DIFFERENTIAL EFFECTIVENESS OF PLAIN AND MULTIMEDIA ENRICHED SEX EDUCATION INSTRUCTIONAL MATERIALS ON SECONDARY SCHOOL STUDENTS' ACADEMIC PERFORMANCE IN TANZANIA

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CERTIFICATION

The undersigned certify that he has read and hereby recommend for acceptance by the Open University of Tanzania a Thesis entitled: **"Differential Effectiveness of Plain and Multimedia Enriched Sex Education Instructional Materials on Secondary School Student's Performance in Tanzania,"** in full fulfilment of the requirements for the Degree of Doctor of Philosophy of The Open University of Tanzania.

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Professor Issa Mchollo Omari

(Supervisor)

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Date

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DECLARATION

I, Hyasinta Catharine Francis Kessy, do hereby declare to the SENATE of The Open University of Tanzania that, this thesis is my own original work and that it has not been presented, and will not be presented to any other university, for a similar or any other degree award.

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Signature

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Date

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ABSTRACT

This study assessed the differential effectiveness of plain and multimedia enriched instructional materials on students' academic performance. Using between groups experimental design, three treatment groups were given a variety of enriched instructional materials. The groups comprised of : 54 students exposed to audio visual materials, 54 students were taught by audio aided instructional materials, 53 printed multicolour, and 54 printed plain as a control group. Multiple choice and matching item questions were used in the pre and post tests to assess student's knowledge of the given set of materials before and after the experimental treatments. The post test result scores were used as dependent variables while multimedia enrichment was the independent variables. Results from the tests showed that differently enriched materials were not equally effective in facilitating academic performance.

The audio visual group was found to perform significantly superior (56.76%) than the printed plain ($p= 0.001$); audio aided group performance was significantly higher (52.31%) than the printed plain ($p=0.05$); printed multicolour group performed higher (49.57%) than the printed plain group (45.54%) but not statistically significant at ($p=0.23$). However, the correlation between gender and performance in different multimedia enrichment levels was only significant in the printed multicolour instructional materials in favour of boys. The study recommends the use of multimedia technology in the preparation and use of instructional materials for secondary schools. The study further recommends studies on teachers' competence in developing, embedding and using multimedia enriched instructional materials.

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CHAPTER ONE

1.0 BACKGROUND AND STATEMENT OF THE PROBLEM

1.1 Introduction

This chapter provides the background to the problem and the situation of sex education in the global, regional, and local contexts. It also covers the statement of the problem, the study objectives, hypotheses and concludes with the conceptual framework of the study.

1.2 Multimedia Instructional Materials

The process of teaching and learning involves the use of different instructional materials to convey the necessary information between teachers and learners. Instructional material includes any physical medium via which instruction is presented to learners (Janovsky, 2003). Multimedia is the use of more than one concurrent presentation medium that applies interactive computer applications, such as graphics, text, video, sound and animation, with the goal of delivering a message. Professionals in multimedia use computer software to develop and manage online graphics and content (Nalliveettil & Ali, 2013). Multimedia may also include all means of instructional delivery, from live instructor to textbooks and such items as charts, kits, magazines, newspapers, pictures, recordings, slides, transparencies, videos, workbooks, and electronic resources such as software, CD-ROMs, and online services (Dubey, 2014).

Traditionally, educators viewed instructional media as supplementary means of presenting instruction where they had the authority to decide what instructional media to employ. For instance, in the 1950s, teachers could decide to combine

written texts with static pictures or graphs as in printed materials (Reiser, 2001). Subsequently, the introduction of modern technology led to the development of information systems and learning environments that combine more advanced forms of instructional media. Furthermore, technological advances in radio broadcasting, sound recordings, and motion pictures led to the so called audiovisual instructional media that have the ability to present concepts in a more concrete manner (Saettler, 1990). According to Reiser (2001), the most important audiovisual instructional technology was the television which seemed to have faster speed, efficient, as well as inexpensive means of satisfying instructional needs.

Moreover, since 1995, rapid advances in computers and other digital technologies as well as internet, have led to increased interest in their use for instructional purposes. A survey of more than 750 training industries revealed that, the percentage of training delivered via such technologies as CD-ROM and internet rose from less than 6% in 1996 to 22% by 2000 (Somon, 2004). From this point of view several forms of instructional media and multimedia can be employed by teachers in the classroom for the purpose of enhancing the teaching and learning processes.

Multimedia is a combination of static and dynamic media in one interactive computer application. Psychologically, multimedia is a combination of information presented to different senses such as seeing, hearing, and touching that can be actively influenced by the user (Hasebrook, 2005). Most researchers agree that multimedia has a considerable impact on various aspects of education. Multimedia learning systems aim at helping learners to construct knowledge structures about a subject matter and updating their knowledge about a specific topic. They also allow

multiple ways of self regulated learning that lead to more elaborated and better applicable knowledge systems (Mayer, 2005; Schnotz, 2008). There are several types of instructional materials including printed plain and printed multicolour, audio as well as audio visual materials. This study assessed the differences in the effectiveness between these instructional materials in learning sex education.

