INAUGURAL LECTURE

Integration of Educational Technology in Teacher Education: A vantage for teacher training at County Level in Kenya

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Chris Wekesa Mukwa

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Chris Wekesa Mukwa
B.Ed (Nairobi), MA. , PhD. (Michigan State University)

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Abbreviations and Acronyms

ATWS – Association of Third World Studies

AAU – Association of African Universities

ATI – African Telegraphic Institute

AVU – African Virtual University

B.Ed – Bachelor of Education

CCK – Communications Commission of Kenya

CDF – Constituency Development Fund

CAI – Computer Assisted Instruction

CARED – Center for Applied Research in Education

DVB – Digital Video Broadcasting

DVC – Deputy Vice Chancellor

EFA - Education for All

EACE – East African Certificate of Education

FPE – Free Primary Education

GCE – General Certificate of Education

GoK – Government of Kenya

IBM – International Business Machines

ICT – Information and Communications Technology

IUPUI – Indiana University Purdue University Indianapolis

IPR - Intellectual Property Rights

ISP – Internet Service Provider

ISTE – International Society for Technology in Education
IT – Information Technology
KCPE – Kenya Certificate of Primary Education
KCSE – Kenya Certificate of Secondary Education
KIE – Kenya Institute of Education
MIS – Management Information Systems
MoE – Ministry of Education
MoIC – Ministry of Information and Communication
MU – Moi University
NFE – Non – Formal Education
NETS – National Educational Technology Standards
ODL – Open and Distance Learning
SCTI – Science Technology and Innovation
SMS – Short Message Service
TSC – Teachers Service Commission
UN – United Nation
UoN – University of Nairobi
UoE – University of Eldoret
UPS – Uninterruptible Power Supply
USA – United States of America
WTO – World Trade Organization

Acknowledgement

To God be the Glory for granting me and others who participated in preparing this inaugural Lecture, Life, Good health and Knowledge. Let me thank my wife and our children as a family.

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Abstract

Sustainable development of a nation is a result of provision of quality education to its people. Superior education is a product of superior teachers. One aspect of training capable teachers is to appropriately integrate instructional technology in teacher education. It is establilshed that when student teachers receive good education, the social economic sectors of a country will receive graduates who have the much needed relevant knowledge and skills for the job market which in turn will contribute to sustainable development of major sectors of a country. Currently in Kenya, there has been approches of carrying out government activities where there has been a shift from conducting activities from national to regional level with a major focus on counties. One of the sectors that has been affected is education. There is need that when planning, implementing and evaluating educational programmes at the county level, integration of instructional technology and teacher education has to be taken into consideration.This inaugural lecture gives a historical and current context for application of educational technology in teacher education. A description of current resources, policies, philosophies, issues and trends that direct and shape use of educational technology in the classroom is presented. It is apparent that the advances in information and communication technology (ICT) have changed the way individuals live, learn, work, entertain themselves and transact business. Suggestions for the way forward on how teachers and instructional technology interact more effectively and efficiently is given.

Citation

Professor Chris Wekesa Mukwa was born on November 15, 1950 to the late Samson Wekesa Namunaba and the late Leah Nasike Namunaba as the last born in a family of six children at West Lugulu Village, East Bungoma, Kenya (currently Bungoma County). Mukwa started school at Lugulu Mixed Primary School (1956-1964) where he sat Kenya Certificate of Primary Education (KCPE). He passed well and in 1965, joined Friends School, Kamusinga for secondary School Education (1965-1969). He passed East African Certificate of Education (EACE) with a Second Division. Mukwa joined Form V in the same school (1969 - 1970) and sat the East African Advanced Certificate of Education (EACE); he obtained 3 principles and 1 subsidiary. Mukwa joined the University of Nairobi to pursue a B.Ed. (Arts) degree (1971 - 1974).

In 1974 Mukwa started teaching at Chesamisi Secondary School in Bungoma North District. In 1976, he was awarded a fellowship by Michigan State University, East Lansing U.S.A to pursue a Master of Arts degree (1976 - 1977) in Educational Systems Development and Technology. In winter of 1977, Mukwa was admitted to a doctoral degree programme at Michigan State University to continue with the Educational Systems Development and Technology degree programme.

On completion of the doctoral degree programme in Michigan State, Professor Mukwa came back to Kenya in March 1979. He reported to the TSC and was posted to St. Lawrence Primary Teachers Training College at Egoji, in Meru, Kenya (1979 - 1981). In 1981, he was transferred to Mosoriot Primary Teacher Training College in Nandi, Kenya.

In the same year, Professor Mukwa joined Kenyatta University as a lecturer in the department of Educational Communications and Technology. He was then promoted to the position of Senior Lecturer in 1986.

Professor Mukwa joined Moi University in 1988, and was re-appointed as Senior Lecturer in the Department of Educational Communication and Technology, Faculty of Education. At Moi University, Professor Mukwa was promoted to the position of Associate Professor in 2007 and full professor in 2013.

Professor Mukwa while working at Moi University, served as Head of the Department of Curriculum Instruction and Educational Media for two terms (2002 - 2008). He has been Faculty of Education representative in the School of Graduate Studies for several years.

Professor Mukwa has taught at various levels of Moi University Curriculum. He has taught Diploma and Postgraduate Diploma, Undergraduate, Masters and Doctor of Philosophy degree Students. He has examined 30 doctor of Philosophy degree thesis, 80 Master of Philosophy degree thesis and 15 Postgraduate Diploma thesis. He has supervised 170 Master of Philosophy and 72 Doctor of Philosophy degree students up to completion. Professor Mukwa has also worked as an external examiner at University of Nairobi, Ergerton University, Masinde Muliro University of Science and Technology (MMUST) and Kibabii University College in Bungoma.

Professor Mukwa has been involved in various collaborative activities with universities outside the region such as: Indiana University Purdue University, Indianapolis (IUPUI) and Michigan State University in the United States of America. He has published books, book chapters, journal articles and

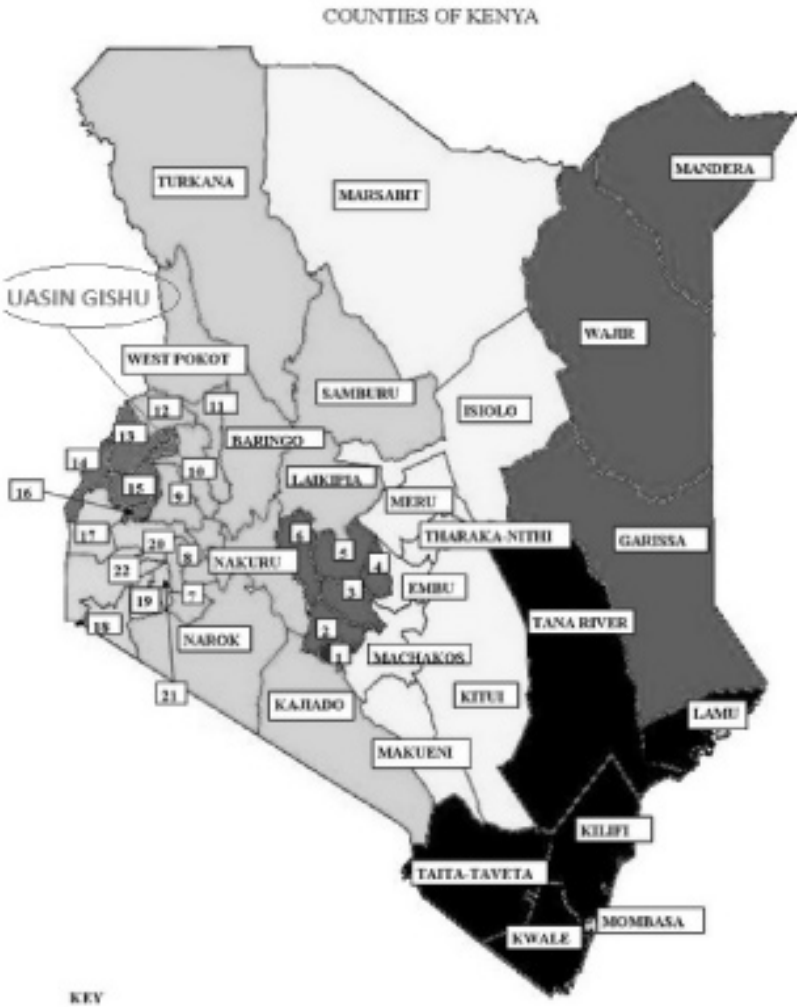
conference papers. He is a founder member and has also served as one of the editors of the Educator, A journal for the school of Education in Moi University. He has attended and presented papers at a number of symposia and international conferences. He has conducted research in Instructional Communications, Media and Technology.

Professor Mukwa is a member of the Association of Third World Studies (ATWS) and Association of Educational Communication and Technology, Washington DC. U.S.A. At the community level, Professor Mukwa has served as a member of the Board of Management in national, provincial, county and district schools within the country. He has been an examiner with the East African Examination Council currently known as Kenya National Examinations Council (KNSC). He served as one of the consultants for the establishment of Friends University in Kenya at Kaimosi. He is one of the founder members of Matatu Association of Kenya.

Professor Chris Wekesa Mukwa is married to Janet Khakasa Mukwa and have five children: Joceline Silako, Hillary Wekesa (deceased), Maxwell Simiyu, Jotham Samita and Samuel Nabiswa. Six grandchildren: Indrae Khakasa, Samuel Omondi Otieno, Natasha Samita, Hope Otieno, Ethan Wekesa and Nadia Samita.

PROF. RICHARD K. MIBEY,FWIF, EBS
VICE CHANCELOR
MOI UNIVERSITY

February 26, 2015.



Map showing Counties of Kenya

Chapter One

Definition of Educational Technology

Chapter objectives

At the end of this chapter, you should be able to:

- Define Educational Technology, ICT and teacher Education
- State and describe the common types of media that constitute instructional media.
- State the benefits and limitations of educational media to a teacher.

Introduction

In this chapter, definitions of main terms encountered when integrating educational technology in teacher education are presented. The resources of educational technology available to the classroom teacher and how the teacher uses them is also examined and presented. Definitions of terms used in educational technology are not defined in the same way by people involved in education.

