THE ROLE OF INTERACTIVE MULTIMEDIA (IMM) RESOURCES IN
ENHANCING DELIVERY OF MEDICAL INFORMATION AND
KNOWLEDGE TO STUDENT USERS:
A CASE STUDY OF MEDICAL SCHOOL, UNIVERSITY OF NAIROBI

BY

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the Award of Degree of Master of Library and Information Science,
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KENYATTA UNIVERSITY

October, 2007
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The role of
interactive
DECLARATION

I declare that this is my original work and has never been submitted for a degree in any other university.

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Date ..................................

HARUN KAMAU MUGO

This research project has been submitted for examination with my approval as a university supervisor.

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DEDICATION

To my dear wife Lucy and sons Bonny, Mark, Godwin and Brian, and my parents, Mzee Samuel Mugo Minjire and Mama Teresia Njeri who have always been my inspiration and encouragement in my academic endeavour.
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It’s with great pleasure that I acknowledge the people who contributed in their own way to the successful completion of this project, but above all my Almighty God, my provider.

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Last but not the least lots of thanks for the support and encouragement accorded to me by my senior colleagues Mrs. Wakari Gikenye, Mr. Mwangi Ngundo and Ms. Agatha Kabugu who worked with me at Medical Library, and Mrs. Jacinta Were, Deputy University Librarian (T) and the University Librarian Mrs. Salome Munavu.

TO ALL WHO ENCOURAGED ME - GOD BLESS YOU
ABSTRACT

The computer networks and internet connections has mostly been assumed to make institutions Information and Communication Technology (ICT) and Interactive Multimedia (IMM) compliant. The internet and Compact Disc Read Only Memory (CD-ROM) based information may be thought to provide class lecture information sufficient support. However, these facilities do not necessarily add up to availability and access to IMM resources or even effective utilization and support to class lectures, surgery and laboratory procedures. The resources should be specially identified and recommended by the lecturers and librarians to the medical students for ready access and utilization. This study sought to investigate the availability of IMM resources in the Medical School, UoN, their access and utilization in delivery of medical information and knowledge. The objectives of the study were to:

- Establish the availability and determine the IMM sources and channels of information in the Medical School.
- Establish the extent of use of IMM resources in enhancing delivery of information in the Medical School.
- Identify areas where IMM technology can be used to gain medical procedure information and knowledge.
- Identify the potential challenges and future of IMM in dissemination of medical information.

The study used a combination of qualitative and quantitative research methods. A set of two questionnaires were administered to student information users and librarians of the Medical Library, UoN. The researcher interacted with students and librarians in the library for direct
observation. The data was coded and analysed using the Statistical Package for Social Sciences (SPSS) computer software. The findings revealed that the students valued the IMM resources. However, the IMM resources available in the Medical School were internet-based and externally acquired CD-ROM resources. The UoN has not integrated IMM in its information system. The IMM resources used are mostly in textual format (e.g. electronic journals) and discussions. The simulations and animations, though considered more effective mode of delivery of procedural information and knowledge are used at negligible levels. The students suggested many practical procedures especially in surgery should be provided in IMM technology. The identified challenges in adopting IMM technology included funding, inadequate IMM literacy among users and librarians, inadequate IMM facilities and user awareness. It was recommended that an IMM designated department should be established to cater for IMM integration into the school’s academic curriculum. Number computers, internet bandwidth and IMM competency and collaborations should be improved. It is pertinent that IMM implementation must be strategically planned for its potential benefits realisation.
ABBREVIATIONS AND ACRONYMS

AMSUN: Association of Medical Students of University of Nairobi

B. Ed: Bachelor of Education

CD: Compact Discs

CD-ROM: Computer Disc-Read Only Memory

CHS: College of Health Sciences

CWIS: Campus-wide Information Systems

D.L.I.S: Diploma of Library and Information Science

DVD: Digital Versatile Disk

EA: East Africa

ENT: Ear, Nose and Throat

FTP: File Transfer Program

GB: Giga Bite

Hons: Honours

ICT: Information and Communication Technology

IMM: Interactive Multimedia

IT: Information Technology

KShs: Kenya shillings

KU: Kenyatta University

KULISC: Kenya University Libraries and Information Services Consortium

LAN: Local Area Network

LCME: Liaison Committee on Medical Education

LGB: Loughborough
M.A.: Master of Arts
MLIS: Master of Library and Information Science
MS: Microsoft
NEMSC: National Educational Medical School Consortium
NRB: Nairobi
NYU: New York University
PC: Personal Computer
PDF: Portable Document Format
RAM: Random Access Memory
SET: Student-Centred Electronic Teaching
SPSS: Statistical Programme for Social Sciences
U.S.A.: United State of America
UK: United Kingdom
UNITID: University of Nairobi Institute of Transmitted and Infectious Diseases
UoN: University of Nairobi
URL: Universal Resource Locator
WIRED: World Information Resources for Education and Development
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CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

Information can take many guises: oral history in form of narration and interviews; artefacts in form of images and descriptions; songs in the form of audio recordings, music transcriptions, and lyrics; dances and ceremonies in the form of video, audio, written synopses and interpretations. Multimedia digital libraries allow such information to be integrated, recorded, browsed, and searched, within a uniform user interface. Lib, et-al (2000) concurs that interactive multimedia (IMM) environment allows active learning in which the learner actively builds rather than passively consumes information and knowledge. It engages the students in a continuous collaborative process of buildings and reshaping information for its better understanding. This signifies the effectiveness of IMM delivery of information.

Knowledge is a result of somebody applying the refiner’s fire to the mass of facts and ideas, selecting and organising what is useful to somebody. Most knowledge is expertness in a field, a subject, a way of thinking, a science, a technology, a system of values, a form of social organisation and authority. Thus, knowledge is that which is contained in realm. ‘Knowledge’ and ‘information’ are often used interchangeably in ordinary discourse.

Au (1995) defined learning as “a relatively permanent change in behaviour or knowledge brought about by practice or experience.” On the other hand Wingfield (1979) said that a piece of information is learnt and becomes one’s knowledge when it is understood and put into memory.

IMM is simply and fundamentally about providing good and effective information delivery. Laurillard (1993) impresses that for effective information delivery and instruction, we must turn away from seeking to describe rules and principles and look towards describing interactions, between information resources, and users. Wild et-al (1994) maintains that effective multimedia must seek to facilitate interactions between these agents. The interactions, for instance, should be based on exploratory and generative approaches to
teaching and learning. Wild et-al asserts that the IMM is a base for multi-channel delivery of information in that it has the requirement that the delivery mechanism incorporates a variety of media. Hence, the user can select and control the rate of progress and the direction of the investigation.

Interactive multimedia (IMM) provides an alternative method of delivering technical medical information. Development of IMM programmes that include formative evaluations and based on theoretical framework, such as Constructivist and Learning styles theories models optimizes outcomes. IMM have been widely appreciated as an effective delivery system of information and knowledge. It improves the information users’ medical related knowledge, skills, attitudes and intent to change information seeking behaviour. It’s a cost-effective method for students with limited resources, such as those in surgery and medical laboratories. More students can be conveniently reached with basic medical information enabling the lecturers’ additional time focus on the needs of individuals during one-on-one sessions.

Sue Browell’s experience in education, and involvement with training and development specialists, advocates for a move away from traditional form of training and information delivery to a much more flexible mode of learning technologies. Recent advances in multimedia database technology and high performance networking present an extraordinary opportunity to transform basic and continuing medical education by bringing search, discovery and presentation capabilities for IMM information directly into medical classrooms. Vast collections of medical videos, clinical slides and laboratory images which hold enormous value for medical faculty and physicians remain a largely unused resource because the information is neither digitized nor catalogued and, as a result, not easily accessed or used. Such a multimedia system would enhance use of content-based query and retrieval for digital medical libraries, supporting basic education courses in the medical courses in the medical schools and offer continuing education to the lecturers.

University medical students often enter physical laboratory sessions with minimal knowledge of experiments to be conducted and little or no understanding of underlying
concepts that govern the investigations. The multimedia information approach provides a platform for incorporating digital images of the equipment to be used, video/audio presentations demonstrating equipment use and techniques to be applied, links to relevant background materials in addition to the pertinent material provided in the modules, and an avenue for exchanging laboratory related information before and after physical experiments are conducted.

By providing the students with a clear understanding of the experiments and theatre procedures prior to entering the physical session, the students are motivated and this reduces the number of ‘lost’ and/or ‘disinterested’ students. This enhances the student’s understanding and quality of medical professional skills. Hence, multimedia either in a library or in the academic or research department is clearly an educational resource with astonishing potential, but for it to be effective the tools must be strategically planned and implemented.

The impact of effects with multimedia can be drastic and dramatic. Students can reach performance levels on intellectual tasks when working with multimedia computers or other information and communication technologies’ (ICT’s) work stations that far exceed what they could accomplish alone (Schulz and Dahale, 1999). Physical distribution of recorded devices can provide an alternative to networks. The compact disk read-only memory (CD-ROM) is very practical format for areas with little internet access. The CD-ROM’s 650 MB capacity can hold a substantial useful volume of information. The CD-ROMs are giving way to the digital versatile disks (DVDs) which can hold from 5 to 20 GB of data. A year’s supply of 5000 medical journals could fit, fully indexed on a single DVD and the appropriate use of this information would facilitate better understanding and saving of lives.

Multimedia workstation should be specially-equipped with PCs dedicated to multimedia production and open to staff and students. Users can import and export audio and video, create Windows Media, PowerPoint, Flash, and other types of multimedia files and burn them to DVD or CD. Technical assistance should be available at the multimedia information
A multimedia computer has made training demonstrations and presentation easier. Animation can be included in multimedia applications to add motion to images. Animations are particularly useful to stimulate real life situations, such as laboratory experiments. Such a facility facilitates eradication or reduction of inefficient use of laboratory time that results in rushed work, poor performance and diminished quality education.

The role of interactive multimedia in practical medical procedures cannot be overemphasized. It results in improved access of information of procedures and time saving for meaningful laboratory and surgery procedures. Multimedia technologies can support a wide range of learning activities which engage students in a continuous collaborative process of building and reshaping information and user understanding. Despite of the theoretical appeal and broadly positive results from a handful of randomized trials conducted by enthusiasts, it can be stated as Greenhalgh (2001) puts it, that the real advantages of computer assisted learning in medical curricula is yet to be shown consistently. Consequently, basing on the researcher's work experience in a medical library, Kenya has not proved any better and hence, interactive multimedia technology has yet to be sufficiently exploited in the local medical schools.

The lecture method of information delivery is restrictive in time and interactivity. The information seeker cannot move at one's own pace in trying to comprehend the information. The physical facilities and medical procedure manuals are limited and interactivity capacity is constrained in terms of real life engagement, cost involved and time factor.

To enhance physical procedures, electronic modules are important to bridge the gap of limited facilities. The limited laboratories and theatre facilities without interactive multimedia facilities may result in inadequately informed and low quality medical professionals. The interactive multimedia modules enhance time utility of physical practical sessions and would result in well informed and highly skilled health professionals.
Multimedia modules are not meant to replace the physical technical sessions but rather to enhance the technical courses through sharpening information delivery and harnessing the understanding capacity of the students prior to their hands-on experience sessions. Schulz and Dahale (1999) likens the modules to a well-conceived laboratory manuals that are designed to provide students enrolled in technical laboratory sessions with an overview of the requisite background knowledge, analytical tools, basic procedures, safety concerns and applicable equipment needed to conduct and evaluate each experiment prior to entering the physical laboratory.

Multimedia information modules are meant to prepare and motivate the students for the upcoming hands-on technical sessions. Sufficient background and practical procedure description are presented in the modules to provide much, but not all of the information needed to answer the homework questions that are due at the beginning of each physical technical session.

1.2 BACKGROUND INFORMATION

Medical School is one of the four schools of College of Health Sciences (CHS) University of Nairobi (UoN). Other schools of CHS are Dentistry, Pharmacy and Nursing. However, the study concern was based on the Medical School. The School is located at the precincts of Kenyatta National Hospital, Upper Hill in Nairobi City. The college utilizes the hospital as its teaching hospital. University of Nairobi College of Health Sciences is one of the major training institutions of health professionals in the East and Central African region. The history of the College can be traced from 3rd July 1967 when the Faculty of Medicine was created. The college trains healthcare personnel in various disciplines; medicine, pharmacy, dentistry, nursing sciences and medical microbiology.

There has been an increase in number of students enrolled at the medical school of UoN over the years. However, the number and size of laboratories and theatre facilities have not improved proportionately over the years. In consideration of these circumstances the researcher assumed that there was need for IMM to facilitate extension of these facilities beyond the confines of the limited physical facilities. The procedures could be relayed
spontaneously as they happen in lecture theatres or they could be recorded on CDs for future and for viewing prior to physical sessions. The specially prepared educational IMM materials can also be availed online via networked database connection or internet. The practical medical procedure modules have been generated in medical schools in developed countries.

1.3 STATEMENT OF THE PROBLEM

Conventional approach to learning and delivery of information and knowledge on medical procedures has inherent inadequacies. The approach to access of information is very passive and lacks interactivity. The IMM technology approach to learning and delivery of information and knowledge is very interactive with great potentials of enhancing learning and delivery of information and knowledge. Conventionally, knowledge is transferred to learners linearly in the form of textbooks, speech or report. This kind of information and knowledge delivery system is rigid and lacks the capacity to cater for diverse needs and capabilities of users' information access. Lack of IMM facilities hampers the follow-up of lectures, laboratory and surgery presentation after class hours. The conventional information system lacks user's controlled and self-paced access of information. At this time of information age, this can be considered to be an ineffective and inefficient delivery of procedures and operations information in medical education. The IMM information system offers diverse information presentations, control of interaction and user's self-pacing of access of information and learning. Hence, effective delivery of information to the students requires that they interact with multiple channels so as to understand how new information meshes with existing knowledge and how to integrate it into complex skills and abilities, and not just remembering isolated medical facts and procedures. The complex skills and abilities in medicine that can be used in real life are the true goals of learning, and not simply the ability to recall information.

With advancement of multimedia technologies, more stimulating media channels such as video tapes, simulations, animations, electronic slide shows, intelligent data bases, internet resources, and other computer aided training programmes can be used as supporting aids in delivery of information and knowledge. Moreover, the advent of IMM technologies has
enabled the input, dissemination and output of any combination of text, graphics, animations simulations, audio and video data on various media.

Medical students and professionals are generally required to review the underlying theory and experimental descriptions prior to physically performing a procedure, but the requisite references and related textual materials are often scattered and difficult to collate and assimilate the information. The readily available information references, including laboratory and theatre manuals, rarely equip students with adequate and clear real life insight of the procedures. Consequently, medical students are rarely adequately informed and prepared when they embark on procedures in laboratories and surgical theatres, thus, a good proportion of practical time is spent reviewing underlying concepts rather than carrying out the practical procedures. This is as a result of ineffective and inefficient method of information and knowledge delivery. As a result of use of the conventional (traditional) way of information delivery with its prevalent inadequacies there is inefficient use of physical procedures practical time. This may result to rushed work due to time factor, poor performance and even worse, reduced quality of education.

Shank (2005) avers that IMM information delivery system is believed to have an added value that can bridge this information and knowledge gap existing in most medical schools. Schulz and Dahale (1999) asserted that the information user utilising interactive media, the IMM simulated mode of information delivery, unbound and unrestricted access and individualized pace of access would experience better mode of delivery of practical information and knowledge in medical physical procedures. The IMM information delivery system provides a more effective and efficient mode of delivery of medical information that is missing in the traditional lecture and procedure manuals (Damoense, 2003). It is this gap that this study on the availability and utilisation of IMM endeavours to fill.
1.4 AIM AND OBJECTIVES OF THE STUDY
The aim of this study was to investigate the availability, access and utilisation of IMM resources for effective and efficient dissemination of practical information and knowledge to medical students at the Medical School of University of Nairobi.

OBJECTIVES
1. Establish the availability and determine the IMM sources and channels of information in the Medical School.
2. Establish the extent of use of IMM resources in enhancing delivery of information in the Medical School.
3. Identify areas where IMM technology can be used to gain medical procedure information and knowledge.
4. Identify the potential challenges and future of IMM in dissemination of medical information.

1.5 RESEARCH QUESTIONS
The study sought to answer the following questions:

A: Availability and Determination IMM Sources and Channels for Medical Student Users.
1. What form of IMM information is available and are currently used in Medical School?
2. Which Interactive Multimedia (IMM) resources does the Medical School have for delivering practical courses (i.e. laboratory technology and surgery)
3. (a) Whether students use IMM facilities outside their medical school
   (b) And, if they don’t use, which are the hindering factors?
4. Whether there are IMM projects developed by the Medical School that give the students’ opportunity to perform simulated surgery and laboratory experiments
5. Whether students are charged a fee to use IMM at the service points (e.g. computer laboratories) and how much.

B: Extent of Use of IMM Resources in Enhancing Information Delivery
6. How many times students use IMM per week.
7. Whether students think IMM enhances their information access and how
8. How IMM resources increase their understanding of the information
9. Whether the Medical School provide IMM resources (e.g. internet) to students in the halls of residence or even at home.
10. Whether students are given IMM-based take-away assignments to assess their medical procedures skills and knowledge, and if they do, where they access the facilities.
11. Whether there are medical institutions that collaborate in IMM experiences in learning and delivery of information with the medical school.

C: How IMM can be Used to Gain Medical Procedure Information and Knowledge
12. Which information system students and librarians consider most effective in medical information delivery among traditional, IMM or hybrid (combination).
13. List areas of surgery and laboratory technology you would recommend application of IMM for effective and efficient delivery of information.

D: Identifying Potential Challenges and Future of IMM in Delivery Medical Information
14. How do students gain skills on use of IMM
15. Seek students' and librarians' opinion of what could impediments in adoption of IMM technology in provision of medical information.
16. Whether the Medical School have a designated IMM department/section to cater for learning, information and knowledge resources.
17. Seek students and librarians suggestions on how to improve IMM services e.g. on formats, cost, training, etc.

1.6 SIGNIFICANCE OF THE STUDY
The study seeks to show that a medical information system to be effective and efficient should embrace IMM technology. IMM system provides multi-channel presentations for improved access of information. The traditional delivery of medical information is ineffective and inefficient. This study will provide evidence on current availability, access and utilization of IMM in accessing practical medical procedure information and
knowledge. It has produced new knowledge and insights into the current situation on the availability, access and utilization of IMM resources in delivery of practical medical information and knowledge at the medical school, UoN. It has established the challenges and problems encountered in adopting IMM system in accessing and delivery of medical information and knowledge in the learning process. The study has recommended solutions to the challenges.