1.3 Types of Instructional Materials

There are several types of instructional materials that can be used in secondary schools and other levels including printed, audio, as well as audio visual materials.

1.3.1 Printed Plain Instructional Materials

These are paper based instructional materials. They represent the traditional way of conveying information in most of Tanzanian schools and colleges. The font colour in such study materials is black and principally the readability of the paper based material is low (Kessy, 2012). This type of media conveys information through the eyes of the reader. Research shows that printed texts can only be improved to enhance learning by highlighting with different colours or adding textual cues such as underlining, italics, and boldface (Armbruster, 2010). This type of instructional material was used in this study as a control group and the academic performance of other treatment groups were compared to its performance in order to obtain the most effective instructional material for teaching sex education in secondary schools.

1.3.2   Audio Assisted Instructional Materials

Audio is an electrical or other representation of sound (Rubery, 2011). Such materials are primarily for hearing and include spoken words, audio cassette tapes,

audio compact discs (CDs), and the machines on which they are played. These materials are frequently used in schools to present music, stories, poetry readings, and speeches (English Curriculum Development Institute, 2010). Students can record and listen to themselves with the help of tape recorders and similar devices. Lectures can also be recorded for later uses. In this study a lesson on sex education was presented through a CD for a group of students to learn and its performance was compared with the performance in printed plain instructional materials.

1.3.3   Audio Visual Instructional Materials

These are the materials designed for both seeing and hearing. They include motion pictures, television, and videotape. There is integration of several forms of media hence the term "multimedia" (Mayer, 2008). Multimedia takes the advantage of both the auditory (ears) and visual (eyes) channels in working memory to deliver content most effectively (Paivio, 1986; Sternberg, 2003). Multimedia instruction challenges teachers to develop a new facilitative teaching culture, to improve learning and using communication technologies to teach more effectively. A good example is video conferencing an effective multimedia teaching where a single facilitator can teach several classrooms at the same time (Hovenga, 2011). Again, this type of instructional material was involved in the study and the resulting academic performance was compared to the performance in the control group so as to get the most effective type of instructional materials.

1.3.4   Printed Multicolour Instructional Materials

These types of instructional materials resembled printed plain instructional materials in one way as well as audiovisual instructional materials (Roy, S. C. 2015). They

resemble the former type because they were prepared in paper materials with black fonts as in the printed plain. The difference between the two types of instructional materials was the presence of illustrations in the later. Such illustrations were of different colours hence, the resemblance with the audio visual instructional materials. These two types were different because the audio visual instructional materials were presented to the learners on a screen through projector while the printed multicolour materials were in paper form. The results in academic performance from printed multicolour instructional materials were as well compared to the performance in the control group.

1.4 The Principles for Multimedia Learning

Mayer (2014) introduced a study insisting on how multimedia learning differs in different combinations. According to Mayer learning should not be viewed as a commodity that can be taken from the outside world and placed in someone's head but new knowledge needs to be related to prior knowledge, rearranged, and try to get the meaning. Multimedia helps learners to understand concepts through words and images. He proposed the following principles of multimedia learning basing on the fact that people learn better from words and pictures than from words alone as revealed in Figure 1.1.

Coherence Principle: People learn deeper when extraneous words, pictures, or sounds are excluded.

Signalling Principle: People learn deeper when there are cues highlighting the main ideas and the organization of the words.

Redundancy Principle: People learn more deeply from animation and narration than from animation, narration, and on on-screen text only.

Spatial Contiguity Principle: People learn more deeply when corresponding words and pictures are presented near rather than far from each other on the page or screen
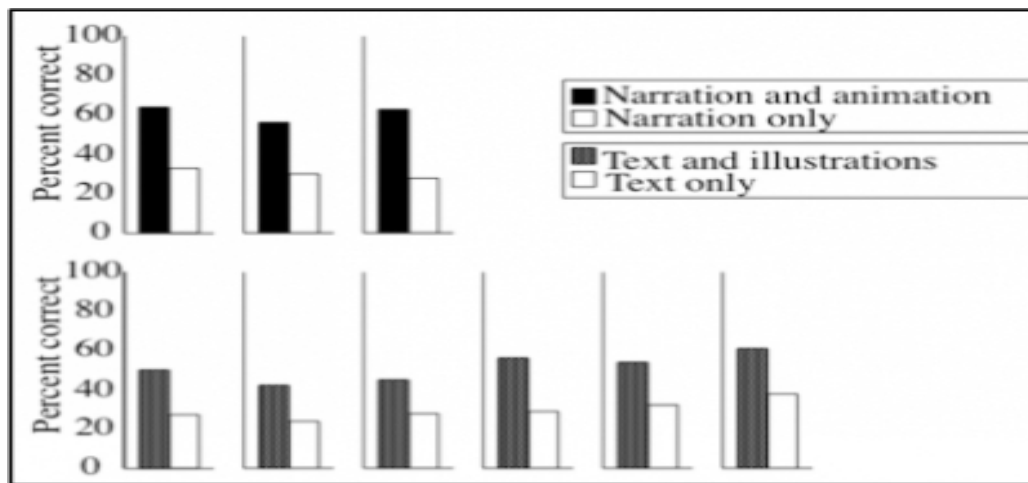
Figure 1.1: Learning from Words and Pictures
Source: Mayer, E. (2014)