Definition of Education

Bhatnagea G.P (1972:3) defined education as: "The process of bringing desirable change into the behavior of human beings. It can also be defined as the process of imparting or acquiring knowledge and habit through instruction or study. When learning is progressing towards goals that have been established

in accordance with a philosophy which has been defined for, and is understood by the learner, it is called 'Education'".

Society of Kenya's development has made education to assume various titles such as, Adult Education, Child Education, Technical Education and Vocational Education, Science Education, Physical Education, Arts and Crafts Education, Driver Safety Education and many others. The other broad classification is; Formal Education, Non-formal Education and Extension Education. This inaugural lecture adopts the second classification.

- Formal Education is an institution activity that is uniform, full time, subject, oriented and leads to award of Certificates, Diplomas and Degrees.
- Non-formal education, this is opposite of formal education, it is flexible, diversified in content and method, it is established on learners participation.
- Extension Education – this branch of education combines adult and informal education. It is concerned with educating adults such as farmers, business people, home makers and others.

According to Ngigi, A. and Macharia D. (2006:11) cited in Otunga, R.N (2010).

"The provision of education and training to all Kenyans is fundamental to the success of government's overall development strategy. This is so because first, the long term objective of the government is to provide every Kenyan with basic quality education and training, including two years of pre-primary, eight years of primary, four years of secondary/Technical education and four years minimum university education".

Education also aims at enhancing the ability of Kenyans to preserve and utilize the environment for productive gain and sustainable livelihoods. Second, development of quality human resource is central to the attainment of national goals for industrial development. Third, the realization of universal access to basic education and training ensures equitable access to education and training for all children, including disadvantaged and vulnerable groups. Fourth, education is necessary for the development and protection of democratic institution and human rights (Ngigi & Macharia 2006).

Policy in education

Education and teacher training is governed by various Education Acts of parliament. After independence in Kenya in 1963, various National commissions were set up to review the education sector. They included the Kenya Education commission of 1964 (Ominde Commission). The Ndegwa Commission of 1970. The National Committee on Education objectives and policies (Gachatti Report 1976); the Presidential working party on the second university in Kenya (Mackay Commission Report of 1981); Working party on education and training for the next decade and beyond (the Karmunge Report of 1998); The commission of Inquiry into the Education system in Kenya (Koech Report of 1999) and Sessional paper No.1 of 2005.

The structure of the Kenyan education system at independence in 1963 was 8-6-3. It then changed to 7-6-3 and later to the current system of 8-4-4, which has 8 years primary school, 4 years secondary school and 4 years in the university.

Education is a weapon used to fight some of the dreaded enemies of human beings: disease, ignorance and poverty. When people are equipped with relevant skills, knowledge and attitudes, a

country develops fast in social and economic sectors. The Kenyan government has emphasized the above in the policy document of the Kenya National ICT Master plan – Towards a digital Kenya (April 2014)

Education is considered as a social pillar in vision 2030 and is also a key economic sector consisting of service and value addition activities by various stakeholders. Its economic aspects touch on service delivery and value addition contributing towards business opportunities in the learning, certification and research processes.

Education Technology

Richard Gilkey and Noward H (1977:2) defined educational technology as:

> "Educational technology is a complex, integrated process involving people, procedures, ideas, devices, and organizations, for analyzing problems and devising, implementing, evaluating, and managing solutions to those problems, involved in all aspects of human learning. In educational technology, the solutions to problems take the form of all the Learning Resources that are designed and/or selected and/or utilized to bring about learning; these resources are identified as Messages, People, Materials, Devices, Techniques, and Settings. The processes for analyzing problems, and devising, implementing and evaluating solutions arc identified by the Educational Development Functions of Research-Theory, Design, Production, Evaluation-Selection, Logistics, Utilization, and Utilization-Dissemination. The processes of directing or coordinating one or more of these functions are identified by the Educational Management Functions of Organization Management and Personnel Management". The relationships among these elements are shown by the Domain of the Educational Technology Model figure 1.1.

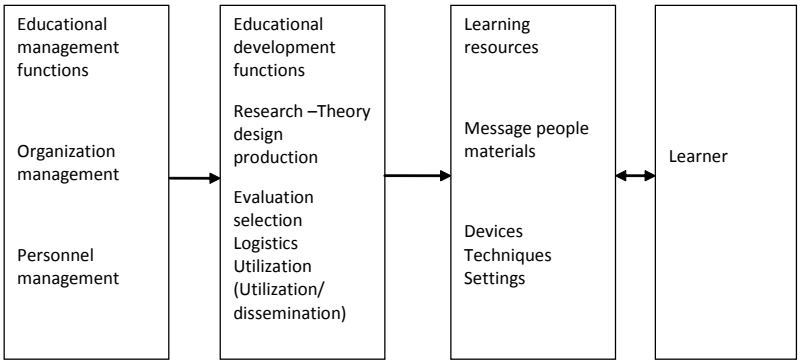


Figure 1.1 Domain of Educational Technology Adopted from Richard Giky and Howard H. (1977)

Instructional Technology

According to Richard Giky and Howard H. (1977) *Instructional technology* is a sub-set of educational technology, based on the concept that instruction is a sub-set of education. Instructional technology is a complex, integrated process involving people, procedures, ideas, devices, and organizations, for analyzing problems, and devising, implementing, evaluating and managing solutions to those problems, in situations in which learning is purposive and controlled. In instructional technology, solutions to problems take the form of Instructional System Components which are pre-structured in design or selection, and in utilization, and are combined into complete instructional systems. These components are identified as Messages, People, Materials, Devices, Techniques, and Setting. The processes for analyzing problems and devising, implementing, and evaluating solutions are identified by the *Instructional Development Functions* of Research-Theory, Design, Production, Evaluation-Selection, Utilization, and Utilization-Dissemination. The process of

directing or coordinating one or more of these functions are identified by the *Instructional Management Functions* of Organization Management and Personnel Management. The relationships among these elements are shown by the Domain of Instructional Technology Model:

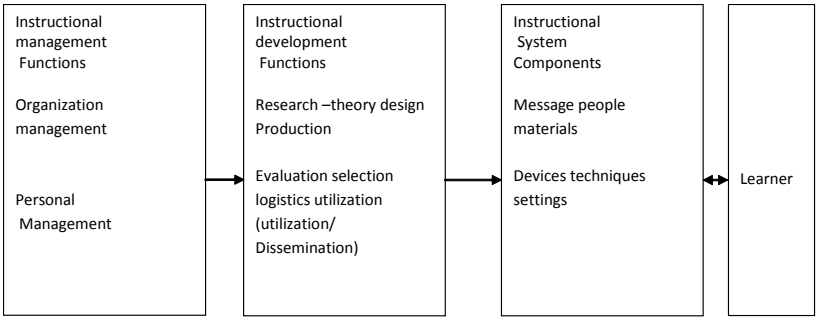


Figure 1.2: *Domain of instructional technology Adopted Richard G and Howard H. (1977)*

Definition Information and Communication Technology (ICT)

Various scholars have defined ICT. Wariga and Waema (2005:60) define ICT as a "gamut of industries and seravices, activities, including internet, service provision, telecommunication equipment and services, Information Technology. (IT) equipment and services, media and broadcasting, libraries and demonstration centres, commercial information providers, networks-basic information services and other related information and communication activities"

Finn, in Eboch (1963:17) defined technology when applied to education as a "complex integrated process for analyzing problems and of devising, implementing, managing, controlling and evaluating solutions to those problems".

Kochhar (1992) argued that countries have introduced educational technology to make education more productive and more individual to give instruction a more scientific basic and to make instruction more powerful, learning more immediate and access to education more equal.

Sessional Paper number 1 of 2005 states that, "The Information and Communication Technology has a direct role to play in education and if appropriately used, ICT can bring many benefits to the classroom as well as education and training process in general. Its uses will provide new opportunities for more student centered teaching, opportunity for teachers to teach and students to learn communication and collaboration, greater collaboration, greater opportunities for multiple technologies delivered by teachers, greater enthusiasm for learning amongst students and offering access to wider range of courses".

Darling H. (2005: 22-24) further suggests that "technology should be infused in all courses so that students/teachers use the tools for practicing and not just learn about them in abstract. Technology integration skills cannot be learned by sitting passively in a classroom, listening to an instructor or watching a demonstration".

The Kenya Government has reported in Wandiga (2008) report,- The National Strategy for University Education, emphasized the need and importance of ICT as a tool for Enhancing Access to teacher Education when it stated: "In order to expand access through e-learning and exploit more efficient course delivery,

there is need to use ICT in spite of the initial high costs of installing infrastructure and commencing operations." (Article 2.4.2.3 of page 41).

With reference to figure 1.2 in the box of Instructional Systems Components, we have "people, materials, devices, techniques and settings". Materials and devices refer to educational media material. The word device refers to equipment and hardware such as computers. Some people look at devices of instructional technology as being computers .It is more than computers. In addition to computer media we have the following types of educational media:

1. Real things - examples of real things include: objects, models, mock maps, specimens, diorama, indoor and outdoor laboratories. Outdoor laboratories include; aquatic terrestrial and geological landscapes.
2. Still pictures - examples include: photographs, graphics, transparencies, film strips.
3. Motion pictures – cinema
4. Audio media - such as tapes, cassettes, radio, compact discs, records and flash discs.
5. Video and Television
6. Computers and Internet
7. Written words and symbols – Text books, magazines, news papers and etc.

The above are some of the examples of instructional media that are used in the classroom. While integrating educational technology in teaching, we should not only focus on computers but also the above types of educational media.