1.7 CONCEPTUAL FRAMEWORK
The base of IMM is the requirement that information and knowledge delivery system incorporates a variety of media (channels), from which users can select the type of resource that they wish to use in their investigations and that they control the rate of progress and the direction of the investigation.

The multiple channels of communication are meant to satisfy the varied information needs and seeking behaviours of the users. The channels have led to the emergence of multi-channel learning systems, where users can use their media of choice when and where it is most convenient for them. Anzalone (1995) has been reported by Mukhopadhyay and Parhar (2001) contending that multi-channel learning system is a pre-planned and organized mode, in which:

- Channels mutually reinforce each other to optimize learning
- Channels can be used as stand-alone sources to suit the learning styles and interests of a learner,
- Learner can configure his/her road map using various channels

The multi-channel learning system embraces the interactive multimedia paradigm of information delivery system. This has been supported by Mayer and Moreno (2002); they said that, it is better to present an explanation in words and pictures than in words alone. They said that the contiguity principle is that, it is better to present corresponding words and pictures simultaneously rather than separately when giving a multimedia explanation. It is through such multiple representation of information that multimedia paradigm proposes that IMM harnesses the ability to reach a level of sensory stimulation, arousal and involvement necessary for a conscious processing of information and effective delivery of information.
Furthermore, it can be reasoned that every media has its own special characteristic, and that using these media in combination may lead to some synergy of effects. It emphasizes on capacity to catch the user’s attention, allowing the user to have control in the process of access and retrieval and to some extent allow the user to manipulate data to verify and validate the information. The information system should therefore offer diversified channels of communication with interaction functionality.

Savery and Duffy (2006) asserts that understanding is in our interactions with the environment. Effective delivery of information and understanding of the same is in an individual’s information construction. The IMM information system interactivity allows manipulation of data where different effects can be understood and studied in different environments. The IMM engages the information seeker in meaningful dialogue. Damoense (2003) professes that the information seeker’s motivation is enhanced, active learning is promoted, collaborative effort takes place, higher order thinking and problem solving skills are developed and performance based outcomes are attained. It stimulates the information user to access and retrieve even the in-depth information which makes the user to recognise his/her purpose of being there in construction of information and knowledge rather than being passive consumer of the information. The IMM learning and information system reflects the complexity under which the information user should be able to function in real life. The IMM supports the student’s inquiry and performance in the practical medical courses like the surgery and laboratory technology. Phillips (1998) argues that the task of the lecturer is to provide material and guide the learner in ways that encourage him/her to synthesise their own knowledge and integrate it into enlarged cognitive structure in the process.

The IMM interactivity encourages testing ideas against alternative views and alternative contexts. In the interaction process the cognitive conflict or puzzlement over information constructed is the stimulus for learning and determines the organisation and nature of what is learned. This triggers the learner to seek the information’s viability and thus test the tasks pertaining to the information in the real world. The IMM simulations and animations
provide near life problem environment that tend to engage learners more since there is a larger context of familiarity with the problem.

The traditional information seeking and learning has been viewed as transfer of information from the source to the information user's memory. This is too simplistic and conceives the information user as a passive receiver of information. This kind of information system lacks elements critical to effective delivery of information and learning, such as interaction, feedback and ability to allow the user to pace his/her own learning. Accessing of information and acquiring of knowledge requires that information users personally integrate and make sense of new information while they apply it in their daily undertakings. Hence, effective delivery of information to the students requires that they struggle through multiple channels so as to understand how new information meshes with existing knowledge and how to integrate it into complex skills and abilities, and not, in this case, just remembering isolated medical facts and procedures. Effective and efficient information delivery system should involve information users as an integral part, where user is able to interact and effectively gain procedural knowledge. Procedural knowledge involves knowing how, that is, the ability to accomplish complex real-life tasks.
1.8 SCOPE AND LIMITATIONS

This study's subject concern was to investigate availability, access and the role of IMM in accessing technical medical procedure information and knowledge. The research looked at the factors that make possible or inhibit effective access to timely and relevant information by medical students at the Medical School, UoN. It was designed to identify the potential opportunities of IMM and its utilization in learning process. The subject of IMM in medical education is quite extensive, but due to time factor constraint the researcher chose to limit himself to the foresaid aspects. The research questions and the methodology used were designed to provide empirical data and generate information on availability, access and role of interactive multimedia at the medical school. Data was collected from 5th year undergraduate and postgraduate surgery students who had undergone laboratory and surgery
experiences in their training, and the librarians who provide information in support of academic programmes. Medical students at the University of Nairobi attend surgery classes at their fifth and final year of study. This was the reason for the choice of the population target that excluded Levels I - IV.

IMM can be used in delivery of all courses in health sciences but time factor and financial implications could not allow inclusion of the four schools of College of Health Sciences, UoN.

The study was limited to Medical School, UoN in Nairobi City. There are other medical schools (e.g. Moi University, Eldoret and Aga Khan University, Nairobi) but due to reasons that the researcher was a part time student in an open learning programme and was working in Medical Library, UoN, the location of study was considered very convenient in both his studies and employment. Logistically, the geographical distance (e.g. with Moi University) and time factor was prohibitive in terms of time and monetary cost involved in the movement.

The researcher was self-sponsored and therefore, financial resources were limited. Thus, he avoided any movement that could distract him from his employment that was his only source of financing his MLIS programme.

Another limitation of the study was the sample size. University of Nairobi medical school’s population is a small proportion of the entire medical fraternity in Kenya. Therefore the findings of this study could only be generalized in the study area and not the entire medical training institutions in the country.
CHAPTER TWO
LITERATURE REVIEW

2.1 INTRODUCTION

This chapter lays ground for the study. The researcher will review literature on pertinent issues related to IMM information systems. This will cover literature involving IMM resources availability, access and utilization.

As Gallini (2002) avers, technologies have created new categories of tools that offer the potential to extend dialogic processes beyond the classroom walls, engaging learners in interactions with global audiences and resources, and bring multiple perspectives from authentic databases and experts from the workplace in real time to the classroom setting. Oulton and Fisher (1995) also supposed that rapid advances in technology and telecommunications have enabled librarians to provide access to, and advice on, information which is well beyond the bounds of the library's own book stock.

Delivery of information on practical subjects in most medical schools is done through classroom lectures and procedure manuals. The researcher of this study considers this mode of delivery of information as ineffective and inefficient. This mode of delivery lacks the property of choice of channel and interactivity where the user is actively involved in constructing information and has control of the system, and can pace his/her own information access and learning. The researcher supposes that utility of information is in the user's understanding of the information. The understanding forms the knowledge base. The researcher suggests that to bridge this gap IMM should be formally introduced in learning medical information systems.

According to a study by Wallace and Mutooni (1997) the average grade performance of the student receiving multimedia instruction was higher than those limited to traditional classroom instruction. The students who received multimedia instructions indicated that they highly valued the ability to pace their learning and access course materials needed, and greatly appreciated the ability of the professors to focus on interaction and discussion with...
the students during class time. Thus, this interactivity can be presented by information material repackaged in IMM resources.

**Conventional Versus IMM Technology System**

Conventionally, information and knowledge is transferred to users linearly in the form of textbooks, speech or reports. This kind of information and knowledge delivery system is rigid and lacks the capacity to cater for diverse needs and capabilities of users’ information access and understanding. Information users should be given options in terms of access and presentation of information, the best way they can understand it. For information and learning system to be effective the users should be provided multi-channel information resources that satisfy users’ diverse requirements of access and presentation for enhanced understanding of the information communicated. Lack of IMM facilities hampers the follow-up of lectures, laboratory and surgery presentation after class hours. The conventional information system lacks user’s controlled and self-paced access of information. At this time of information age, this can be considered to be an ineffective and inefficient delivery of procedures and operations information in medical education. The IMM information system offers diverse information presentations, control of interaction and user’s self-pacing of access of information and learning.

This chapter reviews the IMM resources and the pertinent characteristics that should be considered for effective and efficient delivery of medical information. This is in pursuance of more enriched medical information systems and education. It will dwell on the following broad areas of the study’s objectives:

- Establish the availability and determine the IMM resources and channels of information in the Medical School.
- Extent of use of IMM resources in enhancing delivery of information.
- IMM technology in Delivery of Medical procedures information and knowledge.
- Potential Challenges and future of IMM in dissemination of medical information.
2.2 THEORETICAL FRAMEWORK: The Multi-Channel Theory of Communication

IMM is a communication tool. It was therefore, prudent to come up with a communication theory to base investigations concerning the effectiveness of IMM in delivery of information. Wilbur Schramm (1954) attests that the field of experience of the sender and receiver should be considered in effective communication. The user’s field of experience guided decoding. If there is no commonality in the senders and sender’s field of experience, then communication does not take place. It can be deduced that Schramm called for individualised user channel of information for effective delivery. The user should have a choice that serves his/her capacity to access and retrieve information.

Gibson (1966, 1979) argues that we do not hear, we listen, and we do not see, we look around. This means information users are actively exploring their environments. One of the major visions of multimedia, based on this argument, is that the user of IMM system should be facilitated to explore natural multimedia information in an active way and have choice in the diversity of channels depending on individual’s information seeking behaviour. The multi-channel communication theory supports the view that multimedia is a valuable tool for increasing learning, learning being understood as gain of information and knowledge. The theory contends that, as long as different forms of media are relevant to each other, delivery of information and knowledge will increase due to the reinforcing nature of multiple stimuli. The multi-channel communication theory advocates that multi-channel learning system must be deliberate, planned configuration to create the sync and synergize the power of various media to achieve optimal information and knowledge gain (Mukhopadhyay and Parhar, 2001). Its major effort is to reinforce one another, and also provide alternative information access and retrieval paths to the users according to his/her learning styles and channel preference.

The theory of multi-channel communication postulates that, humans have several channels by which information is communicated. The theory further avers that information presented via two or more channels has additional reinforcement, resulting in greater retention and improved learning. Timothy (2004), in his study concluded that learning is not uniform
among students population. They need information delivery that they can interact with and learn at their own pace, and that users have a sense of self-efficacy. The learner's believe that with effective interaction with information system they can greatly improve knowledge and skills necessary to execute complex tasks successfully. Hence, the IMM offer the opportunity of self direction and self-efficacy.

Every professional teacher and librarian's concern is the growth and improvement of their patron's information and knowledge access gains. However, they undoubtedly encounter either individual student or whole clientele whose information needs they cannot satisfy and hence, need to utilise media channels e.g. CDs, hypermedia, in-house databases of audio-visual material, et cetera, for enhanced delivery of information and knowledge. The multimedia information interactivity capacity has led to adoption of IMM and other instructional information delivery channels in the effort to meet users' needs and improved learning.

The theory of multi-channel communication is supported by Learning Styles theory where Smoke (1981) and Simmerman (1981) attests that educational media that utilises multiple methods of engaging the student in the learning activity has a greater potential for meeting the individual needs of each student. From the two theories it can be deduced that IMM channels of dissemination of information and knowledge can significantly improve college students' ability to apply knowledge.

In this study the IMM was seen as an independent variable that can be manipulated in different ways to produce the required response from the dependent variables; the students/information users and the librarian. The information users who were the surgery and laboratory medical students can be more motivated by IMM information mode. The inherent multi-channel functionality of IMM information delivery system is very convenient. It is personalized and the student can access information and gain knowledge at one's pace. The information user can manipulate the information and the simulated procedures to get the desired results.
Thus, the information user’s comprehension and retention is greatly enhanced by use of one’s choice of channel of delivery, where the user has certain control of the information system. Au (1995) in her study came to the conclusion that IMM can potentially reduce the gaps between the performances of students by using diverse channels of knowledge delivery mechanisms for students who perform relatively less well under traditional knowledge delivery paradigm.

2.3.1 FACTORS AFFECTING AVAILABILITY OF IMM RESOURCES

Using multimedia resources nowadays is much more affordable and available to all educational institutions, business and the home users. Most computers are assembled complete with multimedia facilities, especially the CD-ROM drive.

Browell (1996) avers that multimedia products and materials can be obtained in four different ways

- Purchase off-the-shelf products
- Enter into a joint arrangement with an external producer.
- Commission an external producer to create materials for exclusive use by your institution.
- Produce materials in-house.

Several organizations in the developed world produce off-the-shelf materials that can be incorporated into learning programmes. A number of well-known video producers, for instance, Video Arts of United Kingdom are now providing multimedia materials. Other companies have recently been established to provide multimedia learning resources. The Open Learning Foundation, dedicated to research and development in new teaching and learning methods has several multimedia programs available for use in higher education.

2.3.2 Prerequisite in Adoption of IMM Technology

The National Council for Education Technology, UK suggests a number of issues that should be considered and questions answered as prerequisite to using multimedia for the first time:
• Carefully identify curricular needs and priorities;
• Examine available materials;
• Calculate the cost of hardware, software, disks and other resources;
• Estimate costs in staff time for developing materials and staff development in use of materials;
• Will multimedia reinforce, replace, enhance or extend the teaching and learning process?
• Will students gain new skills, knowledge and/or experience from these materials?
• Does the multimedia material aid concept formation, reinforce skills and facilitate assessment?
• Does the new technology demand changes in current teaching and learning styles and what support will students need from lecturers/trainers?
• Are staff committed to the use of multimedia and determined to make it work?
• How can staff be motivated to take ownership of the multimedia initiative?

When the above concerns are put into consideration, the risks are reduced and success in using multimedia resources in teaching and learning, and delivery of information would be more effective and efficient.

2.3.3 Production of IMM Materials

Browell (1996) avers that production of IMM resources can be easy because software and hardware are readily available and affordable, allowing for the production of one's own multimedia resources.

Hardware and software requirement for multimedia computer laboratory resources include:

• Mid-level Personal computers (PCs) with server.
• Scanners
• Digital video camera
• Digital cameras
• CD-Recorders
• Digital audio-video development workstations
• Web authoring software
• Internet connection

The multimedia modules can be produced by the teaching /academic faculty and made available from a server accessible via computers at the medical libraries. To author a module the programmers need:

• A 200 MHZ-128RAM PC as minimum recommendation
• Scanner
• Zip drive
• Printer
• Digital camera
• Web server machine used on network segment with less than 30 percent network traffic for faster access and downloads.

These items are considered basic and should be readily available within departments of modern academic institutions.

There are sufficient differences between designing traditional instructional sessions and designing multimedia. However, individuals with training design experience and especially experienced in developing and producing open learning resources will be able to use their skills in multimedia production.

As the mission of education changes from teaching to learning, it is imperative that faculty academic members and the library personnel collaborate in ensuring multimedia teaching model implementation is successful. It is important for reference personnel (for example, lecturers, laboratory technologists, librarians and ICT personnel) to take an active role in designing teaching and learning facilities using IMM supportive technologies that add value and context to the learning and information experience.
Educational multimedia projects may incorporate interactive audio and audio from video disc or digital video clips stored on hard disk, or audio playback from a CD player controlled by a Macintosh computer.

Some presentations combine visual media on single computer screen, but many interactive video disc projects use two screens; one for the computer and separate video screen for a video disc player. All Macintosh computers come with a built in speaker, in multimedia presentations, this is often supplemented by large speakers for better sound quality.

Adobe Acrobat is used to create cross-platform portable document format (PDF) files. The advantage of using PDF file approach include the ability to scan figures and documents directly into PDF format and entire laboratory procedures can be viewed and printed in consolidated form. PDF files also have lower memory requirements as compared to other document formats for accomplishing the same tasks. Quick Time Pro can be used for editing the video clips and MS Word for general documentation.

2.3.4 Collaborations and Sharing of IMM Resources
Medical schools should collaborate with partners in health care and medical education to acquire high quality medical education prototype system. Through collaborations Purdue University has achieved significant results in IMM system that supports the medical education in the university. Collaborations and sharing make IMM resources available in variety of ways, for example, rare professional expertise can be repackaged for sharing with collaborating medical school partners.

2.3.5 Educational Medical School Consortium
The Purpose of a consortium is to encourage the collaborative and cooperative development, refinement, assessment and sharing of multimedia based educational materials using a common platform and authority systems. Such consortium in mind is the National Educational Medical School Consortium (NEMSC) in USA. Membership in the consortium is limited to the Liaison Committee on Medical Education (LCME) accredited medical schools with a demonstrated commitment to the development of computer based materials for use in the
undergraduate and/or graduate medical education. The charter members of NEMSC include the medical schools of Cornell, Dartmouth, Georgetown, John Hopkins, Harvard, Mt. Sinai, NYU, Rochester, Syracuse, University of Pennsylvania, Yale, and Jefferson

2.4 IMM SOURCES AND CHANNELS OF INFORMATION
There are a number of IMM sources, for example the Internet, databases, CD-ROM resources, et cetera, that provide diverse channels of communication and delivery of information. These sources and channels cater for the divergent and distinctive needs and behaviour in users accessing and retrieval of information and knowledge.

2.4.1 Internet
The Internet, also known as the “information superhighway enable user to communicate with other users, or seek out information from computers located in the four corners of the earth.

Some examples of types of information on and uses of the Internet are as follows:

Audio-Visuals
Audio-visuals provide information in form of pictures (motion and still), oral presentation, animations and simulations. Some information users prefer oral or visualised information presentation, or the combined, the audio-visual presentation. Thus, the multi-faceted presentations cater for almost every user’s access capability. Even the hearing and sight impaired information users can access the information

Electronic journals
Electronic journals provide topical articles of current research interest within a range of disciplines. They are intended to provide the same function as printed journals, i.e. dissemination of information of a primary nature. The advantage of the “e-journal” is that information is made available more quickly by electronic means.

Electronic texts
Text books (e-books) are also available on the Internet. However, most of the electronic books are accessed at subscription and restrictive in downloading due to copyright protection.
Electronic mail (e-mail)
The Internet allows the formation of geographically dispersed interest groups and communities. Once a medical information user is in touch with people who share vocation and professional interests, they can share knowledge and professional consultation is enabled.

Mailing lists
A mailing list is a single e-mail address that allows many people to receive the message. The address is connected to software that distributes a message to all subscribers on the mailing list. The mailing list may comprise of students with the same professional interests. Once subscribed to a list, a user will receive automatically all messages sent to the list. He/she may in turn distribute a message via the list.