Temporal Contiguity Principle: People learn more deeply when corresponding words and pictures are presented simultaneously rather than successively.

Modality Principle: People learn better from graphics and narration than from graphics and on-screen text only.

Segmenting Principle: People learn more when a narrated animation is presented in learner speed than as a continuous unit.

Personalization Principle: People learn deeper when words are in conversational than formal style.

Voice Principle: People learn deeper when the narration is spoken in a human voice than a machine (Mayer, 2014)

Hence, when teachers design for multimedia learning the information should be based on a theory of how the human mind works as well as basing on research findings. This study aims at assessing the most effective multimedia enriched instructional material to be used in teaching sex education in secondary schools.

1.5 The Concept of Sex Education

Sex education is perhaps the most discussed topic in current education literature due to its presumed effectiveness in the attempt to prevent HIV infections and other STDs (UNESCO, 2009). Sex education is conceptualized differently in different contexts and thus given several names such as sexuality education, family life education, sex and relationship education, sexuality, and HIV/AIDS education (Mkumbo, 2008). Generally, sex education programme is focused on HIV/AIDS and STDs prevention and other health and relationship issues including a process of acquiring information about sexual behaviours, forming attitudes and beliefs about sex, sexual identity, reproductive health, relationships, intimacy, marriage, as well as making informed choices about sex behaviour (Sex Education Forum (SEF), 1999).

Historically, adolescents were not well taught about sexual matters. Such topics were considered to be banned and were provided traditionally by parents and in rites of passage just before marriage (Ogunjimi, 2006). Thus, sexual information was lacking especially during puberty when interest of sexual matters was most heightened. This insufficiency became increasingly evident by the increasing youth

pregnancies, STDs, HIV and AIDS pandemic. Soon after, as part of each country's efforts, programmes on sex education in schools were instituted, initially over strong opposition from parents and religious groups (Saodah, Pute, Abu, & Syed, 2009).

For example, according to Population Council (2012) several programs were initiated in African countries including: The Botswana Skills for Window of Hope series including Life Skills Frameworks (2010); Malawi Life Skills and Sexual and Reproductive Health for primary and secondary schools (2010) and Guidance and Counselling program (2008). Kenya and Uganda had comprehensive sexuality education program titled "*Let Us Talk About AIDS*" in 1999 and Adolescent Sexual Reproductive Health/Life Planning Skills O-Level Curriculum Series that was infused in English Syllabus, Biology, Geography, Christian Religious Education and Islamic Religious Education Syllabuses respectively in the year 2009 (Population Council, 2012).

The council further revealed that in Lesotho sex education programs were infused in Standard 4, 5, 6, and 7 as well as Form A, Form B and Form C while in Malawi it was delivered through Life Skills Series (Primary Level) and Life Skills and Sexual and Reproductive Health Education Series (Secondary Level). It was also reported that Namibia had a comprehensive sexuality education program for Grades 5-7, Grades 8-10, as well as Grades 11-12 and Swaziland programs included comprehensive sexuality education for HIV prevention; delayed sexual debut; preventing, identifying and reporting abuse as well as Guidance and Counselling Program (Gordon, 2007).

1.5.1   Sex Education in the Global Context

The 1960s witnessed the launching of the debate on sex education in the United States of America schools. Precisely, in 1990 the United States Public Health Service strongly advocated for sex education in schools, labelling it as an "urgent need." Two years later, the American Medical Association in conjunction with the National Education Association, published five pamphlets that were commonly referred to as "The Sex Education Series" for schools (Priscilla, 1998). Furthermore, in France, sex education has been part of school curricula since 1973, while in Germany the programme is a governmental directive by law since 1992 (UNESCO, 2000).

In some countries such as Poland, sex education was delayed due to strong objection from the Catholic Church (Mikolaj, 1999). Sex education programmes are considered by various individuals and organizations to be of great importance, especially in the prevention of HIV, AIDS, STDs and unintended pregnancies. For example, Finer and Philbin (2013) show that adolescent pregnancy rate in the United States of America is double the rate in England, France, and Canada, and nine times the rate in the Netherlands and Japan and also each year in the United States, approximately 850,000 or (8 percent) of all adolescents between the ages of 15-19 become pregnant.