Educational Technology in Teaching

There are numerous advantages of using technology during instruction. Otunga R. N., Odero I., and Barasa P.L. (2011) cited the following applications of technology in teaching:

- The learner reconstructs meaning during instruction not only to benefit knowledge-wise but also to be able to relate this to real life situations appropriately. There is a connection between the authentic classroom activities and the real world; making the learners take greater pride in and ownership of their work.
- Supporting multiplicity of cognitive styles and learning behavior, unlike situations where content is presented to learners without the use of any form of learning aid. The modern forms of technology can be used to translate virtually any content into another media, making it more interesting and accessible to all kinds of learners (Conway,1997).
- Suits varied learning environments, content areas and a wide range of teaching methodology.
- Strengthens teaching and learning. Technology enhances delivery of content and motivates a learner into learning process.
- Contributes to change in schools due to the use of modern equipment thus, the running of affairs in schools is made more efficient and effective.
- Connects school to the world. This is possible through the use of internet.
- Learner achievement is increased because of the ease with which information is accessed.

- Accelerates, enriches and deepens learning of basic skills; learner have an opportunity to work on their own and perfect the skills being learnt.
- Motivates and engages students into learning because they approach learning with curiosity which is vital in stimulating learners. It also acts as a form of stimulus variation; learners are able to learn through different media, and not the usual traditional modes.
- Technology helps to relate academics to the practice of today's workforce. The use of computers and internet have become commonplace in the world of work; thus, they provide vital exposure to various forms of equipment, how they operate and help develop learners in the technical know-how in operation of the equipment.
- Increases the economic viability of tomorrow's workers.

(http://www./santecnetwork.org)

Integrating different forms of technology and resources of the internet into a curriculum is valuable to a classroom teacher and learner. Robertson (1997) outlines a number of challenges of using technology in instruction which include:

- Initial Costs: cost of instruction is increased at the initial stages of buying and installing new technology.
- Training is needed for personnel to use technology for instruction, in class and also to maintain the equipment.
- Many teachers in the field are not conversant with technology utilization and find the integration of technology cumbersome or frightening. In addition, there are teachers who still hold the traditional view of what educational technology is and equate this to the use of equipment to facilitate better instruction.

- Many classrooms in the developing world are ill-equipped to adopt the use of technology. In some areas, it is difficult to access telecommunication networks, yet these are essential for technology integration in instruction.

- Many of these machines, such as computers have a short lifespan and must be replaced after almost every two years to make them complaint. This has two draw backs, that of cost and the problem of disposing the old equipment because they carry radio-active materials. (http://nces.ed.gov/surveys/frss/publications/2000102/index.asp).

The dilemma of integrating educational technology in teacher education

The government of Kenya has stressed the importance of ICT which is part of educational technology as a means of bringing innovative benefits to the classroom, of students and teachers, in Kenya Sessional paper number 1 of 2005.

Educational technology media material and equipment already in use in the classroom were in some instancaes not appropriately introduced into the teachers' application, for example, in some cases, teachers and education management authorities might have seen or heard about educational media being used in another country in the region or reading about educational technology application in teaching. They then acquire the material and start using them in the classroom. One of the consequences of such a move is that users who are teachers in this case will develop negative attitude towards the equipments, vandalize, develop resistance and opposition to any move involving integrating educational technology in teacher education. The purpose of this lecture is to examine alternative and systematic approaches of integrating educational technology in teacher education.

Chapter Summary

This chapter has provided an analysis of the definition of Education, Educational Technology and ICT. It has also presented the benefits and limitations of applying and using technology in teaching.

Chapter Two

Historical Development of Educational Technology in United States and Kenya

Chapter Objective

At the end of this chapter you should be able to:

- Describe the historical development of Educational Technology in United States of America and Kenya.

Introduction

This chapter reviews the major historical definitions, theories and models of educational Technology. This review is not exhaustive, it concentrates mainly on major periods in the history of Educational Technology. Each country has its own history and in this review the focus is in the United States and Kenya as cases for illustration.

Visual Instruction

A visual aid is any picture, model, object, or device which provides concrete visual experience to learners for purposes of (1) introducing, building-up, enriching, or clarifying abstract concepts, (2) enhancing development of desirable attitudes, and (3) simulating further activity on the part of learners. Visual aids are classified according to general types along a scale of concreteness and abstraction. (Hoban, and Zisman, 1937, pp. 9-10)

This was the first comprehensive textbook in visual instruction and the first to be concerned with the integration of visual materials with the school curriculum in the United States of America. (Saettler, 1968, p. 153, about Dorris, Anna V., *Visual Instruction in the Public Schools*. 1928; Italic added)

The visual instruction movement was based on the concept of using visual materials to make more concrete the abstract ideas being taught. In addition to the concept of "concreteness," the visual instruction movement introduced two other concepts which are still useful.

First, it introduced the idea of classifying, rather than listing, the types of "visual aids." Second, it emphasized the need to integrate the visual materials with the curriculum, rather than using them in isolation. (Hoban and Zisman, 1938)

From Visual Instruction to Audiovisual Instruction

From a technical perspective, *audio-visual instruction* is a term used to designate an extensive variety of devices which are used by teachers to transmit ideas and experiences through the eye and the ear. The chief distinction between audio-visual instruction and other forms of instructional techniques is a matter of emphasis. *Audio-visual instruction* emphasizes the value of concrete or non-verbal experience in the learning process, whereas other forms of instruction stress verbal or symbolic experience. *Audio-visual instruction should not be regarded as a method of teaching.* Audio-visual materials are of value only when used as an integral part of the instructional process. (Mc Clusky, 1949, p.g 6)

The models created by communication theorists were dynamic models of a process – indicating the elements involved and the interrelationships among them – and included more than the materials used to transmit the message.

While many models of the communication process were developed (see Ball and Byrnes, 1960), the Source-Message-Channel-Receiver (S-M-C-R) Model presented by Berlo, (1960) is perhaps the simplest and most useful for generating concepts related to educational technology. The model is shown in Figure 2.1

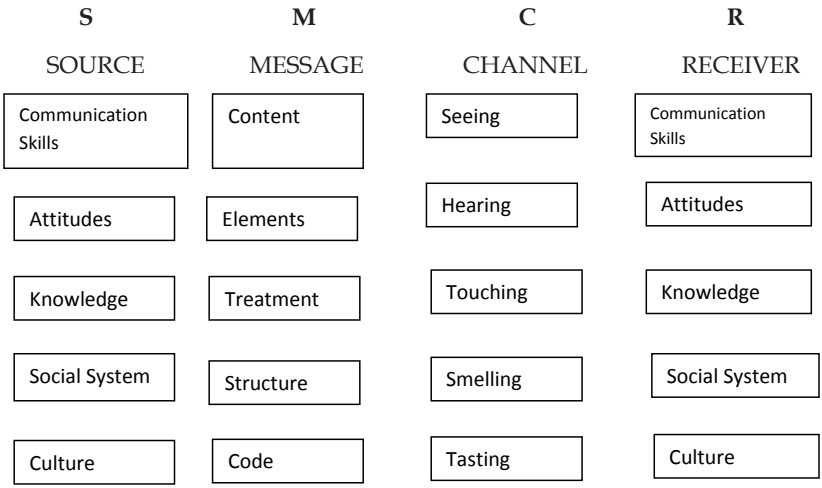


Figure 2.1: *Model of the ingredients in communication*, *Source Barlo (1960:31)*

This model demonstrates the two concepts indicated above. It concerns itself with the entire process of transmitting a message from a source to a receiver and it indicates the elements involved in the process and their dynamic interrelationships. In addition, the model's element brings to light several other important concepts that are used in teaching and learning.

From Audiovisual Instruction to Early Systems Concepts

A system can be defined as an arrangement of components with a common purpose. The importance of the system concept is in the notion of (a) components in a system; (b) the integration of these components, and (c) the increase in system efficiency (Hoban, 1960, p. 110)

The concept of programming and systems analysis implies absorption of the ideas of materials. An instructional material becomes an outmoded, atomistic, pre-technological concept useful mainly to the historians of education. (Finn, 1960b, p. 18)

Synthesizing Communications and Early Systems Components

Communications and Early systems components were looked at as being related and it concluded that "learning theory and communication theory offer the basic concepts for a definition of the instructional technology field," (Ely, 1963, p. 20) and that "in view of a systems approach, the task of the audiovisual specialist may be described as… design of a presentation which utilizes… elements… The appropriate combination of these elements implies a systems approach" (Ely, 1963, p. 24). Thus, the audiovisual communications synthesized the concepts of communication, systems, elements of components of a system, and design of a system.

Influence of the Behavioural Science

The science of behaviour particularly learning Theory is important as an underlying science from which applications to a technology of instruction is likely to be build upon.

The behavioural science input to instructional technology had its origins in Early Learning theories. It therefore started having an impact on the field with skinner's notion of reinforcement and its application in programmed instruction and teaching machines. (Skinner 1968: 4)

Shift from Stimuli to Behaviour and Reinforcement

So far as we are concerned here, teaching is simply an arrangement of contingencies of reinforcement… three variables compose the contingencies of reinforcement under which learning takes place: (1) an occasion under which behaviour occurs, (2) behaviour itself, and (3) the consequences of behaviour. (Skinner, 1968, p. 4, 5)

The theoretical framework of audiovisual communication view of educational technology places heavy emphasis on the stimuli, or messages, transmitted to the learner. It makes passing reference to the fact that there is a response from the learner and feedback to the learner about the response. Skinner's notion of behavioural science reverses this emphasis.

From Audiovisual Communications to Systems Approach and Instructional Development

Recent thinking conceives educational technology as a systems approach to teaching learning process which centres around the optimal design, implementation and evaluation of teaching and learning as such. (Hinst, 1971, p. 41)

The second and less familiar definition of instructional technology goes beyond any particular medium or device. In this sense, instructional technology is more than the sum of its parts. It is a systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of

specific objectives based on human learning and communication theories, and employing a combination of human and nonhuman resources to bring about more effective instruction. (Commission on instructional Technology, 1970, p. 21)

The systematic process of developing instruction is usually presented in the form of a model. Though there is no single universally accepted model, the model presented as Figure 3.5 (according to Wittich and Schuller, 1973) contains the elements and sequence within which most other models can fit.

Wittich and Schuller continued by stating that "the theoretical framework of instructional development serves to synthesize and formalize many of the concepts already discussed: process, systems approach, functions. It is also helpful in expanding and indicating some relationships among: behavioural objectives, criterion-referenced tests, use of appropriate human aid and nonhuman resources, appropriate use of individualized and self-instruction materials, development of complete instructional systems, emphasis on the learner, evaluation and revision of the instructional system and products based on layout with learners, and systematic management- all key elements in applying technology to instruction."