Campus-wide Information Systems (CWIS)
Campus-wide Information Systems (CWIS) can be used by academic institutions to provide information to their students and staff, for instance, new arrivals of IMM projects to create awareness.

Library catalogues
Online Public Access Catalogues (OPACs) around the world can be accessed via the Internet. This is a valuable information resource for researchers in identifying relevant titles of IMM projects and where they are available for interlibrary loan purposes. However, vast collections of medical videos, clinical slides and laboratory images which hold enormous value for medical faculty and physicians remain a largely unused resource because the information is neither digitized nor catalogued and, as a result, not easily accessed or used.

2.4.2 Database
Database utilisation could be decentralized for online searching through telecommunication links. Databases provide various searching approaches from which users can access the information. For instance, keywords or fields requiring specific search information such as author’s name, book title, video clips name, etc. With such varied approaches information users can retrieve information from database without difficult.
2.4.3 IMM Modules

The IMM modules for technical medical procedures present students with better understanding of the upcoming procedures prior to entering the physical laboratory and surgery classes. Consequently, it facilitates spending more laboratory and theatre session time for hands-on knowledge gaining and interpreting the collected data. Course unit modules are normally specially designed to meet the teaching and delivery of certain topic or subject.

The IMM modules present students enrolled in laboratory sessions with overview of the requisite background knowledge, analytical tools, basic procedures, safety concerns and applicable equipment needed to conduct and evaluate each experiment prior to physical practical procedures. Such a resource provide a platform for incorporating digital images of the equipment to be used, video/audio presentations, demonstrating equipment, and use and techniques to be applied. It also present links to relevant background materials in addition to the pertinent material presented in the modules and an avenue for exchanging laboratory related information before and after the physical procedures are conducted. This has been implemented by the Louisiana State University and Southern University in USA. Laboratory and surgery procedures are captured and digitized for out of class usage. A large digital archive of IMM medical data that is relevant to medical education with particular focus on audio-visual can be created for future reviewing.

Cost-effective multimedia modules can be provided in CD format. However, Internet can still be used for dissemination of homework assignments, module revisions and interaction among students and instructors.

2.4.4 CD-ROMs

Azer, S.A (2004) finds multimedia playing a very significant role in harnessing understanding of information communicated. Azer in his research at the University of Melbourne, Faculty of Medicine assessed student learning before and after use of the multimedia CD-ROM and found that students who completed the test before using the multimedia CD-ROM performed better. The incorporation of multimedia CD-ROM into the
first year medical courses indicated great potential in improving student understanding of the main concepts in a variety of body systems.

2.5 EXTENT OF USE OF IMM IN ENHANCING INFORMATION DELIVERY

The researcher was interested to find out what constraints of the conventional learning and information system the IMM has been able to overcome. To do this the IMM resources must provide varied channels and mode of presentation, and influence change of learning and information environment. These should stimulate student learning, and retain their attention as well as meet the educational objectives of the course.

2.5.1 Student Preparation Prior to Practical Procedures

Rais-Rohani, et-al (1999) acknowledged that medical students acquire their practical experiences through the lecturers in the laboratory technology and surgery sessions with minimal prior knowledge of the experiments and procedures to be conducted and little or no understanding of the underlying concepts that govern the investigations and procedures. As a result:

- Laboratory time is used inefficiently;
- Motivated students lose interest; and
- Routine procedures are followed with minimal gain of knowledge.

A well conceived IMM learning and information delivery module would enhance the technical laboratory and surgery theatre experiences.

2.5.2 Extension of the Restrictive Information Resources

Gallini (2002) averred that technologies have created new categories of tools that offer the potential to extend dialogic processes beyond the classroom walls, engage learners in interactions with global audiences and resources, and bring multiple perspectives from authentic databases and experts from the workplace in real time to the classroom setting. Oulton and Fisher (1995) also supposed that rapid advances in technology and telecommunications have enabled librarians to provide access to, and advice on, information which is well beyond the bounds of the library’s own book stock.
Multimedia can increase the depth and breadth of education by utilisation of IMM, especially in specialized areas of the curriculum where access to professors and to the subject matter is limited by the logistics of faculty schedules, the availability of scarce and valuable teaching materials, or stretched class sizes for popular courses. For instance, most medical students do not have ready access to detailed information about diagnostic imaging techniques used in cardiology; these subjects are usually introduced late in a physician's education and are taught by busy clinical faculty members to small groups of residents in cardiology.

The multimedia teaching offers both faculty and medical students a means of repackaging this professional expertise, thus making it widely available to students as well as reducing the time faculty members are engaged answering queries from information and knowledge seekers.

2.5.3 IMM as Bridge in the Paradigm Shift

In the university education system lectures give about 10 percent of information and knowledge required for successful completion of academic program. The student is required to seek the rest from other supposedly available sources. Adalian et-al (1997) could not express it better than this: the ultimate answer is interactive multimedia which among other benefits will enhance delivery of information and knowledge and augment traditional teaching and instruction. He considered that medical profession is to do with human life and would require provision of extra resources to ensure that accurate and relevant information and knowledge is imparted to the students. With the focus from teaching to learning, and shift focus from classroom/instruction-centred to student/outcome-centred; the IMM is supplement as well as compliment to conventional leaning and information system.

2.5.4 Simulations

IMM is beneficial if one wants to use a lot of visual materials and/or create simulations. Schank, author and then director of the US government sponsored Institute of the Learning Sciences, stated that one of the major advantages of multimedia is that it can save time by offering realistic work situations in a condensed form of simulation. Simulation allows
learners, may they be students or employees, to “fail” in a safe environment and learn from their mistakes, and perfect in their real workplace.

2.5.5 IMM Competence

Adalian, et-al (1997) avers that student-centred electronic teaching, abbreviated as SET, can be designed as a combination of electronic classroom, information concourse, and IMM laboratory that provides an emphasis on student-centred learning and information competence. The SET is designed to foster collaborative learning among students and faculty members, both library and discipline-based faculty, while teaching specific techniques to help users increase their information competency abilities. It should be a unique environment that blends the use of multimedia learning tools, online resources, and current print sources. The users are taught these skills through a variety of learning experiences, including point-of-use and small collaborative groups, in a 'learn by doing' environment, small group seminars, drop-in clinics, course-related lectures, and credit-bearing courses with emphasis on collaborative learning across disciplines.

The SET encourage users to understand the structure of knowledge, the path to access and retrieve needed information, as well as how to formulate a search query, critically assess the quality of resources located, and ethically transform the information found into new knowledge.

The Cal Poly library provided a laboratory classroom setting for students where they can work to develop information competence skills, either on their own or within the confines of the information competence project courses. This is primarily geared towards combining three essential elements into one to provide:-

- An electronic classroom and information concourse plus multimedia laboratory;
- An environment to foster and promote collaborative learning; and
- The provision of a setting to blend information competence skills with computer literacy skills.

As defined by the System wide Work Group, the elements of information competence are to:

- State a research question or problem,
- Better more the information requirements for the topic,
• Locate and retrieve relevant information
• Organize information
• Synthesize information, and
• Communicate using a variety of information technologies.

Information competence related to computer competence includes the ability to:

• Use technological tools for accessing information
• Understand the ethical, legal, and socio-political issues surrounding information and technology"
• Use, evaluate, and treat critically the information that is received through the mass media, and
• Appreciate that the skills gained in information competence enable lifelong learning.

The information competence coupled with instructional approaches strives to build student confidence, incorporate active learning activities, and provide a conceptual approach to finding information.

2.6 IMM MEDICAL PROCEDURES INFORMATION AND KNOWLEDGE SYSTEMS

Kamlaskar, C. H. (2007) asserted that use of interactive computer simulations to impart complex educational content enables students to experience phenomena related to abstract scientific concepts and principle. This allows students to explore change in the simulated model before making changes in real world situations. Virtual and simulated training has increasingly become integral to many educational programmes. Medicine, especially surgery, has adapted the technology used in virtual flight simulators to create virtual models that allow a trainee surgeon to get a feel of endoscopic surgery (Lomanto, D., 2007).

Listed below are examples of animations, simulations in medical procedures web addresses

- Robotic surgery utilising the Da Vinci® system has gained popularity worldwide and promises significant benefits for patients especially in such fields as cardiovascular surgery and urology.

  http://www.intuitivesurgical.com/index.aspx)
• Childbirth – Normal Virginal Delivery
  http://www.doereport.com/generalexhibit.php?
• Heart and Lung Surgery videos
  http://www.cts.usc.edu/videos.html
• Image Gallery – Animations
  http://www.splweb.bwh.harvard.edu:8000/images_movies.html
• AIM (Animations, Interaction, Multimedia) your projects with Flash multimedia
  http://www.eduscops.com/flash/multimedia.htm
• Mitral Valve Repair using the Da Vinci® Surgical system video
  http://www.cts.usc.edu/videos-mpeg-roboticmitralvalve-patients.html

These kind of IMM resources work on depth perception on a two dimensional visual display and enhance hand-eye coordination. The simulators endeavour to take a trainee surgeon through an operation step-by-step, allowing him to familiarise himself with anatomical planes and tissues.

Today, medical training programmes are different from the past where didactic lectures were the main mode of instruction. Now, a modern, integrated medical training programme involves dry laboratory and live-tissues training, as well as practising on surgical simulator and discussing surgical videos.

2.7 POTENTIAL CHALLENGES OF IMM INFORMATION SYSTEM

In expressing how important the multimedia is an educational resource with astonishing potential, Rais-Rohani, et-al (1999) acknowledged that implementing the technological advances pose serious challenges.

2.7.1 Funding

Funding is such a big issue in IMM adoption. Internal funding may not be adequate and this calls for external solicited funding and joint venture. This factor will be dealt with later in chapter five.
Labour Intensive Expertise in Modules Design

The expertise required depends on the characteristics required in the final program. Where original video footage is included a director is required. Graphic and text requires a skilled author. To create high quality programs, seven roles require to be performed, even though individuals may perform more than one role:

i. Project manager or producer to coordinate the project and other teams. The manager is responsible for contracts, budgets, ensuring objectives of the project are met and quality upheld.

ii. Director to manage production, editing and post-production of video, audio and graphic material.

iii. Subject matter expert who provides expertise regarding the content and ensures accuracy and appropriateness for the audience.

iv. Author who uses an authoring system to incorporate all the elements of the production - video, audio, text, etc.

v. Programmer who is involved in more complex special functions and systems that cannot be accommodated by the authoring system or author.

vi. Technical specialists who identifies, selects and integrates hardware and software in order to produce the programme.

vii. Instructional designer who provides instructional expertise in designing and developing programs using adult learning theories, instructional design and evaluation models.

The IMM assisted learning materials are initially much more labour intensive and time consuming to prepare than most face to face courses, and they often require input from fairly senior members of staff. However, once the basic format is agreed and the initial materials have been written, the materials can be maintained and updated relatively easily and by more junior members. It is worthy noting at this point that off the shelf templates that allow novice to produce materials of professional quality are increasingly available.
2.7.3 Information and Computer Competence

As defined by the System wide Work Group, the elements of information competence are to:

- State a research question or problem,
- Better more the information requirements for the topic,
- Locate and retrieve relevant information
- Organize information
- Synthesize information, and
- Communicate using a variety of information technologies.

Information competence related to computer competence includes the ability to:

- Use technological tools for accessing information
- Understand the ethical, legal, and socio-political issues surrounding information and technology
- Use, evaluate, and treat critically the information that is received through the mass media, and
- Appreciate that the skills gained in information competence enable lifelong learning.

2.7.4 Maintenance of University Culture

The IMM application project should conform to the university culture and standards. In the absence of tailor-made IMM projects a medical school would depend on internet resources. It becomes quite challenging to maintain institutional culture in the untidy, commercial, and laissez-faire culture of web based publishing and protect the student from the distractions of the internet.

2.8 THE GAP IN THE LITERATURE

The IMM technology integration in university medical schools academic curriculum, information and knowledge systems in the western world have been reviewed in books and research papers. However, the African context is missing in the reviewed literature. The question arises whether technological multi-channel communication channels have been incorporated in the education and information systems in Africa, and to what extent. Could the IMM technology integration into these systems in the western world be the
reason why the locals have been viewing the western education to be more superior? This study has tended to fill this literature gap. However, the issues raised herein could form the basis of further research.
CHAPTER THREE
RESEARCH METHODOLOGY

3.1 INTRODUCTION
A research methodology is a strategy of inquiry which moves from the underlying philosophical assumptions to research design and data collection. The choice of research method was influenced by the way the researcher intended to collect data and put to consideration its analytical presentation.

3.2.1 Research Design
The research took a case study approach where qualitative and quantitative methods were used in collecting data from respondents. It is a case study of Medical School of University of Nairobi. The research respondents were drawn from the Level V medical student information users who have experience in surgery and laboratory technology procedures and the Medical Library staff who have the onus of managing and providing information resources. The research investigated the availability, access and role of IMM resources in enhancing delivery of medical information and knowledge to student users. The tools of investigation used were questionnaires for student information users and librarians (Appendix B and C respectively), interview schedule (Appendix D) and observation guide (Appendix E). The researcher argues that the inherent properties of IMM harness delivery of medical information. Hence, the IMM information delivery system is more effective and efficient than the conventional medical information system. The research has brought to light the reasons why IMM concept should be adopted in medical information systems. The research has highlighted the levels of adoption and the issues that are involved in adoption of the IMM resources in the medical school.

3.2.2 Variables
The independent variables are the IMM resources, the user, understanding of information provided and the information and knowledge acquired therein (Figure 1). The dependent variables considered therein are level of automation, Students IMM literacy, library staff
IMM literacy, ICT and IMM policies, and finance. The independent variables are the focus of this study.

3.3 Area of Study

The study was conducted in Nairobi province at the Medical School of University of Nairobi. It is one of the four schools under the university’s College of Health Sciences (CHS). The Medical School is located at the precincts of Kenyatta National Hospital, Upper Hill in Nairobi City. The college utilizes the hospital as its teaching hospital. College of Health Sciences (CHS) is one of the major training institutions of health professionals in the East and Central African region. The history of the college can be traced from 3rd July 1967 when the Medical School (by then, Faculty of Medicine) was created. The college trains healthcare personnel in various disciplines; medicine, pharmacy, dentistry, nursing sciences and medical microbiology.

The college collaborates with other medical research-oriented institutions in various research areas. It also trains medical personnel at post-graduate level in various disciplines. It focuses on production of high-quality healthcare personnel at postgraduate level in internal medicine, surgery, radiology, pathology, anaesthesia, obstetrics-gynaecology, paediatrics and nursing studies.

The location was selected because it teaches medical courses and due to its convenience to the researcher. The researcher is a librarian in the Medical Library of the school. He has experienced and understood the information delivery system of the school and its challenges. This study was geared towards understanding the intricacies of the challenges in availability, access and use of IMM and offer recommendations to improve the learning, information and knowledge system of the school. By solving the problem the researcher would attain his job satisfaction. The location was convenience in terms of distance and cost.
3.4.1 Target Population
The research took the form of case study approach where combinations of quantitative and qualitative methods were used in collecting data from respondents. The study is a case study of the medical school, UoN and involved Level V undergraduate students (343) and postgraduates (35) in surgery students who have undergone laboratory and surgery procedure courses experience and the Medical Library staff (9) who provide information services making a total of 387 persons in target population.

3.4.2 Population Sample
Mugenda and Mugenda (1999) referred population as an entire group of individuals, events or objectives having a common observable characteristic. The researcher defined the population sample from which data was derived. The population sample was defined in terms of content, extent and time. The undergraduate students do their surgery classes in Level V, hence their selection together with postgraduates in surgery class. Data collection was given three weeks time frame. The researcher administered the data collection tools (Appendixes B-E) to the respondents. Interview schedule and observation guide (Appendix D and E respectively) were used as follow-up to the questionnaires. The researcher aimed to get at least 50 respondents in all. He administered 65 questionnaires to students and 5 questionnaires to librarians making a total 70 respondents as the population sample.

This made 18 percent of the target population of 387 (343 level 5 undergraduates and 35 postgraduate surgery students who have experience in physical procedures of laboratory and surgery classes, and 9 library staff members).

3.5 Sampling Methods – Homogeneity or Heterogeneity
Simple random sampling was used to draw conclusions. Each an every person in the population had an equal chance of inclusion in the sample. The 65 student questionnaires were administered to students who visited the library. The researcher would courteously ask the students which level they were and if they met the selection criteria would asked if they would spare a bit of their time to fill the questionnaire either assisted by the researcher or on their own and hand the questionnaire to the researcher. There were 5
questionnaires administered to librarians. This covered the whole number of library staff eligible to answer the questionnaires. Out of 9 staff members, the researcher included, 3 of them had been involved in the pre-testing exercise and so they could not be eligible.

3.6 Primary or Secondary Data

Primary data was collected by direct observation, interviews and questionnaires. This accorded the researcher first-hand information about the availability, utility, perceived value in delivery and understanding of the interactive multimedia information. The researcher also sought for secondary data from documented records and literature from books and journals both hardcopies and online.

3.7.1 Survey Data Collecting Technique

Questionnaire is commonplace instrument for collecting data beyond the physical reach of the researcher, that is, from a large or diverse sample of study population. The researcher designed the questions in the questionnaire to address specific objectives of the study. It was an impersonal instrument for collecting data and therefore, the questionnaires tried to be as clear as possible, worded as simply as possible. This was aimed at avoiding confusion or ambiguity since the researcher in most cases was not present to explain what was required by each particular question. The questions were put in brief and sequentially in a logical order to enable the respondents find their way around with ease and this enhanced their response. Most of the respondents left no question unanswered which was quite impressive.

3.7.2 Data Collection Instruments

The study used a combination of data collection instruments to enhance the substance of information gathered. It used the questionnaires (Appendix B and C), interview schedule (Appendix D) and observation guide (Appendix E) to collect data. The interview schedule and observation guide were complementary to questionnaires. These tools helped to elicit information that could not have been captured by the questionnaires.

Documentary sources were also used to gather information and knowledge on the utilization of interactive multimedia for accessing information and knowledge in the learning process
in physical procedures in medical courses at the University of Nairobi. These data collection instruments were directed at provision of precise and sufficient data relevant to the objectives of the study.