This has resulted in 30 percent of all girls in the United States of America having a second child before their twentieth birthday (Davis, Brown, Lazard, George, & Shirley, 2010). Moreover, a UNICEF (2014) report indicates that, among adolescents aged 15−19 years old in the developing world, 11 percent of all girls and

5 percent of boys have had intimate sex relationship before the age of 15 and this pattern is seen in all regions. Early sexual intercourse can result in early childbearing and increases the risk of HIV/AIDS and other STDs infection (UNICEF, 2014). Adolescents comprise 18 percent (1.2 billion) of world's population which is estimated to add up to 1.3 billion by 2030 and almost one in every fifth person on the globe is an adolescent (Sekhar & Singh, 2013; UNFPA, 2013).

According to Sekhar and Singh (2013), adolescents and youth in India experience several negative sexual and reproductive health outcomes such as early and closely spaced pregnancy, unsafe abortions, maternal deaths, STD, HIV, AIDS, and sexual violence at an alarming scale. For example, a study done in 144 countries worldwide by Nove, Zoe, and Neal (2014) revealed that, one in every five women aged 15–19 years experience childbearing before 15 years of age and the risk of maternal mortality among such group is twice as high compared to mothers aged 25–39 years. Additionally, schemes on sex education programme, in some countries are not allowed. Like the Government of India sex education plan led to a major controversy where the opponents argued for a ban on starting sex education in schools on the ground that it corrupts the youths and offends Indian values (Sekhar & Singh, 2013).

1.5.2 Sex Education in African Countries

Like in the western countries, the importance of sex education in Africa has increased recently due to its potential in reducing the HIV and AIDS pandemic among the youths (Langfeldt, 2011). Most governments in Africa were forced to set up sex education programmes in collaboration with the World Health Organization

and non-governmental organizations due to HIV and AIDS. In Kenya for example, since 2005, the Ministry of Education released the first national policy document that placed emphasis on objectives and verifiable indicators for managing sex education in schools. Through the Kenya Institute of Education, efforts were made to ensure that information on sex education was integrated within relevant subjects across the curriculum and the primary school curriculum now incorporates aspects of sex education including drug abuse, HIV, child rights, moral values and life skills education (UNESCO, 2010).

Besides, the Kenya Primary Teachers College curriculum has been harmonized with the revised primary school curriculum and now includes information on sex education (UNESCO, 2010; Mondoh, Chiuri, Changeiywo, & Omar, 2007). Nigeria has been implementing a comprehensive sexuality education led by Action Health (AHI) since 1990s whereby community-based organizations have been working jointly to improve the sexual and reproductive health of Nigerian adolescents (UNESCO, 2012). With funding and technical support from external agencies, including international NGOs, these organizations have been implementing model projects with secondary school students, out-of-school youths, parent groups, CBOs, religious leaders and policy-makers (Philliber Research Associates, 2009).

Consequently, the year 2009 was planned to be a year for urgent action by African governments, young people, and civil society to re-affirm the rights of young people to a better future. The Ministries of Education have been given a duty to make good quality HIV, sex education, and reproductive health services a reality for all in the region. It has been found that 63 percent of people living with HIV and AIDS

worldwide are found in Sub-Saharan Africa, while five youths are being infected with STDs including HIV every minute. The statistics did not include the unreported cases in remote areas (WHO, 2015; Nyambane, 2014). A report by UNICEF, (2012) shows that it is a big challenge to provide youths with appropriate HIV/AIDS and STDs-related information and services and cultivating a protective environment for them because many countries where HIV prevalence among adults is above 5 per cent, prevalence exceeds 3 per cent among girls aged 15–19; in Swaziland for instance, it is 10 per cent.

Again, in Sub-Saharan Africa, more than one in four women has given birth before the age 18. However, there are differences among countries. In the West Africa for example,,51 per cent of women aged 20–24 in Niger gave birth before age 18, whereas in Mali the figure is 46 per cent and in Guinea 44 per cent. This can be compared to the average in the developing world, which is only 20 per cent (UNICEF, 2014). This predicts that the vulnerability of adolescents to HIV/AIDS and STDs has been associated with early marriages. Today, approximately 2.2 million adolescents aged 10–19 live with HIV which breaks down to 1.3 million adolescent girls and 870,000 adolescent boys (UNICEF, 2014). Additionally, adolescents are extremely vulnerable because of their age, biology, legal status, drugs, those involved in sex work, as well as adolescent males who have sex with other males (UNICEF, 2014). Sex education is expected to reduce all these problems if well planned and conducted in schools.

1.5.3 Sex Education in the Tanzania Context

Sex education in Tanzania has been conducted by parents and elders early before colonial era (Mbeo, 1997). This type of education prepared youths to take their future roles as responsible adults, parents, workers and citizens (Anangisye, 2008). The introduction of colonial education in the 1880s, led to abolition of the traditional sex education and the government was forced to inherit formal colonial curriculum that excluded sex education (Bilinga & Nkuba, 2014). Consequently, in early 1960s Tanzanian youths knew little about sex and reproductive health, adolescents were unable to make informed decisions about premarital sexual activities as a result there was a need to initiate sexual education in the school curriculum (Muze, 1979).