However, the systems approach theoretical framework did not provide an adequate definition of educational technology. First, it does not deal with the total educational – or even instructional – process. For example, it omits the determination of curriculum, the functions involved in distributing and using instructional systems once they are developed, and the activities involved in applying technology to the non-instructional parts of education.

Second, it accepts current institutional and organizational constraints placed upon the design of instruction (the problem noted earlier by Lindvall and Bolvin), rather than questioning and revising them to fit the new instructional systems.

Third, it is less specific than the 1963 DAVI definition about the types of resources which could be used as well as the direct interaction (communication) between the learner and the source of the message (resources).

Fourth, while it is indeed based on a body of theory and research, there is no provision within the definition or the model for generating or testing new theory.

Finally, it is not connected to the realities – both problems and promises – of Galbraith's (1967) "post-industrial society."

From Audiovisual Communications and Systems Approaches to Instructional Technology

Technology is *not* just machines and men. It is a complex integrated organization of men and machines, ideas, procedures, and management… the term "educational technology" *expands* the areas of theoretical development, research and implementation in education. (Hoban, 1965, p. 124)… Instructional technology, in its modern usage, involves the *management* of ideas, procedures, money, machines, and people in the instructional process. As such, it involves:

1. A physical device(s) which mediates information transmission;
2. A system of instruction of which this device(s) is one of several components; and

3. A range of mediating options involving progression in (a) requirements for physical alteration of the "classroom"; (b) remoteness in time and space between the tutor-planner and student;

The growth of instructional technology as a field follows Rostow's (1960) 5 stages of the growth from a traditional society to a high order technology culture.

1. *Traditional society*- science and technology are not available or regularly and systematically applied;
2. *Preconditions to take off*- there are psychological and political changes in society which make people and institutions receptive to technology, and there is the building of a necessary level of capital overhead in society;
3. *Take-off*- The critical mass of preconditions is researched, and some technological innovations that occur act as a sharp stimulus to technological thinking
4. *Drive to maturity* - there are many refined and complex technological processes used, and society's investment in tools is 10-20%;
5. *High mass consumption* - society applies technological processes and resources anywhere it chooses.

Historical Development in Kenya

Pre-computer Era

Basing on USAID (2006), ICT started in Kenya in 1968 when computers were used for markin Kenya Certificate of Primary Education (KCPE). This was followed by setting up a mainframe computer unit at the University of Nairobi for research purposes.

Apart from introducing ICT in Kenya based on computers, there was utilization of school broadcasting programmes using school radio in the early sixties in Kenya. Also, at University of Nairobi, radio programmes were used to teach students who enrolled in correspondence courses under adult study programmes in collaboration with the Ministry of Culture and Social Services.

In 1975, the School Broadcasts were moved to Kenya Institute of Education, currently Kenya Institute of Curriculum Development and placed under Educational Media Service (EMS) .

Computer Era

Keragi (2001) states that, in 1982, the first computers were introduced in Aga Khan Academy in Nairobi, and in the mid 1980's more secondary schools and institutions of learning in Kenya increased their use of computers.

Post Computer Era

In mid-nineties, cellular phones and internet were introduced in Kenya. It has expanded to many sectors, including government ministries, private companies and individual use. For example, the Kenya government according to a policy document highlighted the need for introducing computer education in primary schools.

Chapter Summary

The chapter presents an evolution and development of Educational Technology in the United States and Kenya. This historical development provides a basis for planning and decision making when integrating Educational Technology regionally in Kenya.

Chapter Three

Advocating Use of Technology in Teaching

Chapter Objectives

At the end of this chapter you should be able to:

- State the factors that motivate the use of technology in teaching.
- State those factors that shape the need and rationale for introducing instructional technology in the classroom

Introduction

The previous chapter looked at how the past has influenced today's Educational Technology. Take for example in the USA basing on (Niemice & Wilberg 1989, Roblyet 1992). Educational Technology is presented in two periods before and after the introduction of metro computers. In this chapter, the focus is mainly on the rational for the use of technology in teaching.

Why teachers use Technology in Education

Computer companies and educators learnt about the role technology was supposed to play in education and who could best shape that role. IBM Company pioneered in this field, producing the first instructional mainframe computer including multimedia learning solutions, the IBM 1500. By the time IBM discontinued it in 1975, some 25 Universities were using this system to develop CAI materials.

These efforts were led by a Stanford University Professor and Grandfather of CAI" *Patrick Suppes*, who developed the course-writer language to show reading and mathematics drill and practice lessons. Other similar university-led instructional activities followed, Suppes founded the computer curriculum corporation. The Digital Equipment Corporation created the first instructional minicomputer (Roblyer D. M. 2007)

Micro computer era

The 1970 decade was characterized by the invention of small, stand-alone, desktop computers which gave way to educational computers which movee from companies, universities, school districts to the hands of teachers and schools.

There was also emphasis on computer literacy skills and curriculum. Basing on Seymour Papert's work (1987) there emerged logo programming language which stated that computers should be used as an aid to teach problem solving began to replace traditional instructional computer use (e.g. drills, tutorials) as the best use of technology.

When research was conducted in use of logo programming language, the results captured no impact from its use on mathematics or other curriculum skills, hence the teachers started losing interest in 1990s'.

Internet era

As teachers appeared to be losing interest in technology potential for instruction, there emerged the first browser software (Mosaic) that transformed a firmly text-based internet into a combination of text and graphics. By the end of the 1990's, teachers and students joined hands on knowing and using "the information superhighway". By the start of the 2000's email, online (i.e. web

based) multimedia, video conferencing became standard tools of internet users.

As teachers continued showing interest in using technology in education, the International society for Technology in Education (ISTE) was developed: National Educational Technology Standards [NETS] for teachers, students and administrators.

Don Knezek, CEO of ISTE rolled the NETS on a symbol of leadership and success when he stated:

> "Leadership in technology is best illustrated by ISTE's creation of the National Educational Technology Standards [NETS] first published in 1978. ISTE is now leading the creation of the next generation of NETs. In 1998, it was enough to define what students needed to know about and be able to do with technology. Now we are defining what students need to know and be able to do with technology to learn effectively and live productively in a rapidly changing digital World." (Don Knezek ISTE CEO, 2007)

What Have we Learnt from the Past?

Knowledge about the history of education technology can be useful if we can apply what we know about the past to future decision making and activities. In doing so, the following issues should be put into consideration according to Roblyer DM & Onering H. Aaron (2007).

i. There is no single technology that is best for education. The past has taught us that even the most current, capable technology resources offer no quick, easy, or universal solutions.

ii. Cuban (2001) proposes that technology was "oversold" from the beginning and is not having the system-changing impact many thought it would.

iii. If one starts with more realistic expectations in mind, there is more potential for success and impact in teaching and learning. Planning must always begin with an analysis of the needs of students.

iv. Computers and technological literacy offer limited integration approach. Most people and educators want technology tools in the classroom mainly because they believe that technical skills can give students the technological literacy required to prepare them for the job market.

v. The capabilities of technology resources and methods must be matched to the skills that display an obvious need for application of reading, writing, computational skills in the current educational system of a given country.

vi. Teachers in most cases do not develop technology teaching and learning material.

vii. In most societies, teaching turns out to be labour intensive and takes a lot of time with several demands on the teacher, most teachers cannot be expected to create or develop teaching materials.

viii. Technically possible "is not equal to "desirable, feasible or inevitable." Technology has enabled teaching practice assessment online. But we still have teachers who want to travel to the field driving in order to assess student teachers on attachment. A case like this one although technology makes issues possible some teachers still see it as not possible. Hence better technology demands that we become critical consumers of its powers and capability. In the final analysis it will turn around that we decide to do what is possible.

ix. In certain instances, environments change faster than teachers can cope with.

x. History has shown that education is dynamic. New curricular get introduced. All these changes place a burden on already overworked teachers. Teachers are supposed to continue learning new knowledge, how to use new teaching resources and changing their methods of teaching. People in education may not be able to predict the future of educational technology but they know it will change and therefore they must be prepared to adjust to the new changes.

xi. Teachers will always be more important than technology. With the new technologies that come into existence, there is always an older question that resurfaces "will computers replace teachers? Yet the answer to this old question is the same and will remain the same. Good teachers are more essential now than ever. In a society that is in need for more teachers who are both technology compatible and student-centred.

Rationale for advancing use of Technology in Education

Instructional Technology in Education

Many educators look to educational research for evidence of technology's present and potential benefits. Clerk L. (1983, 1985, 1991, 1994), argues that research for example attempts to show a greater impact on achievement of one delivery method over the other without controlling the factors such as different instructions, instructional methods, curriculum contents and etc. Kozma (1991, 1994) responded to these challenges by proposing that research should look at technology not as an information

delivery medium but as "the learner actively collaborating with the medium to construct knowledge. (1991, p. 179)

Research Evidence

According to the *Centre for Applied Research in Educational Technology (CARET),* Technology works best when it:

- Directly supports the curriculum objectives being assessed
- Provides opportunities for student collaboration
- Adjusts for student ability and prior experience and provides feedback to the student and teacher about student performance or progress with the application.
- Is integrated into the typical instructional day.
- Provides opportunities for students to design and implement projects that extend the curriculum content being assessed by a particular standardized test, and
- Is used in environments where teachers, the school community, school and district administrators support the use of technology.

The *Centre for Applied Research in Educational Technology (CARET), http://caret.iste.edu.*

The Kenya Government in the National Strategy for University Education, Wandiga (2008:217) emphasized the significance of research and development when it stated that, "To enhance the quality of programmes in public universities in Kenya, the government and the private sector should allocate funds for research, while faculty must commit themselves to defining the research agenda and undertaking research projects vigorously." The report further stated that: "The research enterprise in Kenya

is constrained by poor coordination and harmonization between researchers and research institutes, inadequate funding allocated to research and diminishing motivation for researchers."

Making the Case for Technology Integration.