3.7.3 Interview Technique
The interview was an oral administration of research questions using an interview schedule (Appendix D). The researcher sought face-to-face encounter with the respondents. The researcher embraced the interview technique because of its inherent enhancement of understanding of responses and was seen to have a larger number of potential advantages over other survey data collection tools. The interviews could provide in-depth data that was not possible to get using a questionnaire and allowed follow-up on new issues arising in the other tools. Interviews are usually flexible and the researcher could adapt to the situation and deduce as much information as possible. Interviews yielded higher response rate since no question was left unanswered. The administering of interviews either in form of interview schedule or the questionnaire itself gave instant response while some questionnaires were never returned. The dialogue between the interviewer and the respondent allowed the interaction to move in new and, in some incidences unexpected directions, thus, adding both depth and breadth of researcher's understanding of the issues involved, for instance, that even though the researcher sought to know whether there were charges at service points, it was learnt that there were charges levied on school fees.

3.7.4 Observation Technique
This methodology involved watching and recording behaviours and other aspects within library of Medical School. The researcher was privileged to interact with the respondents in the Medical Library computer laboratories where he was able to systematically record the observable phenomena in the natural setting. The researcher utilized an observation guide (Appendix E) to collect data. The observation technique had reality-verifying characteristics that enabled the researcher to compare what subjects may portend to have or believe, with what is available on the ground when observed in practice. The observation methodology had present orientation, hence, high currency and relevance of information gathered due to
caption of events in their real context. This enhanced the accuracy of the study. The observation situations were unbiased and as such reliable source of data for this study. By use of observation guide the researcher sought to examine availability of interactive multimedia in the library which is the main point of IMM services and their use in the learning process.

3.8 Data Analysis and Interpretation

Qualitative analysis is quite involving work. Before the analysis began in earnest, considerable preparatory work was carried out:

Data editing – All data collecting activities were monitored to ensure adherence to the data collection protocol and prompt actions to minimize and resolve missing and questionable data, for instance, suggested answers outside the options given by the research could be ignored at that level not to disrupt the coding of responses. Such responses were catered for if they were found to be pertinent to the study. They could be recorded as an observation. However, editing data was still done both before and after the data was computerized. Before the forms were keyed, the forms were reviewed to spot irregularities and problems that escaped notice of correction during monitoring.

Data cleaning – once the data were computerized and verified by sight-verified manually they were subjected to a series of manual checks to “clean” them. This was done by range checks. Range checks compared each data item to the set of usual and permissible values for variable. Range checks were used to:

- Detect and correct invalid values
- Note and investigate unusual values

Data coding – This means translating information into values suitable for the computer analysis programme. The objective was to create variables from information, with an eye towards their analysis. The coding decision was guided by the following questions:

1. What information exists?
2. What information is relevant?

3. How is it likely to be analysed?

After completion of the preparatory work the analysis and interpretation of data began in earnest. The analysis and interpretation of the data was directly related to the study objectives and research questions. The analysis began with descriptive analyses, so as to explore and gain a “feel” for the data. The research analyst then turned to address specific questions from the study aims and objectives, from findings and information reported in the literature, and from patterns suggested by the descriptive analyses.

The research engaged the concept of triangulation by involving the various stakeholders (e.g. teaching staff, librarians and peer researchers) in interpretation of the data at different time and locations. This was guided by direction pointed by the interview respondents and responses elicited by open questions from the questionnaires.

Discourse analysis as a result of interviews - This is in the spirit of constructivism paradigm which upholds the understanding that all knowledge and therefore meaningful reality as such, is a contingent upon human practices, being constructed in and out of interaction been the human beings (researcher and respondent) and their world, and developed and analysed within an essentially social context. Despite the research using a computer package, Statistical Programme for Social Sciences (SPSS) it also made use of the manual data analysis to some extent.

3.9 Ethical Issues

Individual permissions were sought from the institution, librarians and student library users that participated in the study. The principle of voluntary participation was strictly adhered to. The respondents were not coerced into participating in the research.

The respondents participated with informed consent. They were informed of the purpose of the research; the academic purpose and the likelihood of the study becoming reference
document to Medical School in their effort to improve the IMM learning and information delivery system.

Protection of the research participants was assured. The researcher guaranteed the participants confidentiality. The questionnaires did not require the participants to identify themselves and any identification information derived from the interaction between the researcher and the respondents was not to be made available to any one who was not directly involved in the study. The participants have been made to remain anonymous throughout the study. This enforces the assured privacy protection.

Intellectual honesty was highly respected in this study. Plagiarism was avoided in the research. The study is the researcher’s own academic work. The researcher did not hire someone else to write the research, or purchased it from a commercial source or from the internet. References made were acknowledged in the study body and list of the bibliography in respect of the same given in the reference section. Thus, philosophy of intellectual honesty highly respected.

3.10.1 Research Quality Control
Quality Control in research ensures the highest possible level of data integrity plus findings that are totally relevant to the project objections and that are actionable. Quality assurance measures were applied throughout the research – from preparation to analysis phase as explained below.

3.10.2 Reliability
Joppe (2000) defines reliability as the extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable.

University of Nairobi medical school is arguably the most established public institution of its kind in the country and in the region. Thus, it is the most suitable representative of
medical fraternity in the region and to a large extent the findings of this study can be
generalised as a view of the region.

The well thought and phrased investigative questions and researcher's prompt response to
the pre-testing helped to elicit reliable information and accrued quality completed research
project. The collection of data from varied respondents and use different data collecting
tools endeavoured to solidify consistency and validity of the research findings.

3.10.3 Validity

Validity is a contingent construct, inescapably grounded in the processes and intentions of
particular research methodologies and projects (Winter, 2000, p.1). It is some kind of
qualifying check or measure for a research to obtain the required data.

The concern of this research was to investigate the complex nature of IMM phenomena vis-
à-vis availability, access and use in enhancing medical information delivery. Multiple
perspectives were deployed in order to adequately reflect the richness of these
complexities. The researcher in this study employed varied data collecting instruments
(questionnaires, interview schedules and observation guide) and gathered data from varied
sources of stake holders in the medical information delivery system, that is, the students
and librarians, and sometimes sought explanations from department members and peer
researchers for better understanding of issues arising therein. The researcher read widely on
the role of multimedia in general to have insight of the arising issues. This was meant to
ensure that the researcher gathers the intended information.

The strategies for ensuring reliability and validity were built into this duo (qualitative and
quantitative) research process per se. Together with the strategies discussed above, others
included the investigator's responsiveness, methodological coherence, theoretical sampling
and sampling adequacy, active analytic stance, and saturation where data is collected until
there were no new insights. The use of these strategies appropriately ensured that the
researcher could correct both the direction of the analysis and development of the study as
necessary.
3.10.4 Pre-testing Instruments

Having formulated questionnaires, the researcher had a big question unto himself: “Will this data collecting instruments work the way I have intended?” This important question was the basis of pre-testing. 10 students and 3 library members of staff participated in the pre-testing exercise. This helped the researcher to detect any defects in his data collecting instruments. The pre-testing questionnaires were given to a small sample of the respondents. This gave an indication of how well the questionnaires would work, whether there were areas of confusion and if the instruments could be made to read better. Thus, the pre-testing instruments were reformatted and made the final version of the researcher’s instruments. This was because the researcher expected to be guided by the direction the pre-testing indicated.

The researcher ensured that the questionnaires were respondent friendly. At the stage of pre-testing, the researcher gathered as much insight as possible: the flow of the questions, whether the instruments were difficult to complete and whether they were difficult to complete and whether they were boring. The researcher could directly ask respondents about their interpretation of specific questions. This was in the understanding that respondents may read what the researcher wrote quite differently from what he intended.

The practice in the foregoing discussion was also geared towards ensuring reliability and validity of the completed project.

3.10.5 Strictness of Data Collecting Instruments

The questions were pre-tested to ensure that they were answered as required so as to avoid ambiguity. The instruments were designed with the aim to contain the respondent to the context of the research. However, at the pre-testing stage the researcher put to consideration that even though his participants were the experts in understanding his questions he was the ultimate authority. Hence, some suggestions from the participants that were impractical and ran contrary to the rules of sound methodology were not incorporated in the final instruments.
3.10.6 Triangulation

As explained earlier in the research design, the researcher employed triangulation by engaging multiple methods, such as, observation, interviews, survey and literature recordings that led to more valid, reliable and diverse construction of realities. Triangulation methodology was employed to strengthen the study by combining research methods. Golafshani (2003) affirms that triangulation is a validity procedure where researchers search for convergence among multiple and different sources of information to form themes or categories in a study.

3.11 Limitations

It was a problem to get the student respondents who were to fill the questionnaires due to their busy schedule between classes and hospital ward rounds. At the same period when data was being collected there was a two week vacation for the undergraduates who were part of participants. The researcher had no knowledge of the vacation. Hence, the data collection that was scheduled to complete within four weeks had to extend to seven weeks.

Even though the postgraduate students were available in the school throughout the data while others went for vacation, they proved the most busy and hard to get. However, this was expected since the researcher had prior experience of the situation during the pre-testing of questionnaire. The researcher would approach them in the library and the respondents were not available and ready he would book ask for appointment with them at their convenient time and place, either in the library or their hospital ward offices. This was necessary so as to administer the questionnaire orally to save time for both the researcher and respondents, and to ensure the study elicited the required information. Some respondents were allowed to fill in the questionnaire to their convenient.

The Purposive sampling of the respondents and inherent limited scope of case study restricts generalizability of findings. The study will not be generalizable to all university medical schools. The findings were limited to University of Nairobi.
3.12 Delimitations

The researcher narrowed the scope of the study to the experiences in Medical School, UoN, excluding other medical schools, for example, Moi and Aga Khan Universities in Kenya. This was not possible due to financial and other logistic constraints such as distance involved.

The other delimitation was the subject in relation to IMM delivery system in question. Surgery is one of the most technical procedures in medicine and hence, only the Level V and postgraduate surgery class qualified to participate.

The researcher also narrowed the subject to the provision of IMM end products and their delivery and thus, did not dwell in details of technical aspect of production of IMM information products.
CHAPTER FOUR
PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Introduction
This chapter presents and discusses findings derived through the use of questionnaires, interviews, direct observations and literature surveys. It discusses the analysis with regard to the stated research objectives and questions. It synchronises the view of the research problem and the literature reviewed with findings and their explanations. The data collected using the structured questions in the questionnaire were analysed using the SPSS, presented by use of tables of simple frequencies and percentages, and graphs. Thus, the tables and figures represent data collected from the field by use of questionnaires. Open questions will be manually analysed where need arises.

4.2 Background Information
There is a wide interest in use of IMM resources that are found in the World Wide Web. The Medical School, CHS of University of Nairobi has made concerted effort to promote access of interactive multimedia resources. The medical school has established computer laboratories in its various faculties and the main library for wider access. Most of the IMM information accessed is internet based. The school has 97 personal computers (PCs) out of which 35 are in Medical Library computer laboratories. This information was availed courtesy of the college’s Information Communication Technology (ICT) department which has the onus of installing and offering technical maintenance of computers and their network infrastructures.

The other 62 computers are located in computer laboratories of the schools of Dentistry, Nursing, Pharmacy, UNITID and, Departments of Community Health and Microbiology. The computers are fully installed with multimedia facilities e.g. DVD drive and the necessary software. For audio, the computers have in-built or detachable speakers and headphones to cater for both group and individual users respectively.

The university through its ICT department has made tremendous effort to lay down the required infrastructure to facilitate computer networks. The university provides both wired
and wireless networks. The medical college encourages its community to acquire computers for increased and wider information and knowledge access. This is evidenced by the free configuration and internet connection the ICT department provide to student as well as staff members. Through the Association of medical Students of University of Nairobi (AMSUN) an Internet connection router (WRT54G Linksys) is installed in the library to allow wireless Internet service within a radius of 400 metres from the library. This covers the whole college. The students can access internet-based interactive multimedia resources in their halls of residence as well as in the comfort of their vehicles’ at the parking bay.

4.3 Response Rate
The researcher personally administered 75 questionnaires to the respondents of the study. The questionnaires were collected with the help of library staff. The 75 respondents were as follows: 70 medical students and 5 library staff members. The 5 questionnaires for library staff were all collected. However, due to the tight schedule and time demanding of the medical course only 50 student questionnaires were returned. Hence, the questionnaires collected added up to 55, a response rate of 73.3 percent.

The data collected from the two categories of respondents was analysed separately since one by the staff was to augment the one by students. The questionnaire by library staff was meant to elicit information that could not be in students’ domain and at the same time shed more light on some issues in student questionnaire.

4.4 Students Response
The student responses were analysed and presented according to the various aspects of the problem that the study sought to investigate. The ultimate aim of the various questions is to give indication of the availability, access and utilisation of IMM in helping to enhance delivery of the more practical medical courses information. The questions provide information for the following objectives:-

- Establish the availability of IMM resources for medical student users.
- Determine the IMM sources and channels of information that are currently used by the medical school.
- Establish the extent of use of IMM resources in enhancing delivery of information in the medical school.
- Identify areas where IMM technology can be used to gain medical procedure information and knowledge.
- Identify the potential challenges and future of IMM in dissemination of medical information.

4.4.1 Availability of IMM Resources

The researcher investigated availability of various IMM oriented information formats. The findings in percentages are presented in bar graph, Figure 2 below.

**Figure 2: Availability of IMM Resources**

![Bar graph showing availability of IMM resources](image)

Source: The Researcher

Among the various formats available internet took 26 percent of usage by student users. However, the research shows that the usage rate of the various formats were very close. This shows that the student user population understand their IMM resources. The textual format took 22 percent, visual 14 percent, discussions 14 percent, audio 12 percent, artefact 11 percent, animations 3 percent, simulation 2 percent and 2 percent video conferencing. Looking at the fairly shared percentages the various formats of information presentations are used except for the animations, simulations and video conferencing. This satisfies the theory of multi-channel communication where multi-channel presentations are said to involve the various human senses and as such harnesses understanding of the information receiver.
Animation, simulation and video conferencing presence accrued only 2-3 percent each. Thus, they were found to be rarely accessed and can be termed as unavailable and not accessed. It was observed that most of the simulations and animations require subscription at a fee as witnessed by the researcher trying to access them. Brief review of video clips are demonstrated and user given instructions on how to purchase the video. These website databases are not listed in university subscriptions. However, it was observed that even the subscriptions have not been sufficiently exploited. Negligible number of undergraduates could be seen using the subscribed sites. They could be seen doing Google searches whose information is not necessarily authentic. This could be due to lack of awareness of subscriptions availability. However postgraduates were observed to be accessing the subscribed website. Animations and simulations are rarely accessed. However, they are available in the internet. This may be due the subscription requirement on some. Those that are free prove cumbersome to access because of the time it takes to download on the screen. For example it took the researcher about two hours to open a Nasogastric intubations video clip available as NEJMvcm050183.wmv at nejm.org. This is an experience that rarely a student would want to undergo. Time is restrictive. It was observed that the internet bandwidth is small for heavy traffic of usage in the medical school and the university as a whole.

Their reported unavailability by the student respondents can be related to inadequate IMM competency with students as well as the staff as it has been reported later in study. It found from both the students and the library staff that the IMM literacy was inadequate. The access and retrieval simulations and animation requires a bite of higher searching skills than the textual information. It also sometimes requires the computer be installed with some special software that could be downloaded from internet e.g. higher version QuickTime for Windows. Time factor becomes prohibitive to the user.

Student discussions are highly appreciated by the medical students and are catered for by the library. They can be held in the study rooms and at the couch seats provided in the library as observed on the ground. Preference for study rooms are given to postgraduate students. The
discussions supplement information accessed in other forms of presentations. Discussions tend to seek wider understanding of the topic at hand.

The medical school was also reported in the study that there was use of artefacts. Artefacts are used as dummies of patients in medical classes. The artefacts are found in the school’s medical museum and laboratories. They are used by lecturers in demonstrating medical procedures in their teaching. The multi-channel learning system embraces the interactive multimedia paradigm of information delivery system. This has been supported by Mayer and Moreno (2002); they said that it is better to present an explanation in words and pictures than in words alone.

From the very close small percentages of use of various IMM formats, it can be deduced that the medical students are widely interacting with diverse information communication channels in search of knowledge to satisfy their learning needs. This proves Mayer and Moreno (2002) where they asserted that it is better to present an explanation in words and pictures than in words alone. The findings show users depending on variety of information delivery channels as evidenced by the fairly distributed percentages among various formats. This signifies the importance they attach in utilization of multi-channels of information delivery to achieve multi-faceted perspective of information in question. Ellis (2004) averred that multi-presentation of information is the main concept of IMM in tapping its potential of information delivery and thus, conforming to the theory of multi-channel communication. According to this theory, humans have several channels by which data is communicated. When information is presented via two or more of these channels, there will be additional reinforcement, resulting in greater retention and improved learning. Tan, et-al (2000) asserts that multi-presentation proves the theory of multi-channel communication. Smoke (1981) and Simmerman (1981) also attested that multiple methods of engaging students in the learning activity have a greater potential for meeting the individual needs of each student.

The internet can be said to enjoy high access percentage due to its diversified information presentation. It offers flexibility of delivery and high levels of learner control and access to
vast stores of information. It can avail information in form of textual, images, audio-visual and even offer forum for student discussion by use of electronic mail and mailing list. The 22 percent of textual format as shown in Figure 2 could account for CD-database articles, lecture note presentations in softcopies, etc. CD-ROM resources are said to be cost-effective multimedia and affordable for student use (Rais-Rohani, et-al, 1999). Some of these CDs come with purchased hard copy books but most of them are donations by stakeholders in health circles. The teaching departments have also contributed to the CDs collection whenever they find one that is relevant to the school’s curriculum.

The study observed that University of Nairobi medical library is specially equipped with PC workstation dedicated to digital multimedia production capacity. Users can import and export audio and video, PowerPoint, and other types of multimedia files, and CD-write them to DVD or CD. Technical assistance is offered at the Computer laboratory staff desk. However, the lecture and printed word remains the most utilised mode of teaching and learning in the medical school. This trend can be associated to lack of tailor-made IMM information and learning programmes as evidenced by both students and librarian respondents when they were asked whether the school had its own produced IMM projects.