The introduction of formal sex education in Tanzania started since 2004 as Life-Skills Education program (URT, 2004). This program consisted of HIV/AIDS, STDs and Life skills education. Specifically it involved provision of basic information and facts concerning the transmission and prevention of HIV and STDs and promotion of responsible sexual behaviours such as delayed and protected sex. Sex education is incorporated in Biology and Civics subjects in secondary schools as indicated in Figures 1.2 and 1.3. However, though the average HIV infection rate has declined by 32 percent in Sub Saharan Africa, it is not the same among Tanzanian youths. Literature reveals that more than 60 percent of all new HIV infections in Tanzania occur among youths aged 15–24 years (United Nations Office on Drugs and Crime (UNODC), 2014; UNAIDS, 2013).

Moreover, recent data from Tanzania HIV/AIDS and Malaria Indicator Survey (THMIS) points out that the number of HIV/AIDS infected youths aged 15-19 is

higher than the older generation. Additionally, a study done by Mkumbo on *An Exploration of the Psychosocial Factors Affecting the Development and Delivery of School-Based Sex and Relationships Education in Tanzania* revealed that youths aged 8 or 9, have already experienced sexual intercourse (Mkumbo, 2008). This predicts that school going youths are in danger of becoming infected by HIV/AIDS and other STDs. Similarly, THMIS (2012) revealed that, 9 percent of women and 10 percent of men aged 15-24, the school going age, had experienced sexual intercourse for the first time before age 15. This situation is worsened by the fact that individuals infected with STDs are two to five times more likely than uninfected individuals to acquire HIV infection if they are exposed to the virus through sexual contact.

In addition, if an individual is infected with HIV and also infected with other STDs, the individual is more likely to transmit HIV through sexual contact than other HIV infected persons (Wasserheit, 1992). For example, a systematic review of the interactions between sexually transmitted diseases and HIV by Rottingen, Cameron, and Garnett (2001) revealed that STDs like Herpes Simplex Virus (HSV), Syphilis, Cancroids, and other Genital Ulcer (GU) diseases significantly increase HIV shedding from the genital tract as displayed in Figure 1.2.

Students are most likely to practice sexual intercourse in dangerous and unprotected situations and in danger of being infected. Hence, sex education is very vital for young people and ensuring that HIV incidence does not increase in the coming years. While sex education is taught in Tanzanian schools, statistics shows that pregnancy is the leading cause of girls dropping out of school. About 30 percent of women under 18 in Tanzania are already mothers (National Bureau of Statistics of

the United Republic of Tanzania, 2012). This crisis is severe particularly for youth because probably they lack enough knowledge on STDs in relation to HIV/AIDs.
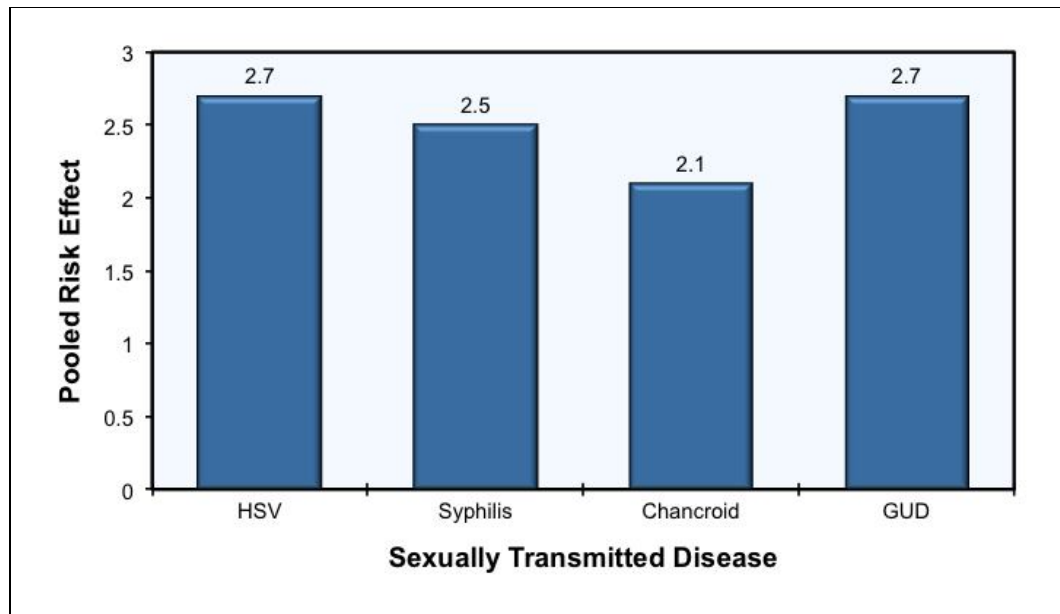
Figure 1.2: Combined Effects of STDs on Susceptibility to HIV