According to Roblyer M.D and Aaron H.D (2007: p.15), the following are issues to be considered when integrating technology in teacher education:

1) To motivate students
2) To enhance instruction
3) To help students learn and sharpen their cognitive, affective, and psychomotor skills.
4) Helps in illustrating the relationship between skills and real life situations.
5) Technology increases students and teachers productively through time, money saving, and accessing information fast.
6) Helps students learn and shape their information skills through technological literacy – word processing, simulations, and games.

Chapter Summary

This chapter has examined the factors that motivated the use of technology in teaching and has also looked at important factors to be considered when introducing instruction technology in the classroom.

Chapter Four

Main Issues Concerning Education and Technology

Chapter Objectives

At the end of this chapter you should be able to:

- State correctly key issues that concern education and integration of technology in a specified environment.
- Explain and relate how these issues affect the integration of educational technology in a classroom.

Introduction

There are issues that affect using technology in teaching which a teacher should be aware of. Integrating technology successfully in teaching will not work smoothly unless these factors are addressed. Roblyer M.D and Aaron H.D (2007, p.17) listed the following factors as being essential in integrating technology in teacher education:

Societal Factors

Societal factors that play the role of shaping educational technology include:

Reduction in funding educational programmes

There has been reduced funding by the government and education sector was one of those affected.

Anti-technology critics of education

There are people in the society who feel that teaching and learning is already established and therefore there is no need integrate technology in teaching. It should be integrated in other fields like Transport, Agriculture, and Tourism.

Other critics say that computers as a component of ICT pose potential health problems like. poor eyesight. In addition, internet cyber cafes pose risks particularly for minor/young people accessing to pornographic material.

Figure 4.1: Photograph of Technology Critics

Impact of Legislative laws

Laws governing how schools should the money are being enforced and the money is always scarce.

Bearing these factors in mind, it is necessary to use research findings to establish sound basis for technology use in education.

Educational Issues Shaping Current Technology Uses

Emerging Learning Perspectives

Agalo, J. and Oluoch J. (2014) present challenges of integrating ICT in delivery of Educational programmes when they state that "These compounding factors constrain the need to prioritize investment in technology and its institutionalization in order to improve service development and delivery in integrating ICT in the delivery of education programmes, they are both technology related and skills based challenges" In addition the type of learner, reliability of technology and availability of adequate technical support are critical components that should be addressed and regularly reviewed for quality to be maintained.

Evaluation

Kenyan system of evaluating student performance is based on educational results. These results make basis for decision making and student placement. Technology plays an important role when integrated appropriately in the evaluation of teacher/student performance.

Reliance on internet

Registration for courses in public and private institutions of higher learning is normally done on-line.

The internet is also used for Distance Education. Through virtual learning, students have access to high quality skills. Critics have criticized distance education especially for the delivery of practical oriented/ based subjects.

Changing curriculum

Methods used in teaching have remained the same for several years. New methods of teaching are being added to new ones. These new methods could be adopted faster if technology is used as a catalyst in introducing and adopting such methods of teaching in the curriculum.

It is essential to establish how current Educational Technology Media material and equipment will communicate to users; how it is likely to benefit students, learning institutions and the entire community where the learning institution is located. It is also important to establish how educational technology will to contribute to teaching activities and the main goals of students. Teachers should try to establish whether the difficulty level of teaching corresponds to the understanding abilities, attitudes and skills of student.

The integration of educational technology should be focused on individual specific subjects offered in the school.

The Kenya Government (Wandiga Report, 2008) supports curriculum integration with educational technology. It recommended that:

- Integration of ICT in university will lead to effective participation and contribution to knowledge and business operations thereby enhancing social-economic development of the country.
- Use of ICT will enhance e-learning as a means of complementing other modes of delivery.

- Embracing ICT will open up channels for acquisition, updating and dissemination of knowledge.
- ICT will enrich teaching, learning and research etc
- Key recommendation 7.1 page 226 (National strategy for university education, 2001-2015)

The Role and Importance of the Teacher

According to Connections Learning for Development (November 2014, Vol. 19 no 3 pp. 10) "some may argue that with the advances in technology, the role of teachers has been diminished and perhaps we soon shall have no need for them. The truth however, is that we shall continue to need teachers even as technology advances: the difference is that the role of the teacher is changing. Teachers have to make a paradigm shift from teaching to facilitating wherein technology complements and supplements their role. Teachers need continuous support to help them adapt to this changing role"

Cultural Issues Shaping Technology Uses

Digital divide

Refers to the interface in access to technology resources among the socio-economic groups. Economic status is what determines the level and sophistication of technology one receives or has access to.

A study by the Corporation for Public Broadcasting (2003) in the United States found that while children from all income levels have greatly increased their internet use, children from underserved populations e.g. low-income and minority students all lag behind other students in home and school access.

Rural Verses Urban and Gender Equity

Technology use in some instances remains dominated by males and certain ethnic groups. For example in the Kenyan environment, ethnic groups living in the Arid and Semi-Arid Areas (ASAL) of Kenya compared to those living in the cities and major towns do not have same access to ICT facilities and use.

Lower use of technology leads to lower entrance into technical careers. Even where computers are available in school, there tends to be unequal access to certain activities. In one instance students can use computers for remedial work rather than for e-mail or multi-media production.

Special Needs People

Students with physical and mental challenges require specialized uses of Technology. In some cases they require specialized gadgets that are at times not readily available. Currently like the students who are visually impaired use brail for reading and writing. What is required is a modern technology that is free from trouble shooting, less noisy and more effective when used.

Legal and Ethical concerns that are affecting current Technology uses

Education is one of the large sectors of society, whatever that happens in education affects the society at large. For example, when there is a teacher strike other activities in the society are also affected.

Cyber Security

Virus and hacking involve writing or creating a program that will do mischief, cause problems that range from system malfunction, loss of files to total system failure.

Hacking involves breaking into on-line systems to access or modify personal data on students and teachers, and other malicious activities.

To handle these problems, globally, nationally and at county level educational institutions are forced to install firewalls and anti-virus software to safeguard classroom and personal computers.

This kind of investments in an effort to safeguard data and systems costs institutions and individuals a lot of resources.

Literary Theft (plagiarism)

Plagiarism is an act of stealing and passing off ideas or words of other people without according credit where it is due. It is a form of literary theft.

Accessing on-line material has in some instances resulted into practices such as "cyber cheating" this is where students use materials they find on the internet and books as their own.

Due to the outcry from local authors there has been need to set up databases and software such as "Turn-It-In" within institutions to help curb this vice. The system is additionally used to check submitted articles to ensure that the work submitted is original.

To reduce or control plagiarism globally, nationally and at county level a workable system has to be implemented when integrating technology in teacher education at the County in Kenya.

Privacy and Safety of Material

Material in the form of personal information, background information of students and their lectures are being placed on-line and students spend more time using on-line material. Social media sites such as facebook, tweeter, whatsapp, instagram and my space are very popular with young people.

Based on hear-say stories we have incidences of on-line predators to contract students and objectionable material is readily available and easy to access.

In places like the United States of America, these issues are being settled through schools by getting parents and students signing up an agreement guarding access to student personal information. There are also filtering software to prevent access to objectionable materials.

Copyright

On-line presentation of full-text publications are now on the increase. Open and distance learning programmes are also using published material. It is therefore important that copyright laws are adhered to. Programmes have to be put in place during the implementation of educational technology County level to sensitize the students, teachers, general public on these copyright issues.

Illegal Downloading of Software (Piracy)

Of late, we have instances whereby make-shift or booths have been set up where copies of software and other media material in form of books, journals and magazines are downloaded and sold without paying for royalties.

The above issues need to be looked into with viable solutions. The Kenyan government has made recommendations on measures that can take care of the issues in a policy document titled The Kenya National ICT master plan towards digital Kenya (April 2014).

The recommendations are contained in table 4.1

Areas/Laws	Legal Gaps	Recommended Action
Data Protection	Privacy law that considers collection, accuracy, storage, use, third party disclosure, security and right of access to information	Fast track presentation of Data Protection Bill to National Assembly
Access to information	There's need to facilitate access, promote routine and systematic information disclosure and provide the protection of persons who release information of public interest in good faith	Fast tract presentation of the Freedom of information Bill to the National Assembly. Develop requirements for public entities and private bodies to proactively disclose information that they hold and to provide information on request in line with the constitutional principles.
Cyber Security	Absence of law governing how the networks will be secured and the interaction between the various government agencies involved	Fast track development of cyber security law.
ICT Authority Act	Change the governance and mandate of ICTA in order to make it effective for providing leadership in ICT in the public sector.	Create an ICT Authority Act to Strengthen the role of ICTA

Co-development	Lack of technical skill to implement and support the proposed projects	Develop a law that will support empower and facilitate social development of the citizens through technical skills and knowledge transfer
Information and communications (Ammendments)	Clarification of issues of intermediary liability	Synchronization and ease of implementation of laws.
Intellectual property Act	Does not consider as intellectual property since it is considered under the copyright law.	There is need to move software intellectual property concerns from the copyright Act to IP Act.
Public Procurement Act	Does not distinguish between purchase of non technical items from technical items	Amendments to correctly procure large technical products and services specifically ICT solutions and services.
Public Archives and Documentation Service	Alignment to other new laws	Provide an amendment
Record Disposal Act Cap 14	Alignment to other new laws	Provide an amendment

Table 4.1 Legal gaps and recommendations. Adopted from the Kenya National ICT master plan (April 2014) pages 120 and 121

Learner Characteristics and Advances in Technology

To start with, the school of Education was set up initially to train teachers who would then teach in primary and secondary schools. Emphasis was mainly on teaching. As changes occurred over a period of time there has been a shift to emphasizing the learner as focus for planning teaching.

Different learners have emerged through these institutions of teacher training. Examples of learners comprises school-based students teachers, evening students many who work during the day and go to study in the evening, then those studying at a distance need to be catered for in teacher preparation and training.

The training of these various types of student teachers can be catered for through application of advances in ICT such as:

- E-Learning
- OERS, MOOCs
- Learning Management Systems (LMS)
- Computer Managed Systems (CMS)
- Flipped Classrooms.