As Gallini (2002) avers, technologies have created new categories of tools that offer the potential to extend dialogic processes beyond the classroom walls, engaging learners in interactions with global audiences and resources, and bring multiple perspectives from authentic databases and experts from the workplace in real time to the classroom setting. A follow-up interview librarians and students elicited information that students requested the medical library computer laboratory services extend working hours up to 10.00 pm. The laboratories are currently open up to 10.00 pm. This has been happening for the last two years. Before then it used to run from 8.00 am to 4.00 pm like the teaching departments. The computer laboratory is also open on Saturdays from 8.00 am to 5.00pm and 8.00am to 12noon when the college is on recess. This encourages self-paced access of information and knowledge outside classroom.
The 8.00 am - 4.00 pm computer laboratory session is run by library staff who have the responsibility to assist the student users in access and retrieval of IMM information in question and maintaining the computers in working order. Both the library staff and the student respondents cited inadequate IMM use competency as a hindrance to adoption in the technology. This meant that availability, access and use of the IMM resources were also affected by staff and student users' working literacy level. The user education to students is inadequate. Even the library staff contend that they are not adequately trained in IMM service delivery. The knowledge management in IMM information service is not well coordinated both in the library and the college as a whole. This has hampered the embracing of the IMM technology to a big extent. This has been noted through observation that it's very rare that teaching staff are seen interacting with the available IMM facilities. Gallini et-al (2002) asserts that among other factors, successful implementation relies largely on lecturers or instructors flexibility to make appropriate shifts in their established and preferred classroom practices to practices that use the capabilities of the technologies to accomplish new and meaningful instructional objectives. Sensitisation seminars and workshops should be organised and encourage them to embrace the technology.

4.4.2 Availability of IMM for Practical Courses

The students were asked if the medical school had its own produced IMM project for delivering practical courses. 100 percent of the respondents affirmed that the resources were not available. When asked if there was a designated IMM department, the response was negative. This explained why there were no school's own produced IMM projects for its curriculum. It is such a department that could coordinate acquisition of IMM resources. This has been affirmed by respondents later in the study. This explains why animations and simulations which can be said to be more crucial in the medical courses are least available in the learning and information system in the school. Mack (2001) and Ellis (2004) attested to the enormous value animations and simulations hold for medical faculty and physicians despite that they remain largely unused resources.
4.4.3 Availability of IMM Resources Outside Medical School

When the respondents were asked whether they use the IMM resources outside their medical school, the response was undivided in favour of affirmative answer. There was 100 percent in favour of availability. This indicates that IMM resources are readily available for use and that there is high demand for them by students, hence using the resources even outside their school. The students heavily use internet as has been earlier indicated by the investigations. This is where most of resources accessed outside the medical school emanate. This is an indication of high demand of IMM resources by the respondents to supplement the practical lessons in the school. As Browell (1996) said IMM resources are readily available on shop shelves it was observed that students do have their personal resources. Schulz and Dahale (1999) likens these specially designed resources to a well-conceived laboratory manuals that are designed to provide students in technical laboratory sessions with an overview of the requisite background knowledge, analytical tools, basic procedures, safety concerns and applicable equipment needed to conduct and evaluate each experiment prior to entering the physical laboratory. The demand for the IMM resources is a call to the university to take keen interest in provision of the resources and save its repute of quality in the field of medicine.

It can be deduced that although students' education occurs through face-to-face with the professors, the fact is that all learning begins with presentation of information and knowledge of real-world scenario. This is why medical practical procedures have tended to experiment with animals before shifting to human beings. If this is the case, then, learning starts with information presentation and as such students need multi-channel presentation delivery system. Tan, et-al (2000) averred that the search for information and knowledge emphasize real world challenges, high order thinking skills, independent learning, information and knowledge management and collaborative skills. Hence, the respondents search and use of IMM resources even outside their medical school.

4.4.4 Frequency of Use of IMM

The study found that 40 percent of the respondents make 1-4 visits to computer laboratories in the Medical Library for IMM use, 28 percent for 5-8 and More than 12 times ranges each,
and 4 percent for 9-12 times range. The distribution can be said to be moderate. However, the high percentage in 1-4 visits can be attributed to the fact that there are inadequate computers in relation to student numbers and so user would try to avoid the problem of securing a computer in the library. The 28 percent of the more than 12 times per week can be said to be those who have identified the resources and therefore make more effort and time to use the IMM resources. The researcher observed and appreciated how the medical students are busy between classes, library and hospital ward sessions. This is one of the reasons why IMM resources should be provided good numbers and quality to afford the students self-paced learning when the student have free time between their tight schedules. However, those who make use of these resources more than 5 times per week are 60 percent which is indicative of a good number of students' appreciation of the capability of the resources in delivery of medical information and knowledge

**Figure 3:** Frequency of Use of IMM per Week

![Frequency of Use of IMM per Week](image)

Source: The researcher

### 4.4.5 Preferred Information Delivery System

The respondents were asked to give their preference between traditional, IMM and traditional- IMM bred medical information and learning systems. The hybrid of traditional and IMM system was preferred at 96 percent, traditional system 4 percent while pure IMM system was rated at zero. This is presented in Figure 4.
The zero percent for the IMM system meant that it’s not the technology that matters what system or media can present information most effective even with the current euphoria with ICT technology. However, the study realised that the students value the human part of interactive information system. It is true that human aspect in form of lecturers and librarians are part and parcel of the IMM system. It can be traced back in the first question where discussions were highly rated among others. It is in this respect that Yen and Seng (2002) said that IMM does not automatically lead to successful acquisition of information and knowledge. Consequently it is necessary to look for a blended information delivery system that combines all sorts of presentations and optimizes good usage of IMM technology. Thus, the new paradigm of information and knowledge delivery requires blending of conventional materials, human facilitation and human-machine interaction. The IMM can only then be considered multi-channel information system and, hence, the overwhelming percentage rate of 96 percent for combined or rather hybrid system. The traditional learning and information system where students are passive consumers can be said to be an old tradition that is hard to die, hence the 2 percent in its favour. This can also be related to inadequate computer and IMM literacy such that a few students find it cumbersome to adopt the new technology. Inadequate literacy has been site in this study by the respondents as an impending factor to IMM adoption. The bar graph presentation is an indication of how best the student respondents understood their needs in terms of IMM, the multi-channel information presentation and communication systems. This is the reason why
the respondents were seen in an earlier query to be seeking use of the IMM resources even outside their medical school. The response also conforms to the theory of multi-channel communication theory where multi-presentation aids and arouses human senses, harnessing access, retrieval and understanding of information therein. The traditional and IMM systems supplement each other and not replace one another, hence the preference of blended system.

4.4.6 IMM Enhancement of Medical Information Access

The study found out that that IMM enhances understanding of the information by 98 percent.

Ellis (2004) did a study whose aim was to develop a model for testing the effectiveness of multimedia in promoting learning in order to allow instructors to make decisions on how best to manage educational resources and promote an optimal learning environment. He affirmatively found that multimedia as an enhancement to learning can produce meaningful results. He asserts that animation does appear to foster a greater degree of learning at the application level than a text-only tutorial.

The respondents answer to their recommendation on how to improve IMM information system was that simulations and animations should be incorporated among others. This is evidence that they understand the effectiveness of this mode of information delivery. This response conformed to other researches as reported in the literature review.

The researcher had also sought to know the factors they considered to enhance the information access. The respondents have shown that the six factors enjoyed considerable importance in enhancing medical information. However, the IMM characteristic of allowing the user to have self-paced and control in accessing information was highly rated among the others at 22 percent. The lowest rated attribute was that of 'user actively being involved in construction and access of information' with a 12.1 percent. This can be attributed in the fact that production of simulations and animations are cumbersome and as such are not commonly available free of charge. It is in animations, simulations and robotics that interactive construction and access of information is mostly experienced. This coupled with lack of in-house designed IMM projects in the school explains the response rate of the 12.1 percent. The Figure 5 presents the percentages in bar graph.
4.4.7 Effect of IMM on User's Understanding

Investigating deeper into ways on how IMM enhances understanding of the presented information, the research sought to get respondents' perception on increased comprehension, recall, and application of accessed information with an option of IMM not enhancing understanding. The responses in favour of the four attributes were – 38.6 percent increased comprehension, 31.8 percent recall, 25 percent for enhanced application and 4.5 percent of does not enhance understanding.

This statistics shows that 95.5 percent is fairly shared among the factors that indicate the IMM's ability to enhance understanding of the information accessed. The IMM engages the information seeker in meaningful dialogue. As a result, as Damoense (2003) acknowledged, the information seeker's motivation is enhanced, active learning is promoted, collaborative effort takes place, higher order thinking and problem solving skills are developed and performance based outcomes are attained.
From the this findings, it can be deduced that the students concurs with the empirical studies done, that the way the information is represented and organised in IMM, which resembles our understanding of people’s mental process, is likely to facilitate and enhance the internalization, retention and recall of knowledge obtained (Au, 1995). These being the case the libraries should evaluate their collection development policies and give consideration to acquisition of IMM information resources. However, it should always be considered that the conventional and IMM resources are complimentary and supplementary to each other and not a replacement.

Figure 6: Effects of IMM on User's Understanding

4.4.8 Availability of IMM in Hostels

The researcher sought to find out if students’ hostels are internet connected. This was intended to look for indication of availability of IMM outside the learning hours. 76 percent affirmed availability of internet connection availability in the hostels and 24 percent indicated unavailability.

The researcher observed that the hostels had wireless internet connected. The connection router is installed in the library that is about 100 metres from hostels. However, it was observed that the university has not installed computers in the hostels. The internet connection is to facilitate connection to those students that may have laptops or personal computers to access internet-based IMM resources. The ICT facilitate configuration of
students' computers for internet connection: This is also meant to encourage students to acquire computers and as result decongest use of ones installed in the computer laboratories. E-mail facility is open over the connection, thus encouraging discussion over the internet. It should be noted here that the e-mail services are not offered in the library and its accessibility in the hostels bridges the gap evident in its absence in the library services. It can also be interpreted as an indirect encouragement for students to acquire computers to supplement the inadequate numbers available in computer laboratories.

The 24 percent of respondents that are not aware of the availability of the resources represent those that don't own computer facilities and have no contact with those who have the facilities.

With the proliferation and increase in use of IMM technology, how people communicate and access information has improved in efficiency and efficacy. The Elliott Masie, President of the Masie Centre in UK, believes that IMM changes the experience of learning. It has extended learning choices and expanded options beyond the limitations of the classroom (Rosenberg, 2001). The medical students are accessing the IMM in their halls of residence rooms.
The student hostels have wireless connection through a router installed in the library. The university has not installed computers in the hostels. The wireless connection is to encourage those students who can afford a computer to access the online IMM resources. This is also meant to encourage students to acquire computers and as result decongest use of ones installed in the computer laboratories.

E-mail facility is open over the connection, thus encouraging discussion over the internet. However, it should be noted here that the e-mail services are not offered in the library. Postgraduates are non-residents and are offered configuration for their laptops which allow them wireless connection within a radius of 400 metres from library. Apart from encouraging use of IMM resources, this is again aimed at easing competition over computers available in the school.

4.4. 9 IMM -Designated Department
The researcher investigated availability of designated IMM department in the medical school. It was found that there is no department dealing with IMM resources. The
researcher observed that the ICT department is meant for general installation and technical support of the IT infrastructure.

With the tremendous interest in internet based IMM resources in the medical school, it is imperative to note that, even though the school does not have its home-designed IMM it embraces the technology with admiration though with limitations. The respondents agreed in an earlier question in this study that the IMM enhances their understanding in various ways and only 4.5 percent disputed this attribute. They use them to make a follow-up of what they learnt in lectures. The students are eager to access information in a different mode of presentation in the effort of supplementing what they learn in lectures and especially in surgery and laboratory practical procedures. The presentations come in form of full-text journal articles, audio-visual clips, peer e-mail exchanges, etc.

The library is left alone in the struggle to provide the 'not-so-much' explored information delivery mode. The library staffs are trained through participation in seminars and workshops. Their view in response to the trainings was that they are no adequate. The also end up giving inadequate user training. Without the formal coordination between library and teaching departments that exist in acquisition of books, the library is left without knowing the IMM requirement of their users. This is one of the reasons why library have depended on internet in provision of IMM resources.

4.4.10 Tailor-made IMM Projects

Investigating on availability of the medical school’s own produced IMM projects, the response was 100 percent of unavailability. This can be explained by the absence of an IMM designated department to cater for learning, information and knowledge resources. It was observed that the ICT department in the school is only intended for installation and maintenance of computers and their networks. It is not involved in information delivery service.

It can be deduced that University of Nairobi medical school does not have formal IMM information and knowledge delivery. The students gain their knowledge from their lecturers and other technical staff. As 100 percent affirms, the school does not have tailor-made or
class recommended IMM resources for delivering practical courses in surgery and laboratory technology.

However, the medical school attaches great importance to computer-based educational resources, hence the computer network in place. The school has internet connection installed in all offices and special attention is given to the library.

4.4.11 IMM-based Assignments

The study sought to understand if the students are given any IMM-based assignment. Investigations on IMM-based assignments found that 75.5 percent indicated that there are no assignments while 24.5 percent indicated there were some assignments. The 74.5 percent confirms there are no IMM-based assignments on practical medical procedures. However, the 24.5 percent of the respondents who indicated there being this kind of assignments could be meaning the textual electronic journal reference. This is because there is unlikelihood of the assignments considering that the study had found that there are no tailor-made projects by the medical school or even a department designated to handle IMM project for learning and information delivery. The responses have been represented in a bar graph Figure 8.

Figure 8: IMM-Based Assignments

![Bar Graph](image)

Source: The Researcher
4.4.12 Charges for IMM Services
The researcher sought to know if there are charges attached to use of the available IMM resources at the service point. The investigations found that there were no charges at the service points. The respondents affirmed this by 100 percent. This encourages the students to use the resources without discrimination on financial capability of the students. Once the students register and become bona fide members of the university community, they are free to use the IMM facilities.

4.4.13 IMM User Training
The research investigated how the students gained skills to use IMM resources. Among five forms of training the students indicated that they have not been trained in class or had seminars and workshops. These two forms of training missed from students' responses. The responses were as follows: 51 percent informal form of gaining skills, 38 percent self-instruction and 11 percent guidance by librarians. The percentage computation is shown five forms of training were used. This is also pointing at the restrictive forms of training available. Figure 8 is a bar graph showing the percentage presentation.

There being no formal establishment of IMM incorporated in the school’s curriculum, this query confirms that there is no formal user education on IMM resources. However, it was observed that there is user education in form of fresh admissions’ library orientation that introduces the students to the library services. The library orientation does not adequately cater for IMM utilisation induction. Having said that, the researcher observed that, orientation plays a crucial role in sensitizing the students on the availability of the resources. To fill this gap the library staff interacts with users on one-on-one basis in addressing IMM queries arising.
Figure 9: Forms of Students' Training on Use IMM

Forms of students' training on use IMM

Source: The Researcher

4.4.14 Students' Recommended IMM Medical Procedures

The researcher investigated what medical procedure information that the students would like presented in interactive multimedia.

The study accrued quite impressive suggestions of what the student information seekers would be interested to see delivered in an IMM system. The suggestions were varied but pointed to the same focal point: there is immense urge with the students to access information interactively. If anything this can only mean it is interesting, arousing, motivating, and culminating in enhancing understanding.

This study is not going to the intricate of explaining the suggested procedures. The study will just list the procedures which can form the basis of future investigation on how best the procedures can be delivered.

A surgery operation technique was the most suggested group of procedures. In this group laparoscopy was quite popular. The researcher got interested to know what it is.

Laparoscopy is one of the invasive procedures that students would like to see it presented in an IMM resource. This is a type of minimally invasive surgery in which a small incision (cut) is made in the abdominal wall through which an instrument called a laparoscope is inserted to permit structures within the abdomen and pelvis to be seen. The abdominal cavity
is distended and made visible by the instillation of absorbable gas, typically, carbon dioxide. A diversity of tubes can be pushed through the same incision in the skin. Probes or other instruments can thus be introduced through the same opening. In this way a number of surgical procedures can be performed without the need for a large surgical incision. Most patients receive general anaesthesia during the procedures. These sounds quite interesting even to a non medic. Others in the surgery techniques were:

- Cardiothoracic surgery
- Open heart surgery
- Neurosurgery
- Endoscope procedures
- Orthopaedics
- Ear Nose and Throat (ENT)
- Nasogastric intubations: a video is available as NEJMvcm050183.wmv at nejm.org

Other procedures were; Radiology, Microbiology technology; Immunology technology, Laboratory microscopy, Clinical Chemistry, Cytology, Anatomy, Haematology, Therapeutics, Ophthalmology, Obstetrics and Gynaecology, Pathology specimen images, and First aid.

Digital images and video clips prepare the medical students for their laboratory and surgery theatre sessions in advance. The IMM digital images and video clips motivate and cultivate interest in students, hence enhancing their understanding. This increases the quality of medical professional skills.

IMM enhances distribution of information and knowledge through networks, for example local area network (LAN) and the Internet, and by use of CDs and DVD technology.

IMM has made training demonstrations and presentations easier. Animations are particularly useful to stimulate real life situations such as laboratory experiments and surgery procedures. Thus, IMM enables efficient use of laboratory time, good performance and increases quality of education.
Another example of improved demonstration and presentation is the techniques that are incorporated in laparoscopic surgery e.g. use of embedded text to image linking. This happens when the mouse is passed over a section of diagram and text box opens up explaining the name of the organ and its function.

4.4.15 Collaboration in IMM
The research investigated the availability of collaborations between the medical school and other medical institutions in the area of IMM projects. The response asserted that there are no collaborations known in existence. However, the libraries do sometimes receive donations of CD-ROM information resources from medical oriented institutions, for instance, the World Information Resources for Education and Development (WiRED). WiRED is a non-governmental organisation that endeavoured to help in health related information to the developing world and remote areas in the world. In 2003 they donated 10 computers and CD-ROM information resources, assisted in networking and provided on staff to support access of the provided information resources. These were textual and audio-visual information resources that were community health related. However, the WIRED could were not able to sustain the service and winded up in 2005.

4.4.16 Factors Hindering IMM Adoption
The researcher sought to investigate factors the students perceived to hinder the adoption of IMM in their learning and information system. Inadequate funding led with 28.8 percent, lack of awareness 23.3 percent, inadequate trained manpower 19.2 percent, ICT user literacy 16.4 percent and availability of software 12.3 percent.
The results can be said to reflect a true scenario of a developing world. Kenya is a developing country and funding of public institutions is inadequate. It was observed that although there are no charges at IMM service points, government sponsored and self-sponsored students are charged KShs. 3,000 (US$45) and KShs. 5,000 (US$75) respectively towards provision of computer facilities. These funds have not afforded adequate numbers of computers for the student population. This is also coupled with lack of awareness of even the readily available simulated and animated information materials in the internet.