Source: Rottingen, Cameron, & Garnett (2001)

For instance, in a study entitled *Knowledge of sexually transmitted diseases among secondary school students in Dar es Salaam, Tanzania* by Kennedy, Mwambete, and Zephania (2006), a sample of 635 students from Ilala, Temeke and Kinondoni Districts were interviewed and it was revealed that approximately 17 percent of children below 15 years of age in Tanzania have been infected with STDs, about 50 percent of the STDs occurred before the age of 29, and 98 percent of students neither knew the meaning of STDs nor the symptoms associated with them. According to Mwambete *et al* (2006), another survey on youth sexuality and behaviour of primary school pupils in Dar es Salaam, revealed that 62 percent of male and 35 percent of

females were at risk of acquiring STDs, and over 80 percent of male and 25 percent of female students were prone to contacting STDs.

1.5.4 Sex Education Curriculum in Tanzania

The mission for the implementation of formal sex education in schools was introduced in Tanzania in 2001 through the national Policy on HIV/AIDS which stipulated that The Ministry of Education and Vocational Training had the responsibility for developing intervention strategies including dissemination of HIV/AIDS information in schools and higher learning institutions (URT, 2001). TACAIDS, in collaboration with other sectors including The Ministry of Health and Social Welfare, Complementary Basic Education Tanzania (COBET), National Aids Control Programme (NACP), United Nations Children's Fund (UNICEF), and The United Nations Education Social and Cultural Organization (UNESCO), prepared Guidelines for Implementing HIV/AIDS and Life-Skills Education programmes in schools since 2004 (URT, 2004).

The importance of sex education in schools was also recognized by other governmental organizations. For example, The Second National Multisectoral Strategic Framework (2012) emphasised that:

> *"Empowering young people with knowledge and skills to dialogue about sexuality, to adopt attitudes and practices that protect them against HIV infection and to access reproductive health services has been identified as one of the key strategies in reducing new infections" (p. 53.)*

The Tanzania's Poverty Reduction Strategy also emphasized HIV and AIDS education, environment and life skills programmes in primary schools, secondary schools and teacher's colleges, as one of their program's objectives (NSGRP, 2010). Today the implementation of sex education in secondary schools is done by the integration of HIV, AIDS, and other STDs in two core subjects, namely civics and biology as shown in Tables 1.1 and 1.2. Figure 1.2 shows five topics related to sex education as indicated in the civics syllabus for Secondary Schools including: promotion of life skills, responsible citizenship, gender and culture (URT, 2010)

Table 1.1: Sex Education in Civics Syllabus

Year of Study	Topics Covered
Form One	Promotion of life skills
	Responsible citizenship Responsibilities to special groups including HIV/AIDS Victims
Form Two	Gender - The concept of gender - Negative socio cultural practices.
Form Three	Promotions of life skills - Good leadership, team work, positive relationship, self worth, and confidence
Form Four	Culture - Positive and negative aspects of cultural values

Source: URT (2010)

However, a detailed analysis of a civics textbook prepared by the Ministry of Education and Vocational Training through the Tanzania Institute of Education (TIE) shows only the following sub topics related to sex education: meaning and types of life skills; importance of life skills; using life skills; courtship and marriage; the concept of family; and rights and responsibilities (TIE, 2011). HIV/AIDS and

STDs topics are not included in the book.

Biology syllabus shows few sex education topics which that are allocated in Form one, two and four while none is allocated in form three as shown in Table 1.2.

Table 1.2: Sex Education in Biology Syllabus

Year of Study	Topics Covered
Form One	The concept of health and immunity
	Human Immunodeficiency Virus and Acquired Immunity Deficiency Syndrome
Form Two	Drugs and drug abuse
	The concept of reproduction
	Family planning and contraception
	Maternal and child care
Form Three	No Topics allocated yet
Form Four	Relationship between HIV, AIDS, and STIs
	Management and control of HIV, AIDS, and STIs
	Counselling and voluntary counselling and testing

Source: URT (2010)

According to Mkumbo (2009) in his paper titled "*Content analysis of the status and place of sexuality education in the national school policy and curriculum in Tanzania*", the purpose of this study was to examine the status of sexuality education in the Tanzanian national school curriculum. The results have revealed that only a few aspects of sexuality education, particularly in the area of HIV/AIDS are covered in the Tanzanian national school curriculum; a greater part is covered during secondary education level which is arguably too late given that sexuality education works effectively if it is provided before puberty at primary education level; and that

the current sexuality education focuses only on knowledge and little on ,

relationships, attitudes and values (Mkumbo, 2009).