Chapter Summary

In this chapter, an over view of issues concerning Education and Technology were examined and those concerning technology and society. Then there was a discussion on cultural, education, social and ethical considerations. It was revealed that these were issues shaping today's technology uses in education.

Chapter Five

A Basis for Planning Teacher and Technology Integration

Chapter Objectives

At the end of this chapter you should be able to:

- State the necessary ingredients of teacher and technology integration.
- State systematically the steps followed when integrating technology into teacher Education.

Introduction

In this chapter we are looking at the basis upon which technology integration can be established. Models that can serve as a base are provided with specific illustrations at national and regional levels.

Technology Integration

Mishva & Kochler, (2006) argue that, for one to understand, define and explain technology integration in the classroom, it is better presented and explained with the help of models. The model attempts to capture essential qualities of knowledge required by teachers for technology integration in teaching. This model is presented in figure 5.1

Figure 5.1 Technology integration model

The model presents to the teachers an overview of some of the challenges expected in integrating technology in teacher education. The model has six levels. The six levels help to ensure that technology use will be meaningful, efficient and successful in meeting the teacher needs. The model provides issues and procedures that a new teacher can address. For the new teacher he or she can use them as a guide. Let us examine each of the phases:

The phases of the model are based on Roblyer M.D and Aaron H.D (2007, p.51 - 61)

Phase 1: Reflection on Technological Pedagogical Knowledge Content

- *Teacher to reflect on his/her knowledge, attitudes, skills and technology*. Teacher should be aware of the technologies to integrate within content area.

- *Teacher's knowledge of Pedagogy*. Teacher to be aware of the ways they stimulate learning through the teaching methods,and resource materials including e-learning.

- *Teacher's knowledge of content*. Knowledge of content on specific subject area is necessary for developing meaningful learning experiences in the classroom.

1) ***Determine Relative Advantage***

In a subject area, there are topics that are easier to teach and others difficult. Students find certain topics in a course interesting while others are boring and difficult. Integrating technology in teaching can help solve some of these problems.

This issue of relative advantage require that a teacher ensures that the technology application is a good solution to a problem by first starting to analyze a clear statement of the teaching and learning problem.

- *Do not focus on technologies*. Focus on the problem and not technology. For example, a teacher stating that students do not know how to use internet. If teachers have a technology available but choose not to use it. This may mean that they do not see the need of using it.

- *Look for evidence*. Look for observable symptoms that there is really a problem. For example when students consistently achieve lower grades in a skill area.

- *Find out if technology based methods can offer a solution by*:

  * Estimating the impact by finding out what others who have used the technology as a solution have gained or lost and why.

* Consider required effort, expenses involved, time and resources required to implement the solution.

2. *Decide on objectives and Assessment*

Focus on:

- Higher achievement outcomes.
- Cooperative work outcomes.
- Attitude outcome.
- Improved motivation.
- Expected outcomes of using the methods.
- Best ways of assessing the outcomes like. using written tests, Questionnaires, among others.

3 Designing integration strategies

Teachers normally carry out several designs and decisions as they integrate technology in teaching.

- Teachers to decide on teaching and learning material
- Types of instructional methods to be used.
- How technology can support methods of teaching and preparing students to learn through technology.

4. Preparing the Instructional Environment

Most teachers decide how they will teach in light of technology available for use in teaching.

Essential conditions for effective technology use comprise the following:

- Hardware, software and Media- e.g. adequate computers and legal copies of instructional resources.
- Time to use resources.
- Money to purchase hardware and software.
- Special needs of students.
- Planning, testing of technological equipment and software.
- Arranging resources to support instruction and learning e.g.
  * Providing access for challenged students.
  * Considering privacy, safety issues and, for example, carrying out an experiment safely in the laboratory.
  * Planning in a way that technology works wells, considering trouble shooting areas like equipment breakdown.
  * Test-runs and back-up plans, there should be sufficient time for practising using equipment before students use them.

5 Evaluate and Revise Integration strategies

The students and teachers need to establish whether the integration worked well by addressing the following evaluation issues.

- Were the objectives achieved?
  * This deals with the success of the integration activity.
- What do students say? Some of the best suggestions usuallycome from students.
- Could improving instructional strategies improve results?

Technologies do not usually improve results significantly; it is the way teachers use them that is important.

- Could improving the environment improve results? At times a small change, can make a great improvement in a project work.
- Have I integrated technology well?
- What could be improved to make the technology integration strategy work even better?

(Robler D.M and Doering A. H. 2007, p. 51-61)

Chapter Summary

This chapter has presented a basis that is essential for integration of technology in teacher education. A model referred to as technology integration planning model for teachers was presented accompanied with illustrative examples.

Chapter Six

Important Conditions For Integrating Technology In Teacher Education

Chapter Objectives

At the end of this chapter you should be able to:

- State correctly and prioritize essential conditions of integrating technology in teacher education.
- Explain how the integrated technology can provide a vantage for sustainable social economic development at county, nation and at regional levels.
- State important policy issues that have to be borne in mind when integrating educational technology in teacher education.

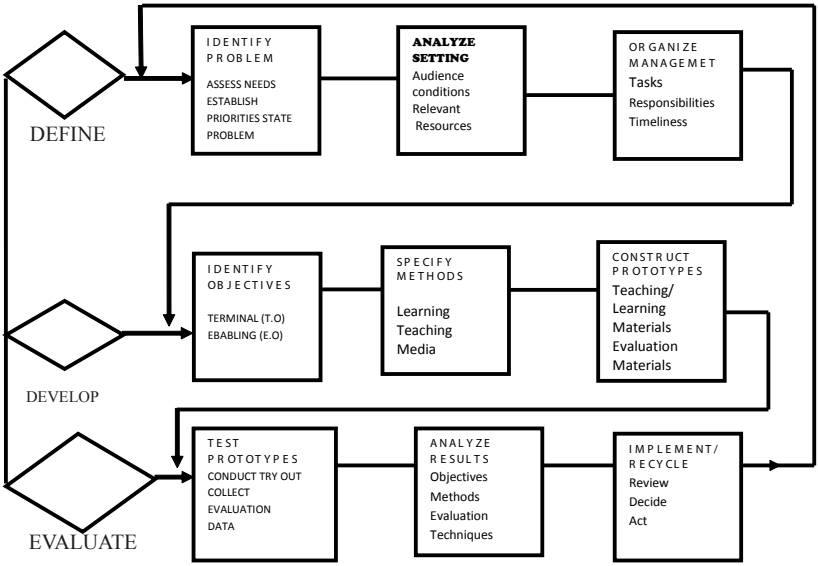
Introduction

In order for technology integration to work best and have far reaching implications these issues must be considered. When teachers complete training and get posted to schools or their working stations, their ability to apply technology in the classroom will be determined by whether the educational programmes have fulfilled the requirements presented here under.

Needs assessment

There is need for county educational institutions to diagnose educational problems and relate these problems to development issues and how educational technology can help meet educational needs. County education planners could conduct needs assessment using models like the nine step educational system development model presented as figure 6.1 below.

4.1 Educational Systems Development Model



Educational System Development Model

Figure 6.1 Source special media program 1976

Planning and Implementation

There is need for planning and pilot testing of Educational Technology integration before large scale county implementation starts. Along this end, there should also be a training programme for teacher professionals. Roblyer and Erlange, (1968), state that to learn technology, participants should have opportunities of practicing integration skills, they should train over time and practice after training.

Further educational development process approach should be followed, this approach is presented below:

Educational Systems Development Process

A study of educational development systems serves to synthesize and formalize the concepts of process, systems approach, functions integrated organization and interactive relationships.

It identifies the elements within an integrated organization such as people, procedures, ideas, and machines. At the same time it emphasizes that each is but a single element. Most important, it emphasizes the role of management as a major concern of educational technology. All of the aforementioned elements must be managed and controlled so that the system operates effectively and efficiently.

The notion of efficiency and financing is highlighted in this way: educational technology aims at expending money in such a way that it maximizes effectiveness of the people, processes and equipment.

The concept of people is defined in three dimensions:

a) Specialization and

b) Differentiation in levels of work done.

c) Feed back is collected and examined in operational terms.

The Three Stages of Problem Solving

Stage I Preparation

Identify the problem (s)

This stage involves assessment of needs: one has not only to define the apparent status quo and what would be ideal situation, but also discover the underlying causes of the problem situation, identify those causes and determine their relative importance. Commitment must be made to provide the necessary time, energy and resources to bring about a satisfactory solution.

Analyze Setting

Here the focus is on the human and functional factors involved in any significant change in the existing system. If a change is to be brought about successfully, we need to be able to recognize and identify the people in the school system who serve as gatekeepers, decision makers, opinion leaders, and change agents. Further, how they carry out these functions is greatly influenced by such human factors as whether they are inclined to be early, middle, or late adopters of new ideas and whether they go about dealing with problems in a creative, defensive or an emotional manner – and to what degree?

Such an analysis is essential in that it assists in locating approaches or strategies needed to gain support for changes which may be proposed.

This analysis should be done in an informal and casual way but with due care especially when a new or a particularly important programme is at stake.

Organize Management

Educational systems development requires well–defined organization, management and scheduling. Specific controls must be established to ensure that task assignments are carried out, expert assistance is identified and arranged for when needed and that appropriate communication takes place with others on ideas, problems and other developments as they occur. In order to ensure task completion by an agreed time, time schedules must be set up to indicate target dates for completing each of the elements involved in the process.

The following management factors are important

a) Who is given the responsibility and necessary authority to accomplish each specified task?

b) What teaching and learning alternatives should be considered and what personnel and material resources can be brought to bear?

c) When and in what sequence they are to be brought to bear in order to meet the proposed objectives and deadlines?

d) How are personnel and material resources deployed and how is the total system organized to function in an effective manner as measured by predetermined specified standard levels?

Stage II: Development

Define your Objectives

- State your terminal performance objectives:
- State intermediary objectives and determine relationships between them and your terminal objectives
- Construct performance measures.

The terminal performance objectives must be spelled out first and then the intermediary or enabling objectives. Finally, performance measures must be constructed for each objective so that we can know definitely whether or not it has been achieved.