The hesitance in adoption of the IMM technology can also be viewed as adhering to caution given by researchers in machine-aided or computer-aided learning and information systems. For example Rais-Rohani, et-al (1999) in expressing how important the multimedia is an educational resource with astonishing potential acknowledged that implementing the technological advances poses serious challenges. They asserted that for IMM technology to be effective the tools must be clearly implemented. These tools include the hardware, software, financial resources and manpower. This could have slowed adoption of the technology.
Lack of awareness was second rated impediment. This can be related to the lack of IMM designated department that could be leading in creating awareness campaign. It was observed that the university has an ICT department that has basically concerned itself with maintenance of computers and their networks rather than the IMM information resources. The lack of awareness can be explained by lack of coordinated collaborations and consultation between the consumer departments and ICT department as observed in within the library.

4.4.17 Suggestions on Improvement of IMM Services

In an open question the researcher asked the student respondents to suggest how IMM services can be improved. The suggestions were quite pertinent. The following enjoyed a frequency of 3 to 9. The researcher listed the suggestions in descending order of frequency.

- Organize IMM awareness campaign for both students and teaching staff.

  Awareness campaign is very important sensitise the medical school fraternity on the availability, how to access and the benefits accruing from utilisation of IMM technology in learning and teaching, and information delivery. In the response to the challenges IMM adoption faces, lack of awareness was ranked second. It is then evident that it is a problem that dealt with to ensure access and utilisation of the IMM resources. The library should market its services. It should market the services by convening meetings with student users, and produce a monthly bulletin where services can be featured. The library can also market the resources in collaboration with student leaders due to their influence within the student community. This can still work as public relations gesture to library users.

- Training the teaching staff how to use IMM in their teaching: The library should organise seminars and workshops for lecturers they can be sensitised on the IMM availability, how they are accessed and their benefits in delivery of teaching materials. Teaching departments will be asked to have close cooperation with the library. By so doing they should recommend the IMM usage to their students just as they do for the books.

- Introduction of formal training of medical students on IMM

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For effective use of IMM the medical school need to institute formal training sessions if the maximum exploitation and cost-effectiveness are to be achieved. A good example of IMM information competence training is offered by Cal Poly Campus library of California State University. It provided a laboratory classroom setting for students where they can work to develop information competence skills, either on their own or within the confines of the information competence project courses (Adalian et-al 1997). It managed to implement multimedia approach in imparting information and knowledge. It embraces a "learn-by-doing" instructional philosophy.

- Improved ICT infrastructures- more computers, increased bandwidth, readily identified available IMM resources for increased access. This will make computers readily available and hence reduce or eradicate queuing for the service. Increased bandwidth will improve the response rate. The library should work closely with teaching departments identify their special needs. This will shift the school from the idea of introducing technology for sake of it to technology service oriented. The university should involve the various departments in exploring IMM as supplement to the conventional/ traditional system of teaching and learning.

- Establish a formal IMM resource centre to cater for learning, information and knowledge resources and establish IMM policy so as to foster well coordinated and faster development

The following suggestions had single frequency with the respondents:

- Improve internet services to students in the hostels and provide wireless hot points to those students who do not reside in the hostels.

- Establish collaborations with other institutions in provision of IMM resources. The study found that the university is member of KULISC consortium in the effort of provision of electronic resources. However, the medical School should make effort to identify medical institutions that they can partner in provision of specialised IMM services.

- Introduce IMM programme and create a local database where they can be incorporated into the learning and information system.
• Avail CD-ROM based and other IMM teaching aids that can be copied for home use.
• There was also the suggestion that the hostel should be given more computer facilities, for instance, installation of computers and maintenance of reliable internet connection.

The researchers evaluated the respondents' suggestions and were found to be very pertinent in improving the IMM services. The awareness campaign is very important. This corresponded quite well with earlier findings that lack of awareness was rated second in factors impending adoption of IMM technology in learning, information and knowledge system.

4.5 Staff Responses
4.5.1 IMM Formats Available
The researcher sought to know from librarians what IMM formats are available in the Medical Library. The percentages are fairly shared among five of the eight formats. The internet based IMM resources takes the highest 22.7 percent, Textual and Discussions 18.2 percent each, Audio and visual 13.6 percent each, and Animations, Simulations and Artefacts 4.5 percent each. The last three forms of IMM resources are rarely available and call for quite an effort to identify and access them. These can only be accessed from the internet as it was observed that they are not available in CD-ROMS. The clustering of the percentages of top five formats affirms the true position of their availability. The availability of these formats has been presented in Figure 10 below. The findings indicate of use the various formats of information. This again confirms the earlier indication by students on what they use and what the librarians provide. This confirms the concept of the theory of multi-channel communication that information is better delivered in multi-presentations.
Figure 11: IMM Formats Available

Source: The Researcher

4.5.2 Availability of IMM for Delivering Practical Courses

The researcher asked the librarians to indicate availability of IMM resources for delivering medical procedures. 80 percent of the respondents indicated that they are available while 20 percent indicated their unavailability. Figure 11 above presents the findings in bar graph. The variation indicates the discrepancy in IMM literacy level. The training is neither coordinated nor formal, and hence it is possible to have this problem. On the other hand there is inadequate knowledge management in the library department. This calls for sensitization on the importance of knowledge management meetings where members of staff can be sharing their IMM experiences among other aspects pertaining improving their services to the student patrons.
Figure 12: Availability of IMM for Delivering Practical Courses

![Bar chart showing availability of IMM for delivering practical courses]

Source: The Researcher

4.5.3 Preferred Information System

The librarian respondents were asked to indicate their preference for information systems and their reasons for their choice. 100 percent chose the hybrid system which is a combination of traditional and IMM information system. The reasons for this preference are listed below:

- The traditional and IMM technology systems supplement each other, hence the choice for the hybrid system.
- The hybrid system provides choice and is user friendly.
- There is a higher mental retention capacity where a combination of the two systems are used for learning.
- Availability of multi-channel presentations, thus harnessing retrieval and access of information.
- Availability of archival materials and local materials that may not be present in pure IMM technology system.

4.5.4 Cost of Services

The sought to know the cost of available IMM resources to students in terms of monetary charges, time factor and distance to service point. The researcher found that students are offered the services free of charge. The internet connection in the hostels is free. The
researcher observed that medical school's ICT department offers free configuration to students' personal computers for use in the hostel.

The response on internet search recall or rather response time varied from 1-5 minutes. It was observed that early in the morning (8 am - 10.30 am) the recall response is better. This is also the case after 5.30 in the evening. The rest of working hours the response time is quite poor and can be frustrating to access the internet-based IMM resources. The researcher observed that a search recall speed depends on intense of information traffic on the internet infrastructure within the university and some extent without due to circumstances involving the Internet Provider. However, the university has a big role to play to improve the situation. There is need to increase the internet bandwidth to accommodate the heave traffic of access to ease the overload.

The library is within a distance of 100 metres from the hostels and classes, and can be said to be strategically positioned within convenient access to users.

4.5.5 Forms of Training Given to Students

Librarians were asked how the students gain their skills in use of IMM information resources. The researcher found that guidance by librarians and informal/self-taught methods of training accrued 38.5 percent each, 15.4 percent training in computer colleges and 7.7 percent formal training in the medical school. The percentage proportions are presented in pie chart in Figure 12 below. The true position can be said to be induction by librarians and the informal/self-taught way of training. Due to the need to be computer literate students do private training in computer college and hence, the 15.4 percent accrual. This kind of training do not meet the specific need of IMM information resources but serves as a stepping stone for self-paced learning.
4.5.6 Medical School IMM Competence Training

The study sought to know whether the library trains other staff members of the medical school and whether it is considered adequate. The responses affirmed 100 percent that training was offered to members of staff. However, the training was considered inadequate by 100 percent of responses. This can be considered together with the students’ response that also affirmed that the orientation and one-on-one induction in information competence was not enough. The medical school should learn from the Cal Poly experience for better results. The Cal Poly library provided a laboratory classroom setting for students to develop and nurture their information competence skills, either on their own or within the confines of the information competence project courses. This helps the users to conceptualise the best way of finding information.

4.5.7 IMM Policy in Medical School

The researcher investigated availability of IMM policy and what it constitutes. 80 percent of the responses indicated there was no policy while 20 percent said there was one in place. The researcher also observed that there was no formal policy in place and the library has not had close coordination with teaching departments in provision of IMM resources. It is lack of such a policy that has resulted in lack of a department to establish and coordinate provision of IMM services.
The only accruing response to what the policy constitutes was that the IMM resources are for educational use only and leisure engagement was prohibited. This is a rule by the library to avoid misuse of the resources.

Lack of IMM policy can be said to mean that there is no proper mapping of the implementation of IMM technology. This can be sited as the main factor that has hindered the development of IMM projects in the school. Despite of policy not been factored in the impediments of the IMM implementation, it affects all other factor. The policy could have placed the requirements of IMM implementation in their proper perspectives as advised by Browell (1996).

4.5.8 Acquisition of IMM Resources

When the librarian respondents were asked to say how the IMM resources were acquired. Purchases and donations share at 50 percent each. Other options of producing the materials in-house, commissioned external producer and joint arrangement with an external producer were rated at zero. Presentation of percentage is shown in graphic presentation in Figure 13 below.

The 50 percent of purchase response are reflected in the subscriptions of internet IMM databases through the consortium. The internet resources will be listed in the next research query. The 50 percent of donation responses represents the various CD-ROMs donated by stakeholders in health circles and teaching departments.
4.5.9 IMM Subscriptions
The researcher sought to know if there are IMM subscriptions. The researcher was provided with a list of subscribed internet sites (Appendix F) that are at students and university staff's disposal for access. To access the resources, the user needed a username and password or are Internet Protocol-based where users need to be in the university network to gain access. The list could not be presented in its original format due to copyright legal issues. In accordance with research ethics, the passwords had to be removed because they are not supposed to go to the public domain. To this effect, a notice of warning has been given on the document. It should also be noted that the list covers all subscriptions by the university among which the medical resources are included. However, it should be noted that most of the resources are publisher databases and most of them have medical materials. This is an indication of how the university values the IMM resources and what remains is more marketing and sensitisation to both students and members of staff by the library in collaboration with teaching department who need to identify their IMM items of interest for specialised attention.

4.5.10 Expenditure on IMM by Library
The researcher investigated the expenditure on IMM by the library and the source of the funds. It was found that KShs. 2 million (US$30,000) is spent on IMM resources annually. It
observed in the follow-up interview with librarians that library acquisitions including IMM resources are centrally processed and the allocation is restrictive.

The funds are drawn from the university finances that are drawn from the government exchequer. This being the only source of IMM financing, then this can explain why inadequate funds was earlier quoted as a major impediment to implementation of IMM and its incorporation in teaching and learning, and information system. The university should solicit for funding from corporate and individual partners who may be very willing to be associated with the institution, for example, the university’s alumni.

4.5.11 Medical Library Membership to Consortium

Provision of IMM resources can be an expensive venture. The researcher sought to know if UoN is a member of any consortium in provision of IMM resources. The researcher found that the university is a member of Kenya University Libraries and Information Services Consortium (KULISC). The consortium endeavours to identify and bargain for access for its members. It pools funds from its members for collective subscription for the resources.

4.5.12 Designated IMM Department

The study wanted to know if there was specially designated department for the provision of IMM resources and qualification of the personnel heading the department. It was found that there was no establishment in place. However, as stated earlier medical library has computer laboratories that cater for IMM information services but collaboration with teaching departments is lacking. However, it was observed that library has always encouraged the teaching departments to recommend their preferred electronic resources for subscription. But electronic resources have been understood to be exclusively electronic journals and books. This has restricted subscription of audio-visual materials which would complement the textual materials

4.5.13 Organization of IMM

The researcher investigated how the IMM resources are organised in the library. The resources in form of CD-ROMs are arranged alphabetically by title in a cabinet for easier
retrieval. Special collection donated by WiRED International is arranged in CD folder. The CDs are listed in book catalogue whose list numbers are used for retrieval.

4.5.14 Collaborations
The researcher investigated on collaboration in IMM with other institutions. It was found that there were no collaborations with other medical institutions. It was also observed that there was very little collaboration between the teaching staff and the librarians in identifying the online IMM resources available to the student users. Otherwise there are quite a number of free IMM resources available in the internet and ready for use if only there would be concerted collaborations among the stakeholders in medical school.

IMM resources designed and developed in the medical school are missing. Thus, the school is dependent on internet based IMM resources which may not necessarily meet the students’ information needs.

4.5.15 Factors Hindering Adoption of IMM
The researcher investigated on prevalence of factors impending adoption of IMM from librarians. The results were 25 percent inadequate funding, 20 percent inadequate trained manpower, availability of software and lack of awareness had 20 percent each and 15 percent for ICT user literacy. The close clustering of the percentages indicate the serious appreciation of the problems. The factors hindering adoption of IMM technology are presented in Figure 14.
The researcher closely observed the student users while accessing internet resources and realized that there is considerable frustration and time wasting arising from poor IMM access and retrieval literacy in both users and library staff.

Another observation made was that some students make no use of the IMM resources available and staffs (lecturers) are ill prepared for the change in the learning and information delivery medium. These points at the reason why the differences in the learning cultures, multimedia based and traditional learning, should never be underestimated, especially for the novice. Fear is an important element in every novice user's first attempt to use a new machine or new software: fear of seeming stupid in comparison to others, or even to the machine itself, fear of destroying data, fear of hurting the machine, etc can be hindrance. This requires that awareness campaign be considered seriously across all information users.

From observation made, it has surfaced that there is a big variance in knowledge about availability of IMM among librarians. This indicated that knowledge management in IMM literacy among librarians in the medical library was inadequate. Gartner (2000) has defined knowledge management as a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving and sharing all the information resources of an organisation.
Thus, creating an approach for transforming tacit knowledge into explicit knowledge should be encouraged (Mphidi and Snyman, 2004).

### 4.5.16 Suggestions on Improvement of IMM

Creation of awareness/marketing of the services/emphasis e-learning/ awareness  
Sourcing for donations form other medical schools locally and internationally  
Learn from other institutions that have adopted the technology  
Library to take leading role in supporting the teaching  
Enhance internet connectivity  
Acquire the necessary hardware and software  
Develop collaborations  
Train staff more adequately  
Subscription of more and reliable online databases  

The university should come up with an IMM technology implementation policy. Such a policy will accommodate the following pertinent issues:

- Well defined modalities of implementation of the technology within the university.  
- Acquisition of the necessary instruments and software that goes with IMM technology  
- Incorporate IMM technology in the course curriculum of “Information and Communication skills”. This will induct all the university students on IMM technology and should be earmarked as a vital element in university learning and training.  
- Allocate a definite budget for IMM technology.  
- Determine the qualifications of the staff to be involved in installation and maintenance of the IMM knowledge and information system.

### 4.6 CHALLENGES AND FUTURE OF IMM

There are many factors impending adoption of IMM in learning, information and knowledge delivery systems. This study had put five factors in perspective. These are inadequate funding, inadequate trained manpower, availability of required software, lack of awareness of IMM existence and ICT user literacy.
Inadequate funding tops by 29 percent followed by lack of awareness 23 percent, inadequate trained technical support staff 19 percent, ICT user literacy 17 percent and availability of software trailed with 12 percent. The librarians’ responses are in agreement with those of student users. This was an indication validity of findings in respect of challenges facing adoption of IMM technology in the medical school’s information system.

Capacity building of the library staff was found inadequate and uncoordinated to enable them offer sufficient help to students in identifying, accessing and using IMM resources in the library. They end up using only the textual resources. This was realised through researcher’s interaction with members of staff and observing them attend to user queries.

It was observed that collaboration between library and teaching departments was lacking. Very little is realised in identification and provision of IMM resources. Most of the coordination is concentrated in provision of hard copies resources, that is, books and journals. Adoption of IMM has not been appreciated beyond provision of computers and internet connection.

IMM had not been incorporated in the teaching, learning and information system. There was no IMM designated department that would foresee establishment of IMM teaching and information delivery projects. The department could have ensured user education was adequate both to student and staff users. Such a department would establish formal coordination of IMM implementation with the library.

The Future of IMM

There are many efforts being made to develop computer-centred, media-enabled intelligent tutoring systems that would teach medical students and personnel approaches to various medical procedures.

The future of IMM and especially robotics promises to facilitate complex surgery procedures (e.g. endoscopic) by virtue of voice control over the networked operating room. Mack (2001) continues to say that this brings enhancement in understanding of intricate
procedures that would facilitate micro-scale operations, and development of virtue simulator trainers to enhance the ability to learn new complex operations.

Apart form availing the computer and internet connections, the realization of interactive multimedia requires that UoN to further develop and refine its approaches IMM where technology-based learning should be embraced considerably. This would facilitate development of an extensive library of health professional educational programs employing the "virtual clinic" (and other appropriate) models. In addition, the medical school needs to facilitate development of a Center for Applied Communications Technologies, dedicated to the application of computer, multimedia, and network technologies to it medical fraternity public information services.
CHAPTER FIVE
SUMMARY OF THE FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION
The UoN continues to build on its potential to adoption of IMM resources in its learning, information and knowledge delivery system. The findings of the study indicate that there are various IMM resources available. These are internet, textual audio-visual, discussions, artefacts, etc. They offer multi-presentation of information. The students have IMM choices to make to suit their information needs and understanding capability. It was observed that in the last five years a lot has been done in establishing computer laboratories in its library and outside for easy access to IMM information. Medical School has also taken keen interest in offering in-house training in basic computer applications to both technical and teaching staff members. The provision of computer networks coupled with I.T literate staff, the university medical school can be said to be warming up to greater heights in adoption of IMM technology.

With the above investment in the university, it would be timely to establish factors that affect the availability, access and use of IMM resources. The mere presence of computer networks and internet connection in the university and its library does not guarantee availability of IMM resources and their accessibility. The ultimate significance of the study was to establish the situation on the ground and identify any problems encountered in availability, accessing and use of IMM information and knowledge system, and make recommendations on solving such problems.