A deeper analysis done by the researcher on the biology and civics books prepared

by TIE indicates that neither pictures nor illustrations of HIV/AIDS and other STDs

are available for students to learn better but only plain text. As stated by Mayer,

(2014), the quality of multimedia instructional materials enhances learning

effectiveness. Thus, if such materials are used in the process of teaching sex

education in secondary schools learning will be improved.

1.6 Multimedia Enriched Instructional Materials and Learning Effectiveness

Multimedia enriched instructional materials involve a combination of teaching and

learning materials that have been improved to combine audio visual, audio assisted,

printed multicolour, and printed plain instructional materials in order to involve all

learning modalities (Mayer, 2005; Schnotz, 2005). Most of the information in

schools is presented through lectures or plain printed materials. Moreover, Bandura

(1977) reveals that learning is a function of observing, retaining, and replicating, or

modelling novel behaviour. Therefore, for effective learning to take place students

need instructional materials that they can observe, hear, touch, taste and even smell

so as to retain the information for later retrieval and use.

Additionally, Kolb (1984) views an effective learning as the extent to which

objectives are achieved and targeted problems solved; interplay between

expectations and experience progressing through concrete experience, observation,

reflection, analysis, and generalizations. Ron, Jan and Omar (1996) demonstrated

that an effective learning occur as results of interaction between the teacher, learner

and instructional materials. Studies on effective learning suggest that people who use multimedia enriched instruction materials performed better in terms of test scores, compared to those who receive instruction through traditional classroom lectures (Sims, 1998; Harper & Hedberg, 1997; Hede, & Andy, Andy, 2002; Shinde, 2003). The studies involved topics such as languages, chemistry, biology, as well as procedures for the operation of devices. Equally, the context of the studies varied from primary school, higher education, industry, and military education. Evidence shows that Tanzanian teachers deliver educational information through lecture methods and sometimes supplement with plain printed materials whereby only few learning modalities are involved hence comprehension may be interfered (Shirima, 2013; Walsh, 2012). Most subjects including Sex Education have terminologies and structures that are not easily understood by secondary school learners - therefore, they need to be enriched through different multimedia forms.

1.7 Statement of the Problem

There is a growing body of evidence indicating that school based sex education programmes are valuable and have a positive impact on youth's sexual and reproductive health. For instance, an extensive review of school based interventions revealed that school-based sex education reduces sexual acting out and the onset of sexual intercourse (UNAIDS/WHO, 2009). Additionally, Kirby (2012) assessed the impact of sex education on youth sexual behaviour and revealed that, sex education programmes lead to delayed initiation of sexual intercourse, reduction in the frequency of sexual intercourse, increase in the effectiveness and consistency of condom and contraception use and such programmes does not increase the frequency

of sexual intercourse.

Few studies conducted in African and Tanzanian contexts, in particular, have shown similar results and suggest that such programs should preferably be conducted in schools (Mkumbo, 2008; Mbonile & Kayombo, 2008; Mlyakado & Timothy, 2014). Generally, most of these studies support the fact that school based sex education reduces STDs and unplanned pregnancies. Despite the introduction of the sex education programmes in primary and secondary schools, the situation of STDs infections and early pregnancies among Tanzanian youths is worsening. For example, recent data from the Ministry of Education and Vocational Training indicate that 28,600 girls left school between 2004 and 2008 because of pregnancies which further added up to 36,713 in 2010 (Basic Education Statistics in Tanzania (BEST), 2010).

The data did not include girl students who secretly practise abortion or those who deliver their babies and continue with school unnoticed. Moreover, information from the Association of Journalists against AIDS in Tanzania (AJAAT), (2012) indicates that sexual abuse is rampant among students. This was also declared by the Coordinator of Parenting and Counselling in the Ministry of Education and Vocational Training in Tanzania AIDS Week (Munisi, 2012). Moreover, a study conducted at Muhimbili hospital on induced abortion revealed that, 70.6 percent of the victims were students and school leavers (Mabula, 2012). Likewise, Kennedy *et al.* (2006) revealed that 98 percent of secondary school students did not know the concepts, symptoms and transmission of STDs, while 38 percent admitted that they were at risk of contracting STDs. Most of these studies assessed the effectiveness

and the impact of sex education in schools but none investigated the quality of instructional materials used for the subject.

Currently, the Tanzanian programme on sex education is mainstreamed in social studies and science for primary schools while in secondary schools it is incorporated in civics and biology syllabi (URT, 2010). However, the quality of the instructional materials used is doubtful as the situation of youths is worsening with time (Kessy, 2012). Of special interest are questions regarding the effectiveness of learning the sex education subject from different levels of multimedia enrichment. The researcher consider it necessary to explore whether the process of comprehending the content of the subject in printed black and white instructional materials differs from the ones enriched with audio, visual as well as coloured illustrations. It was also deemed important to investigate how the combination of pictures and text affect comprehension of sex education that is reflected in students' performance. In view of these concerns the present study assessed the effectiveness of different multimedia enriched and plain printed sex education instructional materials in academic performance among secondary school students in Tanzania.