Specify Methods

Here we must determine what are likely to be the best methods and materials to employ under the circumstances in order to attain those objectives. An examination of what is practical considering available resource personnel, equipment and facilities is done. Now and then " trade – offs must be made to reach a workable decision – for instance, it might be desirable to introduce a television system but it is not available or is out of reach financially, the best practical alternative should therefore be sought. This is the stage where we get concerned with media, along with other materials. Decisions are made after identifying both the specific needs of learning situations and the particular advantages of various media in satisfying those needs.

Construct Prototypes

This is in the design, procurement and production stage. Having decided on the kinds of learning experiences and materials most likely to be effective for the target purposes, we then spell them out in detail.

A comprehensive description of teaching and learning design specifications is prepared together with a detailed design for the evaluation of teaching and learning. A study is planned on how designs are executed.

Then follows a technical assessment of teaching, learning and evaluation designs. This implies that specified procedures for collection and development of teaching and learning materials have been explored.

Last comes the construction and assembling of teaching and learning materials and the specification of procedure to be used by personnel during the tryout period for teaching and learning prototypes.

Stage III: Evaluation

Test Prototypes

At this stage, the produced package is tried out with a representative group of the target population in order to collect evaluation data on what works, what does not and why. It is likely that certain revisions and alterations might be needed before the newly developed systems is tried in a regular classroom.

After conducting evaluation, the information gathered is tabulated and processed.

Analyze results

A determination of the relationship between results, methods, objectives and goals is conducted. Of major importance is close observation of all aspects so as to note which further adjustments might be needed either in the teaching and learning design or in the materials used. It is also important to test along the way to ascertain how well enabling objectives are being met, and at the end of the unit, how adequately the terminal objectives have been achieved.

Implement/Recycle.

An indication of necessary revisions (if any) should now be suggested after results have been interpreted and methods, objectives and goals scrutinized. One has to determine if suggested revisions indicate that the prototype is to be completely recycled or if the design could be implemented without major revisions

The above stages of the educational system development process are summarized diagrammatically in figure 6.1.

Research and Development

There is need for systematic research in education and development which assist design and production team with relevant learning material and assist administrators to the decision affecting effective utilization of educational technology integration.

Research in Instructional Theory

There is need of conducting research at the Counties based on the following theories:

Behaviorist Theories

According to B.F skinner (1968), these studies were based on operant conditioning concept that was postulated by a Russian physiologist by the name, Ivan Pavlov who viewed learning as physical response to outside stimuli. According to skinner, learning processes occur inside the mind and cannot seen directly, it is inferred from Behaviour.

Information Processing Theories

According to this theory, learning is encoding information into memory. Much of the work on information processing theory is based on a model of memory and storage of information proposed by Atkinson and Shiffin (1968). They state that the brain contains three kinds of memories that process information just like a computer. The three are: Sensory register, short term and long-term memories.

Cognitive-Behavioural Theories

The main psychologist under this theory is Robbert Gagne. According to Gagne, learning is shaped by a sequence of instructional events appropriate for the type of learning.

Systems Approach Instructional Design Model

This theory was developed by Educational psychologists Robert Gagne and Leslie Briggs (1971:80), who developed a method of applying Principles Learned from Military and industrial training to developing curriculum and instruction for schools. According to these two learning is most efficient where supported by a well designed system of instructions.

Research should be conducted in Counties on stated four theories of learning. This should be followed by an analysis of research findings on educational and Technology Integration Strategies.

Information derived at the County level instructional environment can now be used in teacher education training curriculum to train teachers.

The importance of research was emphasized by the Kenya Government in the National Strategy for University Education, 2007 – 2015 in key Recommendation 3.1 page 81, "we need to appreciate and build on existing research infrastructure and ongoing reforms in order to improve quality."

Research on the theories of learning and findings based on children and environment at the county should be used in the integrating technology and teacher education at the County taking into consideration circumstances under which education technology works best, testing on the methods of teaching.

Ndaula S. (2009) supports the issue of research and development when he made the following recommendations after a study conducted in Uganda.

Basing on his findings and conclusions of this study, the following recommendations are made:

1. The study illustrated no significant difference in attitudes between how male and female attitudes towards the use of the Internet. Drawing upon Hargittai's (2002) findings about gender mentioned earlier, this finding demonstrates that both the female and male can adopt the technology in a manner that fits their everyday practice. With the increasing diffusion of technology, some of the differences between genders can disappear.
2. Nduala S. (2009:147-148) continued to state that: "It is worth noting here that one very important factor in this study is the issue of computer ownership. Computer ownership is one of the variables that many researchers have intensively investigated and found to be a significant factor that influences attitude toward Internet. For that reason, at Kyambogo Unuversity (KYU) there should be a policy in which all students taking ICT classes are provided with a personal computer at subsidized prices. Students' loan schemes can also be initiated to enable students acquire personal computers."

Criteria for Selecting Educational Technology Software and Hardware Material and Equipment

The selection process starts by setting up a selection panel which could consist of a diverse composition representing all spheres of ICT and teacher educators.

Upon setting up of the panel, a job card describing their individual responsibilities in the equipment selection is created. Each panel member should have powers that enable him/her to reach the final decision in affairs related to his/her work. The panel should also establish an operation plan that would indicate how they will coordinate the whole process.

The following criteria apply equally to most ICT media equipment and material used commonly in primary, secondary schools and tertiary institutions of learning:

Portability

The teacher must know whether the piece of equipment is easy to handle and move around with it.

Strength

It is essential to find out whether the piece of equipment can give good operation service with minimum problems during its life span. Find out if it is free from vibration during its operation, whether the joints can sustain movement, and connections are light or strong.

Costs

In comparison with other equipment prices find out whether the price is reasonable and competitive.

Ease of operation

It is essential to find out whether the teachers and students can operate the equipment effectively and whether it is easy to learn to operate it. One also has to see if the control mechanism is easy to use, whether the equipment is free from operation peculiarities such as loose parts that have to be removed and re-inserted.

Quality of performance

The teacher has to determine how well the ICT media equipment meets performance standards. Does the equipment do what it is supposed to do, well enough and consistently?

Effective design

Teachers have to find out whether the appearance and shape of ICT equipment is attractive and free from unfinished or rough exterior parts. Further, teacher should determine whether the equipment was designed with school use in mind. For example: a tape recorder, slide projector or record player designed for home use only may not be designed strongly enough for daily handling by students without frequent need for repair and service.

Ease of maintenance and repair

Find out whether necessary minor adjustments can be made easily and quickly. The teacher also needs to determine if the parts are standard and easily available for purchase within the county or geographical region.

Manufactures reputation

One should choose an equipment manufacturer who has the greatest probability of staying on the market as opposed to those who will close prematurely.

Existing local equipment

Consideration on whether to shift from existing equipment should be evaluated carefully. If switching implies, then one need to replace all similar units owned. The new device should be compatible with the existing one.

Service availability

Confirm if emergency services are available nearby and weather there is adequate spares and service team at your disposal in the county or region.

Educational Technology Software and Hardware

There is need to access educational technology hardware and software. Funds to be solicited to purchase hardware and software learning resources; centers in the county to set up or to modernize those that are already in existence so that they match new equipment.

Sustainability means that a plan for initial and sustainable funding over time must be in place.

It is suggested that at the county level, a media center should be set up. If there is one already in existence, it should be restructured and re-organized in harmony with the requirements of integrating educational technology at the county level.

Curriculum Bearing

Design content area and technology to support each other. There is also need to integrate individually each teaching subject with educational technology.

Funding

- Adequate funding from central government, large companies and state cooperation
- Contribution through fund raising
- Writing good successful funding proposals to be submitted to funding agencies e.g banks and NGO's

The government of Kenya supported funding for University teacher training when it stated in its National Strategy for University Education, (2007 – 2015 page 151) that:

1. Identify strategic academic and capital development programmes.
2. Develop modalities of HELB working jointly with CUE in programme funding.
3. Attract private sector and development partners to provide support in strategic programmes.

In another document "Digital Kenya" (Apirl 2014) the Kenya Government stated that:

The following are sources of funding for ICT master plan.

The government shall fund the foundational pillar through a re-focused expenditure planning

There is need to be exposed to characteristics of successful applications of funding which involve:

- Having ideas of how to make things better
- Keeping in constant contact with funding opportunities.
- Having things already written up so that they are able to respond quickly when an opportunity arises.
- Having one or more good writers at hand.

Building on success.

In order to keep up with receiving external funding, educators who have a funded project have to do the following:

1) Carry out what they proposed – to show that you did good things with what you received.
2) Publicize their success.
3) Generate new funding opportunities.

Social Economic Development

There is need for social-economic development in which teachers and students teachers interact with the community. Student teachers go for teaching practices in schools in a community and postgraduate students go for research in industries that are located in their community. Undergraduate go for internship in industries and other social sectors. Individuals also venture into partnership with student teachers like those owning private learning institutions.

In a policy document titled Towards Digital Kenya (April 2014) the Kenyan government has made recommendations concerning how to improve the socio economic development of the country using ICT innovation and research. If teacher training is improved through Technology integration in teacher education, this will yield better teachers for the job market. Good teaching is a vantage of turning out a higher caliber of teachers who in turn contribute positively to the socio economic development of the region and in turn the whole nation.

Technical Assistance

There is need for skilled personnel and openings for professional development. Pre-service teacher training needs to incorporate a program containing service training in how to integrate technology effectively in teaching. Technology equipment change so rapidly and therefore there is need for continued training and refresher courses for teachers. Reblyer and Evlanger (1998) have suggested the following requirements:

- *Hands on integration* emphasis Technology integration skills cannot be learned by sitting passively in a classroom listening to an instructor or watching a demonstration. Participants have to get hands on practice.
- *Training over time* – There should be continuous in-service training sessions, for example, what is in use at the present school based programmes.
- *Modeling, mentoring and coaching* – Instructors who model the use of technology in there own teaching long have been acknowledged as the most effective teacher trainers. (Handler, 1992: Wetze, 1993)
- *Post – training access* – Teachers need access after training to practice and use what they have learned. Proper trained personnel requires professional development for all professionals involved in technology within learning institutions – teachers, media specialists, administrators and others.

