----------

m) ----------

n) ----------

END

Appendix IV: e-Learning Technicians Questionnaire

1. Name of institution: _____
2. Section: _____
3. Current position: _____ Grade: _____
4. Number of years served in the university: _____
5. Number of years using a computer in the university, if any: _____
6. Number of years using a computer network, if any: _____
7. Number of years using Learning Management System Software, if any: _____
8. Number of years using databases: _____
9. Please state institution, period and level of training in computers, if any: Institution:

   _____

   (If self-taught, please say so)

   Period of training: _____months/years (please delete as appropriate)

   Level of training: (please indicate with a tick where appropriate)

   Elementary (E): _____ (certificate level and below)

   Intermediate (I): _____ (college diploma level)

   Advanced (A): _____ (university degree and above)

11. Indicate in the table below the user requirements and preconditions set and available in your university.

    (Please tick appropriately in the boxes labeled (Yes or No)

Sno.	Description of component	User requirements and Preconditions	Yes	No
a.	Availability of network	Network is available when required and where necessary		
b.	Flexibility of network	Network facilitates extensions and variations to the network		
c.	Maintainability of network	Network facilitates adaptability of network components		
d.	Performance of network	Network indicates speed at which data/info is transmitted		
e.	Reliability of network	Network is consistent with respect to correctness, completeness, timeliness and authorization while in use		

f.	Security of ICT	Networks protects data/info from loss		
g.	Information policy and planning	IPP facilitates development, utilization, exploitation and maintenance of networks in the university		
h.	Centralization of e-Learning activities	e-Learning activities are centralized in the university to maintain control		
i.	De-centralization of e-Learning activities	e-Learning activities are de-centralized to distribute resources and personnel		
j.	Concentration of network components	Network components are concentrated for control and security		
k.	De-concentration of network components	Network components are de-concentrated for autonomy and control		
l.	Financial resources	Supported by university administration		
m.	Personnel allocation	Technical staff allocated		
n.	Safety of staff/equipment	Safety of staff/equipment is assured for compensation for injury		
o.	Standardization of network components	Network components are standardized to improve services across the University		
p.	Service level agreements (users, vendors)	There is SLAs between network vendors and the University		
q.	Culture communication infrastructure	The location of the university contributes to its communication infrastructure problems		
r.	Network components	LAN and Internet components are provided for local communication and access to WWW and Internet		
s.	Hardware	There is upgraded hardware to the state-of-the-art		
t.	Software	There is upgraded software to the state-of-the-art		
u.	Network components	There is upgraded network components to the state-of-the-art		
v.	Hardware	New acquisitions regularly		
w.	Software	New acquisitions regularly		
x.	Network components	New acquisitions regularly		
y.	Choice of software tools	Choice of the automated tool is dictated by the need to use software that is simple, easy-to-use, cost-effective and commonly available in Kenya.		

12. In your institution, network is a collection of PCs, laptops, printers and any other form of hardware connected together by network components (tick appropriately in the table below the network components you apply in your university)

Sno	Network component	Tick
a.	Routers	
b.	Bridges	
c.	Hubs	
d.	Satellite disks	
e.	Fibre optics	
f.	Cables	
g.	Wireless cards	
h.	**Others (specify below)**	
i.		
j.		
k.		
l.		

13. What are your roles in the e-Learning Department?

    a. ----------

    b. ----------

    c. ----------

    d. ----------

    e. ----------

    f. ----------

14. In what ways do you assist the e-Learning tutors? (Tick appropriately)

    a. Uploading of course content ☐

    b. Interacting with students ☐

    Specify others

    a. ----------

    b. ----------

    c. ----------

15. Which problems do students encounter in accessing e-courses?

Specify

a. ----------

b. ----------

c. ----------

d. ----------

14. **Please specify the components of e-Learning you use in your institutions?**

SNo.	Name of the e-Learning component e.g Video conferencing, streaming videos, e-Learning portals e.t.c	Version
1.		
2.		
3.		
4.		
5.		
6.		
7.		