5.2.1 AVAILABILITY OF IMM RESOURCES
From the students and staff questionnaire responses it was affirmed that IMM resources are generally available in the medical school. These resources are not tailor-made to support the school’s curriculum. However, IMM resources are available on the internet and on IMM shop shelves that can match to the medical school’s needs. These resources contain information that students need. The students are given choices of what suits them best. The study found that the students highly appreciate the availability and the benefits they draw
from utilization of the IMM resources. They were categorical that IMM enhances their understanding in form of comprehension and high recall, and that it leads to high precision in performance. The resources are available in form of CD-ROMs and internet resources. The subscribed on-line resources are mostly textual and the more technical and crucial resources, like the animations, simulations and video-conferencing are missing. It was noted that even though animations and simulations are to some extent available, their access is cumbersome. Most of the hosts of the resources require users to be subscribed members. The library acknowledges the situation and as such takes identification and subscription of the IMM resources as an on-going process. This has been evidenced by the continuous progress the Medical School has made in adoption of IMM technology in provision of information.

However, the Medical School should be focussed in the provision of IMM facilities. The teaching departments in collaboration with the library should identify specific IMM projects that support the Medical School academic curriculum directly. The students should be made aware of their availability for optimum exploitation.

The Medical School should explicitly appreciate that provision of IMM resources can directly support the school’s curriculum and improve the education standards of the students. This would improve the performance of end product doctors in their health service career. The university would improve its status to a more highly respected medical training institution.

5.2.2 Cost of IMM Service

Access in terms of cost to students is affordable. The services are free at the service points ensuring equitability in access to all students. The IMM service points are within a distance of 100 metres from classrooms and student hostels, thus within reach and access of service. The distance is very convenient. The open hours (9.00am – 10.00 pm) of library computer laboratories are convenient to the busy medical students who have tight schedules from classes to the hospital wards. The university’s ICT department is mandated to configure
students' laptops and PCs for wireless connection so as to increase access of the available IMM and service points.

However, there are few computers for the students. As it has been reported earlier in the study there are 35 PCs against 347 students. The computer laboratories in the library are open to other students in the College of Health Sciences schools. There are long queues of students waiting to use the computers in the library. This is a price students have to pay to use the computers. It had also been found that internet bandwidth is also poor.

There is need to increase the number of computers so as to save students time. This should go hand-in-hand with increased bandwidth for quick retrieval rate. An automatic computer monitoring system should be devised so that a student can be timed for at most one hour at a computer workstation in a day.

This will increase number of students served in a day. The students will feel encouraged to seek IMM services and thus, realise greater potential of the IMM delivery of information.

5.2.3 IMM User Competence

The study found that the training administered to library users was not adequate. The student users do not get formal IMM competency training and the informal training is not sufficient to draw maximum access and utilization of IMM information. The library staff also admitted that their IMM competency is inadequate.

The IMM user competency should be integrated into the learning curriculum. Increased emphasis should also be given to library staff IMM competency so as to provide maximum support of the service. The information user competence is coupled with instructional approaches that strive to build student confidence, incorporate active learning activities, and provide a conceptual approach to finding information.

The researcher observed a considerable gap in IMM competency among the librarians. It is recommended that librarians should organize meetings every after two months in which forum they can share whatever new knowledge they may have acquired towards improving access of IMM and other information resources. Any problem encountered can be
collectively be tackled by members of staff. This would foster knowledge management. This can be extended to embrace library collaborations for expanded knowledge base. Mphidi and Snyman (2004) concur that this would result to skilled and competent librarians in IMM information and knowledge delivery. When librarians share their expertise with each other, they simultaneously learn from each other to fulfil the needs of their student users. Such knowledge management forum emerges as a powerful focal point for exploiting technology to add value to the IMM information and knowledge delivery system.

The user information competence skills can be given in form of communication skills course administered in first year of every bachelor degree course as a common course to all the students. Having the right information competence skill would enable the users and staffs make right choices of IMM for effective access and use of the information. This can be evidenced by situation on the ground at Cal Poly campus of California State University as reported by Adalian et-al (1997) Cal Poly’s approach was primarily geared towards combining three essential elements into one to provide:-

- An electronic classroom and information concourse plus multimedia laboratory;
- An environment to foster and promote collaborative learning; and
- The provision of a setting to blend information competence skills with computer literacy skills.

IMM competence is essentially aimed at facilitating access of relevant and quality information that can easily be transformed to knowledge and in the best mode of presentation.

5.2.4 IMM Designated Department

The study found that there is no specially designated department to cater for IMM in learning. An integration of IMM in the academic organizational structure is important in order to shape a coherent response to the rapid increase in multimedia use. However, IMM resources for medical student users are available in the developed economies’ IMM shop shelves and in the internet. Some are free, hence, the availability and access by UoN
students. However, their availability is highly dependent on the effort of the individual users and their information searching skills.

The Medical school, UoN should have a complete IMM teaching unit incorporating, for example, chat rooms in which lecturers and students can interact. Such interaction courses in which students are free to follow at their own time and pace provide an excellent opportunity to enhance their learning experience. This will at the same time reduce to some extent the pressure on the curriculum and negative effects of large classes. The availability of IMM designated department in collaboration of the colleges ICT team should move towards implementation of IMM system and not the mere provision of computers. Computers don’t necessarily mean availability and access of IMM resources. For computers to improve access of information the ICT department in collaboration with library should come up with a policy to ensure coordinated IMM development and effective utilisation.

Such a department should work together with the library to attain effective and efficient implementation and utilization of IMM resources. Once established, the IMM designated department in conjunction with teaching departments should train the librarians on how to access the IMM for onward administering of IMM competence at access points. The IMM resources should be tailored to the schools course requirements.

User education affects availability of IMM resources. For example, it would be difficult to identify the internet sites without the right skills of online searching. Hence, it is recommended that the university should give user education its deserving attention to ensure both students and staff members are skilled adequately for better use of IMM resources. It should set aside funds for administration of seminars and workshops for both library and teaching staff.

The study found the IMM resources enhances information delivery in various ways for betterment of learning process. The university should appreciate the capability of IMM technology and formally adopt and entrench the technology in its delivery of learning and information materials, and as such in its educational curriculum.
Strategic planning and identifying implementation steps of IMM projects would be the surety of right direction towards adoption of IMM technology. This would lead to realisation of the need for IMM designated department. For now the university have been providing IMM resources without development plan. The guided implementation coupled with the university’s zeal in provision of ICT facilities greater utilisation of IMM can be realised.

5.3.1 SOURCES AND CHANNELS OF INFORMATION CURRENTLY USED

The study appreciated that the medical school has had conventional information system comprising of its teaching staff, library with its hardcopy information materials and its staff. A well established conventional learning and delivery of information system is a good basis of IMM delivery of information that is part of the multi-channel communication concept. It was encouraging to realise that library have adopted the IMM information system with its collection having subscribed to internet and CD-ROM based database resources. Researchers in IMM information systems have found a CD-ROM resource more focused and can be used as an adjunct to traditional education, act as a stimulus for higher learning and is a useful supplement to traditional educational and delivery of medical information (Azer, S.A, 2004).

The search recall rate is a bit poor and sometimes frustrating. Among the IMM resources internet is the most popular source of information, and hence need for better computer response rate. In the absence of tailor-made or home-designed IMM programmes, internet is expected to continue gaining popularity with users who embrace the IMM technology. It is recommended that the university secure broader bandwidth for faster and better recall rate.

It is recommended that more interactive IMM resources be added in the subscription e.g. the animations and simulations, and video conferencing should be adopted to cater for the fast expanding student numbers. The recorded medical procedure clips can be used as extension of studies outside the classroom and surgical theatre rooms.

The computers should have adequate memory capacity as demanded by IMM resources and services provided. This calls for a planned memory capacity specifications. It should be
noted that video clips utilize significant computer memory and can significantly slow down a learning module and could therefore be used sparingly. However, incorporation of video clips provides a significant advantage over traditional laboratory manual and lecture approach of providing 2-D schematics and sketches of the equipment and experimental set-up (Kamlaskar, C.H., 2007).

The Medical School was seen to have most of the required multi-channels of communication that can facilitate provision of IMM information delivery. However, it requires cooperation of teaching departments and the Medical Library for coordinated, effective and meaningful realisation of the IMM potentials in information and knowledge delivery.

5.3.2 Consortium and Collaborations

The study found out that the university library is a member of the KULISC whose interest is provision of electronic information resources especially e-journals. However, this was considered as ‘not good enough’. The consortium caters for general information and not directed to particular academic curriculum.

The school should link-up with global networks of medical schools as is already being done currently in Europe through the EMSIS as observed by Lip (2000). Such a venture can involve designing and production of IMM projects. It can serve as forum for exchange of IMM experiences for better adoption and implementation of IMM programmes. More co-operations are needed to facilitate sharing of IMM experiences that would result in improved availability and utilisation of the technology. The Medical School should identify other medical institutions that can partner with in provision of IMM information services.

Consortia and collaborations are the economical means of providing and developing the IMM information services. Considering that the technology is relatively new to many institutions sharing of experiences is very important to avoid hindrances in the implementation.
5.4 EXTENT OF USE OF IMM IN ENHANCING INFORMATION DELIVERY

The research found that the medical school has established internet service points all over the school. However, the most important are the library laboratories which are available to every student and staff as opposed to departmental computer laboratories that are meant for departmental staff.

The users access available IMM resources to supplement what they have learned from their lecturers. It was noted that the school did not have its curriculum-designed IMM resources. Thus, there are no assignments on IMM projects. The school has not integrated IMM technology in its educational curriculum. It was observed that lecturers rarely seek to interact with IMM information services.

Despite the theoretical appeal and broadly positive results from a handful of randomized IMM trials conducted by enthusiasts, this study concurs with Greenhalph (2001) that real advantages of IMM assisted learning, information and knowledge access in medical curricula is yet to be exploited consistently. The IMM technology has not been adequately embraced in the Medical School of University of Nairobi, and most probably in the region considering that university is a front runner in medical training in the country and the East Africa (EA) in general.

Interactive multimedia entrenchment in medical schools’ curriculum is somewhat strange and has not been adequately explored in University of Nairobi. It is yet to establish the most appropriate topics and designs for multimedia and to provide the tasks to which multimedia is most suited. This can be explained by the realization that we are in a culture that is still dominated by the print media.

The school should incorporate IMM in its learning and information system to reap full benefits of the technology. However, it should be implemented with a caution: neither course materials nor teaching skills are directly transferable from the traditional lecture theatre to the multimedia learning environment and the virtual campus. Thus, the medical
school should recognize, and take systematic steps to guard against the danger of allowing inadequately trained tutors and lecturers to go full length multimedia.

The researcher recommends that teaching departments and lecturers utilize the networks by posting learning resources that can be shared by all student users. These materials can be posted on the library website or even on the Medical School's web page. These networks enable easy and wide access to the IMM resources. The resources can be accessed through computer networks or even CDs. They should be available in teaching departments, library and halls of residence.

The school should introduce multimedia lectures with educational objective to help students to think broadly about issues, search for more information, and foster their skills to reuse learned information. The lectures should be designed to enhance student skills to think in integrative way by use of multi-channels interactive media.

The college should set up a listserv that enables any student to send a message to every student and an FTP (File Transfer Program) directory to allow posting of course outlines, bibliographies, assignments, and student projects. To encourage IMM usage, all correspondence should be handled electronically (Shneiderman, 1994).

5.5 MEDICAL PROCEDURES THAT NEED IMM INFORMATION DELIVERY
Interactive multimedia is somewhat strange and partly unexplored territory in this part of developing world. Medical School had not established the most appropriate topics and designs for multimedia tasks that multimedia were most suited. This was explained by the realization that we are in a culture that is still dominated by the print media.

The students were asked to suggest areas they thought IMM would effectively deliver. The suggestions were varied but pointed to the same focal point: there was immense urge with the students to access information interactively. If anything this can only mean that IMM systems were interesting, arousing, motivating, and culminating in enhancing their access to
medical procedure information. Most of the suggestions were surgical operation procedures; procedures that are practical.

IMM has made training demonstrations and presentations easier. Animations and simulations are particularly useful to simulate real life situations such as laboratory experiments and surgery procedures. The suggestions point to the fact that the students know what they need in IMM information products and services and are eager to use them the sooner they are provided. They needed interactive learning and information delivery, and as such gain procedural knowledge as opposed to the conventional system that mostly harnessed factual information. Medical learning and information system concerns procedural knowledge which involves knowing how, that is, the ability to accomplish complex real-life tasks. As Damoense (2003) asserted this can only be achieved when user’s motivation is enhanced, active learning is promoted, collaborative effort takes place, higher order thinking and problem-solving skills are developed and performance based outcomes are attained. This can only be attained through the various IMM resources supplementing each other.

The suggested procedure presentations are not among the resource subscribed for by the university. It is imperative that the university management and the library should involve the users in identifying IMM information resources to ensure provision of information on areas of their interests.

They can also be involved in the implementation stage. The lecturer and student users should be given opportunity to evaluate the programmes before they are fully implemented so that they can own the programmes to ensure maximum utilization.

There is need, therefore, for all those involved in the teaching and learning process, and information service to be aware of developments taking place with regard to new information and communication technologies. The researcher concurs with Browell (1996) that multimedia are only for enhancement of overall learning, training and development scene and hence, should not be considered in isolation. In essence multimedia can only be
considered as a supplement rather than a replacement for conventional form of learning and information system.

The IMM resources have not been utilised to a good extent. The resources were not identified to suit particular tasks in the curriculum. The university have not established the target of accomplishment with the technology. If the university would set benchmarks, it could realise measurable and coordinated development in IMM adoption.

5.6.1 POTENTIAL CHALLENGES AND FUTURE OF IMM
The research identified a number of challenges that need to be addressed for increased access and utilization of IMM resources.

5.6.2 Availability of the IMM Resources
The respondents sited unawareness of availability of most of IMM resources. This was also observed from the library staff who could only give reference to textual form of IMM information available.

It is recommended that awareness campaign be carried out for improved availability and accessibility of the IMM resources. There is dire need for user information and computer competency. This literacy will give the students and staff the skills, confidence and be capable of accessing IMM resources and transform it into knowledge.

Awareness is very important and could be considered as the first step towards availability and access to the inconsistently exploited IMM resources.

5.6.3 Funding
Funding was cited as very significant impediment to adoption of IMM technology. Thus, initial problem is to obtain funding, first for the experiment and then for the extensive development and implementation of the IMM projects.

To develop high quality interactive multimedia curriculum materials of any type demands significant funding. This includes the full-scale evaluation essential for the experiment. Then, development cost could be less because people learn from their earlier efforts.
It seems unlikely that the university would be able to obtain this funding for the project within the university, given the current financial constrains. Thus, outside funding would probably be required.

As such the university should avoid relying solely on internal funding in this venture. Funding may come directly from government ministries and other state sources or from stakeholder organizations such as the AMREF and Nairobi Hospital, etc. It is also possible to get funding from Commercial entrepreneurs and individuals of good will. The Medical School and the university as whole enjoy a wealth of alumni who would be willing and happy to be associated with such well intentioned project.

The library in collaboration with the Medical School departments should look for funds externally to supplement the internal available funds to coordinate a multi-user project on information competence. This effort would be in response to the university’s strategic plan for libraries to provide a coordinated effort in the teaching of information competence skills to students.

The experiment might be funded this way, with the prospect that if successful, further funding might come from other sources.

**Cooperating Universities**

Another possibility is that several universities might be interested in working together, each providing some of the funding. Perhaps this could be done through an organization such as KULISC.

**Foundations**

Private foundations interested in major improvements in higher education would be another possible source.

**Commercial Funding**

A major course development would provide an exciting new area for companies to explore, a market that no-one is involved with to the extent suggested and one that has considerable
promise.

The university can prepare a prospectus for venture capital groups and commercial companies, outlining the likely markets and the possibilities for working together in this direction. Such a prospectus would elicit suggestions from readers who have more experience. Perhaps this document would serve partially for that purpose.

Funding is always the first item to be considered in any project. This is where the budget is factored in. Budgetary planning would put to consideration of amount of money required for various items and sources of fund required. Thus, the university should set aside a budget to cater for provision of IMM resources to ensure steady development.

5.6.4 User Education
The study found that information user education in the medical school is catered for by the first year students ('freshers') library orientation programme. The librarians understand the user education is a continuous activity. The library undertakes one-on-one IMM user competency on the spot at the service point where need arises.

However, the study found that the IMM user education was found inadequate. This was an impediment to effective access and utilisation of IMM resources. It is recommended that user education be made a continuous programme where user education forum can be organized in few months apart to cater for various levels of students. The user education and more so the IMM competency should be entrenched in the common course, library and communication skills course taught in level I class.

User education is very important and determines effectiveness and efficiency in access and utilisation of IMM information.

5.6.5 Collaborations
Cooperation and collaborations are very inadequate. The sharing can be done between university medical schools, ICT firms and health stakeholders. Otherwise the development and effectiveness of IMM in practical medical procedures will only be achieved through
sharing experiences among medical training stakeholders; teaching departments, library, ICT, and the interested health sector.

Collaboration touches virtually all aspects of IMM provision aspects; availability, user competency, access, utilisation, etc. It then arises that in the effort to transform the conventional teaching system to the IMM participatory learning and information system a great deal of cooperation and collaboration should be embraced.

5.7 SUMMARY

This research in general investigated the availability, access and utilization of IMM technology in delivering practical medical information in Medical School, UoN. This was in the understanding that IMM information presentations involves the various senses of the user and as such enhances effective access and use of the information and knowledge gained. The university has provided its library and its users with computer infrastructures. Learning and information resources have been accessed in support of student users’ needs to a good extent. However, a lot can be done to turn the computer network infrastructure a resource that directly supports the university’s academic curriculum.

It is upon the university to borrow a leaf from other universities that have established IMM learning and information systems entrenched in their educational curriculum. For example, Louisiana State University, Southern University and California State University in USA, and University of Melbourne. It should put itself on the paradigm shift, from teaching to learning; passive information consumption to involvement in construction of information and access in interactive mode. We are in the era of information explosion, hence, information superhighway and, back in Kenya, in the era of education explosion where universities are exploding with student numbers eager to acquire higher education. The IMM learning, information and knowledge systems will cater for the extended classrooms where students can pace their information access and learning. It will enhance delivery of learning, information and knowledge catering for each individual user’s needs in the most preferred, effective and efficient presentation.
Lecture materials, laboratory and surgical theatre procedure information resources should be extended to all possible locations where student's information need may arise, that is, classroom, library, parking bay, halls of residence/home, et cetera. Hence, the university is encouraged to widen its wireless internet connection. They should electronically be accessed in form of open learning modules but this time maintaining the teacher student contact. Human factor is part and parcel of IMM information and knowledge system.