There should be arrangements at the County level of teacher programmes in the form of continued professional development. In such programmes, teachers can learn not only the latest instructional technology but also the most effective methods of teaching involving technology integration in the classroom.

Appropriate Teaching Assessment

Depending on technology integration model, teachers are expected to assess students performances. During educational technology integration each teacher requires some training in the detection of trouble shooting points in using educational integration equipment such as computers and projectors.

Buban, Kirkpatrick and Peck (2001) cited equipment problems as a major obstacle to effective technology integration. It is suggested that learning institutions support teachers through replacing, repairing and purchasing equipment for classroom use.

Local leadership

For an innovation to succeed, all interested parties should be involved at all stages and levels of the community, school and the county. Civic leaders, teachers, parents and student leaders must be involved throughout integration of educational technology in teaching.

Policy application

There is need for required policies to be developed and put in place. As mentioned in chapter four, these policies are required because schools are affected by legal-ethical issues. Effective and efficient integration of educational technology in teacher education requires schools and county policies to be reinforced. Enforcement of copyright laws and national strategy for education training that was formed in June 2006 must be reinforced.

Teacher motivation

Teachers who use instructional technology in teaching and those who do not use it in teaching are treated equally. As such, those teachers using instructional technology should be motivated to sustain their continued use of instructional technology in teaching. They should be provided with financial assistance to purchase software for classroom use, attending short courses, and conferences on the integration of technology in teaching.

Motivation of teachers can take the form of incentives such as promotion to the next grade, monetary gains, giving study leave with pay, issuing of certificates and recognition in terms of involvement in regional and international familiarization trips.

Teachers using technology be given opportunities to accompany government delegations when visiting other countries in the region or internationally.Teachers who do not support integration of instructional technology in teaching should be held accountable.

Figure 6.2 Photograph of motivation of teachers

Need to consider alternative uses

There is need for considering alternative uses of educational technology in the county. Each provision of educational technology into the education of the disadvantaged, those with visual, auditory, mental and physical challenges - non school population through open distance learning and virtual learning.

Chapter Summary

In putting into consideration the past experiences of educational technology integration in teaching, the inaugural lecture is skeptical about the long lasting educational improvement occurring by use of educational technology unless many of the suggestions raised in preceding chapters are put into consideration by county planners, decision makers, implementers, and teachers. What educational technology cannot do at the county level must be recognized so that the educational potential for integrating educational technology in teaching is to be realized and also a conducive environment where teachers and technology integrate efficiently, effectively and productively.

References

Agalo J., & Oluoch J. (2014). Emerging Learning perspectives: Technology as the driving force. *International Journal of Current Research*. ISSN: 0975-833x, vol. 6 issue 03 pp 5828 - 5832

Aguti J.N (2003). A study of ID service distance education for secondary school teachers in Uganda. Teacher Education Programs. *Unpublished PhD. Dissertation*, University of Pretoria.

Ajiboye, J.O (2007). University Undergraduate students' information seeking behavior implications for quality in higher education in Africa. *The Turkish online Journal of Education in Africa.* The Turkish online Journal of Educational Technology – TOJET January 2007 ISSN: 1303-6521 volume G issue 1, Article 4.

Anderson, D.K, & Reed, W.M (1998). The effects of Internet instruction, prior computer experience and learning style on teachers' internet attitudes and knowledge. *Journal of Educational Computing Research*, 19 (227 – 246).

Applebbe, A. Pascoe, C. & Clayton, P. (1996) Tidal wave or ripple? The impact of internet on the academic. Australian Library Review, 13(2), 147-153.

Association for educational Communications and technology. (1997)

Educational Technology: Definition and Glossary of terms vol. 1 Washington, D.C: Association for Educational Communications and Technology.

Bhatnagar O.P (1992). *Communication for Education and Development*. New Delhi: Oxford & IBH Publishing.

Barlo, David (1960). *The process of communication*, New York: Hott and Richard Publishers.

Kochhar S.K (1992). *Methods and Techniques of Teaching*. New Delhi: Sterling publishers.

Dale, E. (1954). *Audio visual methods in teaching* (Revised Edition) New York: Dryden Press.

Eboch, (1963). Ely, Donald P. (ed) The changing Role of the Audio Visual process in education: A definition and Glossary of Related terms, TDP managed No. 1 AV Communication Review vol. 11, NO. 1 supplement No. 6.

Finn, James D. "Automation and Education, Technology and the instructional process "AV Communication Review vol. 8 No. 1 winter 1960 pp. 5-26

Gagne, R.M. (1973). Learning and Instructional Sequence. In F.N. Kerlinger, et., *Review of Research in Education I. Etasca, III: F.E.* Peacoak, pp. 3-33.

Gagne, R.M. and Basshen O.G. (1963). Study of Retention of some Topics of Elementary Non-metric Geomerty. J*ournal of Education Pyschology.* 54: 123-131.

Galbraith, J. K. (1967) The New Industrial State, New York: Signet Books

Gathuthi, E W. Mukwa C. and Kimengi I.N (2011). *Instructional Media, Performance Quality Assurance and Standards.* Lambert Academic Publishers.

Hinst K, (1971). Educational Technology: Its Scope and Impact: consequences for educational policies and the organization of the teaching learning process. *Educational Technology* Vol.11, No.7, July1971.

Hoban, C. F.A (---) Systems Approach to Audio Visual Communication" key note address at the Lake Okaboji Audio – visual Leadership Conference, Lake Okoboji, IOWA.

Hoban, C. (1960) '*The Unable Residue of Educational Film Research" in New Teaching Aids for the American classroom*, Palo Alto, California, Stanford University Press. (Institute for Communication Research)

Hoban, C. F (1965) From Theory to Policy Decisions. *AV Communication Review*, Vol.13 No.2 (http. // caret . iste.org)

Jeruto, F. (2013). An investigation of Primary Schools Teachers' competencies in planning for instruction: The case of primary schools in Nandi South District.(unpublished M. Phil. Thesis, Moi University, Eldoret).

Kavagi, L. (2001). The use of computers in Secondary Schools: A survey of schools in Western Kenya (unpublished M. Phil. Thesis, Moi University).

Kerre, W. B. (2010). Technical and Vocational Education and Training (TVET). A strategy for National sustainable development. Moi University *Inaugural Lecture 9 series* No. 1 2010 Moi University, Moi University Press, Eldoret.

Mwaka, M., Nabwire, V.K., Ethusaman J. (2014). *Essentials of Instruction: A handbook for school teachers*. Eldoret: Moi University Press.

Mukwa C.W. (1985). *Design and Use of Educational Media in Primary Education* / Kenyatta University and London, Institute of Education

Mukwa C.W. (1979) Towards a systematic approach to educational media use in The secondary school education of the Republic of Kenya. A field survey of tools and technologies for learning. Dissertations microfilms abstracts. International Ann Arbor, Michigan, USA

Mukwa C.W. (1986) Educational Communication and Technology, Part one General methods. Nairobi: University of Nairobi

Mukwa C.W. (1987). *Educational Media*. Nairobi: University of Nairobi.

Mukwa C.W. and Too J. A. (2001). *General Instructional Methods*. Eldoret: Moi University Press.

Mukwa C.W. (1982), Guidelines for selecting, evaluating and utilizing written words and symbolic materials. *Kenya Teacher Magazine*, Nairobi, Kenya.

Mukwa C.W. and Too J. (2000). Gender and classroom challenges in mathematics in Secondary schools in Kenya. *The Journal of Education and Human Resources 3* (2) Egerton University, Nakuru, Kenya.

Mulambula S.M, Mukwa C. W. and Simiyu A.M (2001) Evaluation model of needs satisfaction in change evidence from Kakamega District Education. *The Educator* Journal. Moi University Press.

Mukwa C. W. (2007). Training of Secondary School Teachers in Third World Countries 1(2). *The Educator*. Moi University Press.

Mukwa C.W. (2007). *Communication, Change and Technology: an analysis of their application to African extension education*. Eldoret: Moi University, Press.

Onditi O.S (2013) Effect of computer Assisted learning on learner attitude and mastery of content in Science in Primary Schools in Kisumu East District, Kenya. Unpublished M. Phil, thesis. Moi University, Eldoret.

Otunga R.N., Odero I.J. and Barasa P.L. (2011). *A Handbook for Curriculum and Instruction*. Eldoret: Moi University Press.

Patel, M. M, and Mukwa C.W. (1993). *Design and use of Media in Education*. Nairobi: Lectern Publications.

Rotumoi L.K.T (2013). The influence of Instructional resource availability on the choice of teaching methodology by pre-school teachers in Kenya: A study of Baringo County. Unpublished D. Phil, Thesis, Moi University, Eldoret.

Richard A. and Howard H. (1977). *Definition and Glossary of Terms*. Association for Education and Technology, Washington DC.

Rostow, W.W. (1960) *The Stages of Economic Growth*. Cambridge: Cambridge University Press.

Roblyer, D.M. & Onering H. A. (2007). *Integrating Educational Technology into Teaching*, 5th edition. Boston: Allyn & Bacon.

Robley, M. P. (1991) Electronic hands across the ocean: The Florida England connection. The computing teacher 19 (5) 16-19.

Sifuna D.W. (1998) A study of school dropouts in Givis High Schools. A case study of Bungoma District in Kenya. *Journal of Educational Research*.

Skinner, B.F (1968). *The Technology of Teaching*. New York: Appleton Century – crafts.

Saettler P. (1958). *A History of Instructional Technology*. New York: McGraw – Hill Book Company.

USAID (2006. *ICTs in Education Options Paper*. Nairobi: Ministry of Education.

hhtp://www.santecnetwork.org

http://nces.ed.gov/survey/frss/publications/2000102/index.asp

http://caret.i.ole.org

Wariga, B.N. and Waema, T. (2005). ”The Institutional Structures and Models for Implementing the Kenya National ICT Plan” In Outa et al. (eds) *Mainstreaming ICT Research Perspectives from Kenya.* Nairobi: Mvule Africa Publishers,