15. How do you ensure security of the following in the e-Learning Department?

(i) e-Learning course content

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

(ii) e-Learning Hardware

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

(iii) e-Learning Software

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

(iv) e-Learning Network

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

(v) e-Learning infrastructure

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

16. How do you ensure maintenance of the following in the e-Learning Department?

(i) e-Learning course content

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

(iii) e-Learning Hardware

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

(iii) e-Learning Software

a. ----------

b. ----------

c. ----------

d. ----------

e. ----------

(iv) e-Learning Network

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

(v) e-Learning infrastructure

a. ----------

b. ----------

c. ----------

d. ----------

e. ----------

END

Appendix V: ICT Manager/e-Learning Director Interview Schedule

1. Name of the university----------
2. Does the university have a policy and plan for e-Learning?
3. Is e-Learning allocated an annual budget? What amount is allocated for e-Learning in 2007/2008 academic year?
4. Would the university wish to face out conventional learning in favour for e-Learning?
5. What strategies have you put in place to market e-Learning courses?
6. How does the university ensure that there are no power shortages and cutoffs?
7. What strategies has the university put in place to expand e-Learning as course delivery method?
    a) ----------
    b) ----------
    c) ----------
    d) ----------
    e) ----------
    f) ----------
    g) ----------

Appendix VI: Document analysis

The researcher reviewed written material which included published and unpublished documents on e-Learning from ICT sections, departments and faculties in the respective institutions. e-Learning policy and plans in the respective universities were also reviewed. The researcher requested for permission to take copies of the relevant documents and use them during data analysis.

Appendix VII: Direct observation

Here, the researcher was a direct observer of the events on this study. The researcher participated in the use of the various e-Learning components and observing their various interface designs that enhance interactivity between the various categories of users as well as viewing interactive cds. The direct observation schedule which was developed by the researcher was a check list to ascertain information given by respondents by observing the scenario on the ground.

Models of Education and Associated Delivery Technologies	**Available**	**Not Available**	**In good working condition**	**Often utilized**
FIRST GENERATION - The Correspondence Model • Print				
SECOND GENERATION - The Multi-media Model ▪ Audiotape, ▪ Videotape, ▪ Computer-based learning (eg CML/CAL/IMM), ▪ Interactive video (disk and tape)				
THIRD GENERATION - The Telelearning Model ▪ Audioteleconferencing, ▪ Videoconferencing, ▪ Audiographic Communication, ▪ Broadcast TV/Radio and Audioteleconferencing				
FOURTH GENERATION - The Flexible Learning Model ▪ Interactive multimedia (IMM) online, ▪ Internet-based access to WWW resources, ▪ Computer mediated communication				
FIFTH GENERATION - The Intelligent Flexible Learning Model ▪ Interactive multimedia (IMM) online, ▪ Internet-based access to WWW resources, ▪ Computer mediated communication, using automated response systems, ▪ Campus portal access to institutional processes and resources				

Appendix VIII: Pearson's product moment correlation formula

The formula for Pearson's correlation takes on many forms. A commonly used formula is shown below.

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{(\sum X^2 - \frac{(\sum X)^2}{N})(\sum Y^2 - \frac{(\sum Y)^2}{N})}}$$

A simpler looking formula can be used if the numbers are converted into z scores:

$$r = \frac{\sum z_x z_y}{N}$$

where z_x is the variable X converted into z scores and z_y is the variable Y converted into z scores.

Appendix IX: Calculating the rating average

	Not Likely	Least Likely	Likely	More Likely	Most Likely	Rating Average
Weighted Value	**1**	**2**	**3**	**4**	**5**	
Answer Options						
High cost of hardware & software	28.6% (2)	14.3% (1)	14.3% (1)	28.6% (2)	14.3% (1)	2.86

Part 1: Calculating the Respondent Number with the Column Weight

- In the formula below, for the "High cost of hardware & software" answer option the numbers in the parentheses are the weighted values assigned to the columns. The number multiplied with the weighted value is the respondent count or the "frequency" of those that picked that rating:

  [2*(1) + 1*(2) + 1*(3) + 2*(4) + 1*(5)] = 20

- In this example above, we see that the "High cost of hardware & software" row choice had "2" respondent pick **Not Likely**. Since the number of respondents that picked that rating is "2" and the weighted value is assigned a "1", you will see [2*(1)] as the 1st part of the equation.
- Next for the **Least Likely** column, you see that "1" respondent picked that answer choice and the column weighting is "2." For this 2nd part of the equation, you see [1*(2)]. This process continues through to the end of the equation for each frequency and for each weighted value.
- After multiplying the weighted values with the actual number of respondents who picked that rating, sum the totals = 20

Part 2: Add the Respondent Totals

- Add the respondent totals (or frequency number) of those that picked the ratings.
- In this example, it is total of the numbers that are not in parentheses: (2 + 1 + 1 + 2 + 1) = 7

Part 3: Divide the Weighted Value Calculation by the Sum of Respondents

After all parts have been calculated, the formula for the Rating Average would look like:

- RA = [2*(1) + 1*(2) + 1*(3) + 2*(4) + 1*(5)]/ (2 + 1 + 1 + 2 + 1)
- RA = 20 / 7
- RA = 2.86

A response rating of 2.86 means that this falls to the **Likely** rating.