For continued quality university education there is need to provide information in multi-channels of information communication. This will enable matching of information resources to the user's information needs and his/her style of learning. By so doing such learning and information system channels will be reinforcing each other for improved learning and effective information and knowledge utilisation.

The study achieved its objectives. The student population expressed their preference of IMM and its multi-channel information communication mode. It was found that Medical School prescribes to the multi-channel information delivery concept and has provided computers endowed with multimedia capabilities. To enhance the IMM information resources access, the library has ensured that there is a librarian to personally over assistance when needed.

However, the school has not adopted the IMM technology in its academic curriculum. It was found that there is need to establish an academic department that would spearhead the planning, development and implementation of IMM academic curriculum projects. Meanwhile the students continued to use the Internet, CD-based and local database resources for their interactive information access. These are the readily available resources in the market since the Medical School was not producing its own tailor-made projects. The library had its local designed online public access catalogue (OPAC) available in all internet connected computer work stations in the library and everywhere in the university. The University of Nairobi Internet connection provides links to subscribed IMM resources for easier access.
Both the student and library staff respondents indicated without doubt that the IMM enhances access of practical procedure medical information and enhances their learning capacity. This was evidenced by the subject areas that the students suggested could be delivered in IMM format.

The researcher appreciated that the IMM as information and learning technology is relatively a new phenomenon and as such was faced by numerous challenges. The study realised that close attention was to be given to the project funding, user and information providers' information and computer competences, number of computers, Internet connection speed, et cetera. Dedicated interest in these factors would harness provision of a well strategized adoption of the IMM technology.

The study has strongly indicated that IMM with its multi-channel information presentation has elicited great interest from the student users. The future of delivery of information and learning materials of physical and practical medical procedures lays in the IMM technology. The animation, simulation and real-life video recordings of laboratory and surgery procedures provide an almost real-life environment hence enhancing learning and performance of the medical procedures.

In absence of the school's tailor-made IMM projects the lecture notes and the books remain the key learning and information resources for undergraduate students while postgraduates lead in seeking information from the available IMM resources. It was observed that IMM is best for postgraduate research work that demands to be supported by the most current findings in medicine. This made the library separate the two classes of students with postgraduates getting a separate computer laboratory for improved access. It should be noted that adoption of IMM technology does not render the teachers without a role. However, rather than just presenting information and issuing instructions, the teachers have an essential role; they will inspire, motivate and serve as a referee for the human to human discussion that IMM instruction is designed to provoke. Rather than acting like a coach directing a football team, a teacher will be more like a floor captain of a basketball team directing the overall flow of actions but allowing other team members take lead when the
situation warrants it. The IMM allows the students learn and discover through their manipulation of information access processes.

However, it was noted that medical students are adept at using IMM resources. Lemonick (1992) in his article ‘Tomorrow’s Lesson: Learn or Perish’ had foreseen the current situation where technology has made it possible to provide tailored instruction within a single class with diverse information access and learning abilities. The students have become skilful at using IMM system consisting computers, exhaustive data bases of information, moving images and sound. Lemonick acknowledged that while scientists have found ways to improve the learning abilities of people with dysfunctional brains, nothing had been realised to radically improve normal brains ability. The normal brained student access and understanding can only be improved by a steady enhancement of the abilities they already possess.

In the 21st Century nothing is more fashionable than adoption of IMM technology in information and learning systems. The library in collaboration with teaching and the ICT departments have the responsibility to satisfy the necessity of IMM resources to the medical students. The librarian and ICT technicians has the immense task to ensure users gain the necessary computer and information competence necessary for maximum exploitation of IMM technology information and learning resources.
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APPENDIX A

Dear Respondent,

REF: QUESTIONNAIRE FOR A RESEARCH PROJECT

TITLE: THE ROLE OF INTERACTIVE MULTIMEDIA (IMM) RESOURCES IN ENHANCING DELIVERY OF MEDICAL INFORMATION AND KNOWLEDGE TO STUDENT USERS: A CASE STUDY OF MEDICAL SCHOOL, UNIVERSITY OF NAIROBI.

I am second year Master of Library and Information Science (MLIS) student, Kenyatta University (KU), Department of Library Studies and a member of staff in Medical Library, University of Nairobi (UoN). The study is an MLIS Research Project whose findings will be shared with the Medical School, UoN to map up areas where use of IMM requires further attention.

The purpose of the questionnaire is to investigate the current availability, access and use of interactive multimedia in enhancing delivery of practical medical information and knowledge to the medical students. It identifies follow-up activities that can be taken towards improving provision of basic IMM information resources.

Please respond to the questions frankly and honestly. Your response will be kept strictly confidential.

Thank you for taking time to respond to the questionnaire.

Harun Mugo
Date: 12/4/2007
APPENDIX B

The Role of Interactive Multimedia (IMM) in Delivery of Medical Information and Knowledge

QUESTIONNAIRE 1: FOR STUDENT

1. (a) What form of IMM information is available in medical school? Tick as appropriate
   i. Textual (e.g. internet where you text in a query and get textual response)
   ii. Audio
   iii. Visual
   iv. Animations
   v. Simulations
   vi. Artefacts (objects made/given shape by man used as a teaching or learning aids in a classroom)
   vii. Internet resources
   viii. Provision for students' discussion
   ix. Video Conferencing

2. (a) Does your medical school have interactive multimedia (IMM) resources for delivering practical courses (i.e. laboratory technology and surgery)?
   YES ☐ NO ☐
   (b) If your answer is YES in (a) what are they? Tick appropriately
      i. Simulated procedures ☐
      ii. Animated procedures ☐
      iii. Video procedures ☐
      iv. Artefacts ☐

3. (a) Do you use IMM facilities outside your medical school? YES ☐ NO ☐
   (b) If your answer in (a) is NO, tick reasons that apply to you.
      i. Lack of IMM facilities. ☐
      ii. IMM available but not beneficial to your learning. ☐
      iii. Don't know how to use the IMM. ☐
The Role of Interactive Multimedia (IMM) in Delivery of Medical Information and Knowledge

4. How often do you use IMM per week? Tick the range appropriately.
   i. 1 – 4 times
   ii. 5 – 8 times
   iii. 9 – 12 times
   iv. More than 12 times

5. Which information system do you consider most effective in medical information delivery? Tick appropriately
   i. Traditional system (books, manuals, lectures)
   ii. IMM system (Audio-visuals, simulations, animations, etc)
   iii. Combination of (I) and (ii)

6. (a) Do you think IMM enhances your information access? YES ☐ NO ☐
   (b) If your answer in (a) is YES, tick reasons that applies to you.
       i. They provide information not available in hard copies
       ii. Information is presented in a more understandable way
       iii. User is actively involved in construction and retrieval of information
       iv. Information can also be accessed outside the school
       v. User can have self-paced and controlled access of information
       vi. IMM channel of information supplement each other

7. How does IMM increase your understanding of the information?
   i. Comprehension made easy
   ii. Recall is increased
   iii. Application of the obtained information
   iv. Does not increase understanding

8. Does the college provide IMM resources (e.g. internet) to students in the halls of residence or at home? YES ☐ NO ☐

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9. List any IMM projects developed by your school that give you opportunity to perform simulated surgery and laboratory experiments?

10. (a) Are you charged to use IMM at the service points, e.g. computer labs? YES □ NO □
    (b) If YES, how much per time? (e.g. Sh.2 per minute)

11. (a) Are students given IMM-based take-away assignments to assess their medical skills and knowledge? YES □ NO □
    (b) If YES where do they get/access the resources from?
        Library □ Home □ Cybercafé □ Friends □

12. How do students gain skills on use of IMM? Tick appropriately
   i. Formal training in the medical school □
   ii. Seminars and workshops organized by the medical school □
   iii. Guidance by library staff □
   iv. Informal □
   v. Self-instruction □

13. (a) Does the medical school have a designated IMM department/section to cater for learning, information and knowledge resources? YES □ NO □
    (b) If YES name the department(s):

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14. List areas of surgery and laboratory technology you would recommend application of IMM for effective and efficient delivery of information?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

15. List medical institutions that collaborate/share IMM experiences in learning and delivery of information with your medical school.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

16. In your opinion, what are the challenges hindering adoption of IMM technology in the medical information system? Tick appropriately

   i. Inadequate funding
   ii. Inadequate trained manpower
   iii. Availability of required software
   iv. Lack of awareness of IMM existence
   v. ICT user literacy

17. Give suggestions on how to improve IMM services e.g. on formats, cost, training, etc.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
APPENDIX C

The Role of Interactive Multimedia (IMM) in Delivery of Medical Information and Knowledge

QUESTIONNAIRE 2 FOR STAFF

1. (a) What form of IMM information is available in medical school? Tick as appropriate
   i. Textual (e.g. internet where you text in a query and get textual response) □
   ii. Audio □
   iii. Visual □
   iv. Animations □
   v. Simulations □
   vi. Artefacts (objects made/given shape by man used as a teaching or learning aids in a classroom) □
   vii. Internet resources □
   viii. Provision for students’ discussion □
   ix. Video Conferencing □

2. (a) Does your medical school have interactive multimedia (IMM) resources for delivering practical courses (i.e. laboratory technology and surgery)?
   YES □ NO □
   (b) If your answer is YES in (a) what are they? Tick appropriately
   i. Simulated procedures □
   ii. Animated procedures □
   iii. Video procedures □
   iv. Artefacts □

3. (a) Which information system do you consider most effective in medical information delivery? Tick appropriately
   i. Traditional system (books, manuals, lectures) □
   ii. IMM system (Audio-visuals, simulations, animations, etc) □
   iii. Combination of (i) and (ii) □
   (b) Give reasons for the your choice above

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4. (a) Does the college provide IMM (e.g. internet) in the halls of residence or at home?
   YES □       NO □
   (b) i. If YES, what does it cost? (e.g. Shs. 2 per min., 1000 per Semester) ____________
   ii. What is the waiting time of a search result/computer response time? ____________
   (c) How far is it from halls of residence to cybercafé library? ____________

5. (a) Is the college library ICT facility providing IMM resources? YES □       NO □
   (b) If YES in (a) what formats. Tick appropriately
      i. CDs □
      ii. DVDs □
      iii. Videos □
      iv. Artefacts □
      v. Internet resources □
      vi. Provision for students’ discussion □

6. How do students gain skills on use of IMM? Tick appropriately
   i. Formal training in the medical school □
   ii. Seminars and workshops organized by the medical school □
   iii. Guidance by library staff □
   iv. Informal/self-taught □
   v. Trained in computer college □

7. (a) Does the library train teaching staff how to use IMM resources? YES □       NO □
   (b) What is covered in the training?

   (b) If YES do you consider the training adequate? YES □       NO □

8. (a) Does the college have IMM policy (stated or not stated)? YES □       NO □
    (b) If YES briefly explain what it constitutes.

__________________________

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9. How do you obtain multimedia products? Tick as appropriate
   i. Purchase off the shelf products 
   ii. Donation 
   iii. Produce materials in house
   iv. Commissioned external producer. If yes which one(s)

   v. Joint arrangement with an external producer.
      If YES, list them.

11. List down the subscribed IMM resources by your library

12. (a) How much does the library spend on IMM resources? ____________________________________________
     (b) What is the source of funding? ____________________________________________________________

13. List any consortium your library is a member for delivery of Multimedia resources.

14. (a) Does the medical school have a designated IMM department/section to cater for learning, information and knowledge resources? YES  □  NO □
     (b) If YES name the department(s):
         ____________________________________________________________
     (c) What qualification(s) is required to work or head such a section?
     (d) How are the IMM resources e.g. CDs, organised?
         ____________________________________________________________

15. List any other medical institutions that collaborate/cooperate in IMM experiences in learning and delivery of information with your medical school.

__________________________________________________________
__________________________________________________________
__________________________________________________________
16. In your opinion, what could be hindering adoption of IMM technology in provision of medical information? Tick appropriately

i. Inadequate funding  
ii. Inadequate trained manpower  
iii. Availability of required software  
iv. Lack of awareness of IMM existence  
v. ICT user literacy

17. Give any other suggestions on the acquisition and use of IMM in the space below.
APPENDIX D

INTERVIEW SCHEDULE

1. What form of IMM information is available in medical school?

2. Which interactive multimedia (IMM) resources does the Medical School have for delivering practical courses (i.e. laboratory technology and surgery).

3. (a) Whether students use IMM facilities outside their medical school.

   (b) And, if they don’t use, for what reasons.

4. How many times students use IMM per week.

5. Which information system students and librarians consider most effective in medical information delivery among traditional, IMM or hybrid (combination).

6. Whether students think IMM enhances their information access and how.

7. How IMM resources increase students’ understanding of the information?

8. Whether the Medical School provide IMM resources (e.g. internet) to students in the halls of residence or even at home.

9. Whether there are IMM projects developed by Medical School to give the students opportunity to perform simulated surgery and laboratory experiments?

10. Whether students are charged a fee to use IMM at the service points (e.g. computer laboratories) and how much.

11. Whether students are given IMM-based take-away assignments to assess their medical procedures skills and knowledge, and if they do, where they access the facilities.

12. How do students gain skills on use of IMM?

13. Whether the Medical School have a designated IMM department/section to cater for learning, information and knowledge resources.
14. Students were asked to suggest areas of surgery and laboratory technology they would recommend application of IMM for effective and efficient delivery of information.

15. Whether there are medical institutions that collaborate in IMM experiences in learning and delivery of information with the medical school.

16. Seek students’ and librarians’ opinion of what could be impediments in adoption of IMM technology in provision of medical information.

17. Seek students and librarians suggestions on how to improve IMM services e.g. on formats, cost, training, etc.
APPENDIX E

OBSERVATION GUIDE

1. Establish the availability of IMM resources for medical student users.

2. Determine the IMM sources and channels of information that are currently used by the medical school.

   Identify the available information resources

3. Establish the extent of use of IMM resources in enhancing delivery of information in the medical school.
   - See what students are accessing
   - What kind of interaction are they having e.g. scrolling for text and reading, performing robotic simulations, watching video clips, etc.
   - Look for signs of lecturers concern on IMM resources
   - See whether lecturers visit computer laboratories

4. Identify areas where IMM technology can be used to gain medical procedures information and knowledge.
   - Identify students areas of interest in what they show effort of accessing

5. Identify the potential challenges and future of IMM in dissemination of medical information.
   - Number of computers
   - Effort and ease in accessing IMM resources
   - Effort and ease by which librarians offer support in access and retrieval
   - Is it all librarians capable of offering assistance or some
   - Are computers readily available or are the queues.
We are pleased to announce that through the Program for Enhancement of Research Information (PERI), more electronic resources have been availed to University of Nairobi. You can access over 15,000 electronic journals and download articles (Full Text) free of charge! You can access the information directly through your PC if you are connected to the University network. A list of the databases is given below. Please contact the library for more information.

**WARNING!!**

The passwords given below are strictly for use by University of Nairobi Community (staff & students). It is an offence against copyright laws to pass them on to people outside the University.

1. **EBSCO**  
   URL: [http://search.global.epnet.com](http://search.global.epnet.com)  
   Access by IP via campus network

2. **Blackwell-synergy**  
   URL: [http://www.blackwell-synergy.com](http://www.blackwell-synergy.com)  
   Access by IP via campus network

3. **Wiley InterScience**  
   URL: [http://www3.interscience.wiley.com](http://www3.interscience.wiley.com)  
   Access by IP via campus network

4. **Gale**  
   URL: [http://infotrac.london.galegroup.com](http://infotrac.london.galegroup.com)  
   User ID:  
   Password:

5. **MCB/Emerald**  
   URL: [http://www.emeraldinsight.com](http://www.emeraldinsight.com)  
   User ID:  
   Password:

6. **American Society of Civil Engineers**  
   URL: [http://www.pubs.asce.org/journals/jrns.html](http://www.pubs.asce.org/journals/jrns.html)  
   Access by IP

7. **Africa Journals Online (AJOL)**  
   URL: [http://www.ajol.info/](http://www.ajol.info/)  
   Search for documents you need and request your articles through the library.

8. **Mary Ann Liebert**  
   URL: [http://www.liebertonline.com/](http://www.liebertonline.com/)  
   Access is by IP
9. AGORA
URL: http://www.aginternetwork.org
User ID: 
Password: 

10. Landesbioscience
URL: http://www.landesbioscience.com/journals
     http://www.landesbioscience.com/handbooks
Password: 

11. HINARI
URL: http://www.healthinternetwork.org/scipub.php
User ID: 
Password: 

12. GOOGLE SCHOLAR
URL: http://scholar.google.com
Vlink enabled via University of Nairobi Library

13. OXFORD UNIVERSITY PRESS
URL: http://www.oxfordjournals.org
Access by IP

14. INSTITUTE OF PHYSICS
URL: http://www.iop.org/EJ/
Access by IP

15. WALTER DE GRUYTER
URL: http://www.extenza-eps.com
Visit the website and select "Browse Online Journals by Publisher" then select Walter De Gruyter. Search by Journal Access by IP

16. MULTILINGUAL MATTERS
URL: http://www.multilingual-matters.net/default.htm
Access is by IP

17. ROYAL SOCIETY OF CHEMISTRY
URL: http://www.rsc.org/Publishing/consortia/periproducts.asp
Access by IP on University Network

18. SourceOECD
19. **CABI Global Health Database**

URL:  [http://www.cabdirect.org/globalhealth](http://www.cabdirect.org/globalhealth)
Username:
Password:
Expiry: 31/12/2006

20. **American Physical Society**

URL:  [http://publish.aps.org](http://publish.aps.org)
Access by IP

21. **JSTOR**

URL:  [http://www.jstor.org/](http://www.jstor.org/)
Access by IP

Users can also visit the Library website at [http://library.uonbi.ac.ke](http://library.uonbi.ac.ke) and access some of the journals through the WebOPAC. Links to all the above databases are provided through the library website under online databases.

What is not available in the databases can be ordered directly (online) from the British Library Lending Division. Contact the library, Periodicals Section, Ext. 28033/28521 for orders from the British Library. The library has an internet café for electronic journals in the JKML library 1st floor in Seminar Room 1A. It is open 8.00 – 4.00 pm daily.

You can also contact:
Library:
Jacinta Were
Dorothy Njiraine
Agatha Kabugu