1.8 Objectives of the Study

1.8.1 Main Objective of the Study

The purpose of this study was to assess the differential effectiveness of plain and multimedia enriched instructional materials on students' academic performance.

1.8.2 Specific Objectives of the Study

The following were the specific objectives that guided the study:

1. To determine the differences in effectiveness between printed plain and audio visual sex education instructional materials

2. To determine the differences in effectiveness between printed plain and audio aided sex education instructional materials

3. To determine the differences in effectiveness between printed plain and printed multicolour sex education instructional materials

4. To assess gender differences in academic performance in different types of multimedia enrichment

5. To compare the differences in effectiveness between multimedia enriched and printed plain sex education instructional materials among students with different levels of academic abilities.

1.9 Hypotheses of the Study

In view of the above objectives, this research was guided by the following hypotheses regarding the provision of sex education in Tanzania.

1. There is a significant difference in effectiveness between printed plain and audio visual sex education instructional materials.

2. There is a significant difference in effectiveness between printed plain and audio assisted sex education instructional materials.

3. There is a significant difference in effectiveness between printed plain and printed multicolour sex education instructional materials.

4. There are gender differences in performance in different levels of multimedia enrichment.

5. The effectiveness of multimedia enriched and plain instructional materials

differs among students with different academic abilities.

1.10 Significance of the Study

Given the situation of HIV, AIDS, STDs, unplanned pregnancies and other youth problems this study is expected to be of great importance to inform on how sex education knowledge delivery is done in education system; it is a long time programme and according to AJAAT (2012) youths do not seem to change so it is believed that this study will stimulate the use of multimedia for better comprehension and thereafter positively impact behavioural change. Moreover, the study will make an important contribution to the general area of learning. Most available literature and studies emphasize only on the general ICT issues that is the use of computers (Daniels, 2002; Kozma, 2005). This study is expected to be among the sources of literature for further studies in education, multimedia technology, psychology and more specifically in the area of sex education.

Different educational undertakings in Tanzania deliver instruction through normal lectures or printed black and white texts. This study is an eye opener for curriculum developers and other stake holders on the preparation of instructional materials to develop more effective teaching and learning materials embedded with multimedia to enhance the teaching and learning process. The knowledge of multimedia enriched instruction is expected to benefit not only the learners but also teachers' competences. Of greatest importance is the stimulation of research in relationships between the type of instructional materials and students' comprehension as well as performance. The result from this study is expected open the minds of educational

practitioners and researchers on different learning styles and preferences in learners so as to enhance the learning process in different contexts.

1.11 Limitations of the Study

The study was limited in its findings in the following ways: Firstly some pictures and illustrations included in the study may have diverted the attention of the respondents and thus interfere with thinking, response and findings of the study. Secondly, the sample size was limited to only 215 form three students of Benjamin Mkapa Secondary School. This may not be a good representation of the majority of Tanzanian form three students and hence could affect the significant relationships from the data and generalizability of the findings.

Thirdly, it was assumed that all the control and experimental group subjects were not aware of the topic and could accurately and honestly respond to the pre-tests and post-test questions. If some were knowledgeable about the topic at hand it could have affected the study findings. Additionally, since the assessment of the pre-test and post tests were conducted by the researcher herself, it was unavoidable that in this study, certain degree of subjectivity could be found. However, the above mentioned limitations were minimized by a pilot test that was conducted before the entire study was undertaken.

1.12 Delimitations of the Study

Only Benjamin Mkapa Secondary School was involved in the study and the participation in the study was confined to form three students. It was assumed that

form three students were not aware of the topic "*The Relationship between STDs, HIV, and AIDS*" which is always covered in form four, although some information could have been found through other sources. Furthermore, the study was delimited to study school confined in Ilala district.

1.13 Conceptual Framework for Investigating Multimedia Enrichment

Figure 1.3 the conceptual framework for this study represents the context-input-process-product (CIPP) model as adapted from Stufflebeam (1971).

1.13.1 Contextual Variables

This is the Tanzanian situation in terms of educational, technological and social economic variables, which determine the possibilities of using multimedia enriched instructional materials in the teaching of sex education in secondary schools. The contextual variables are not involved in the study but they affect both the dependent as well as independent variables. They are the factors that may influence the effectiveness application of multimedia technology in schools, For example, Tanzania's National ICT Policy (2003) stipulates that information and communication technology (ICT) offers new opportunities to enhance education and improve the quality of delivery of education in all areas.

Moreover, the Ministry of Education and Vocational Training (MoEVT), in collaboration with the Swedish International Development Cooperation (SIDA), and other stakeholders agrees that applying ICT to empower education, and learning

about ICT in schools, is an asset to overcome the challenges facing the education

sector (Secondary Education Development Plan (SEDP), 2009).
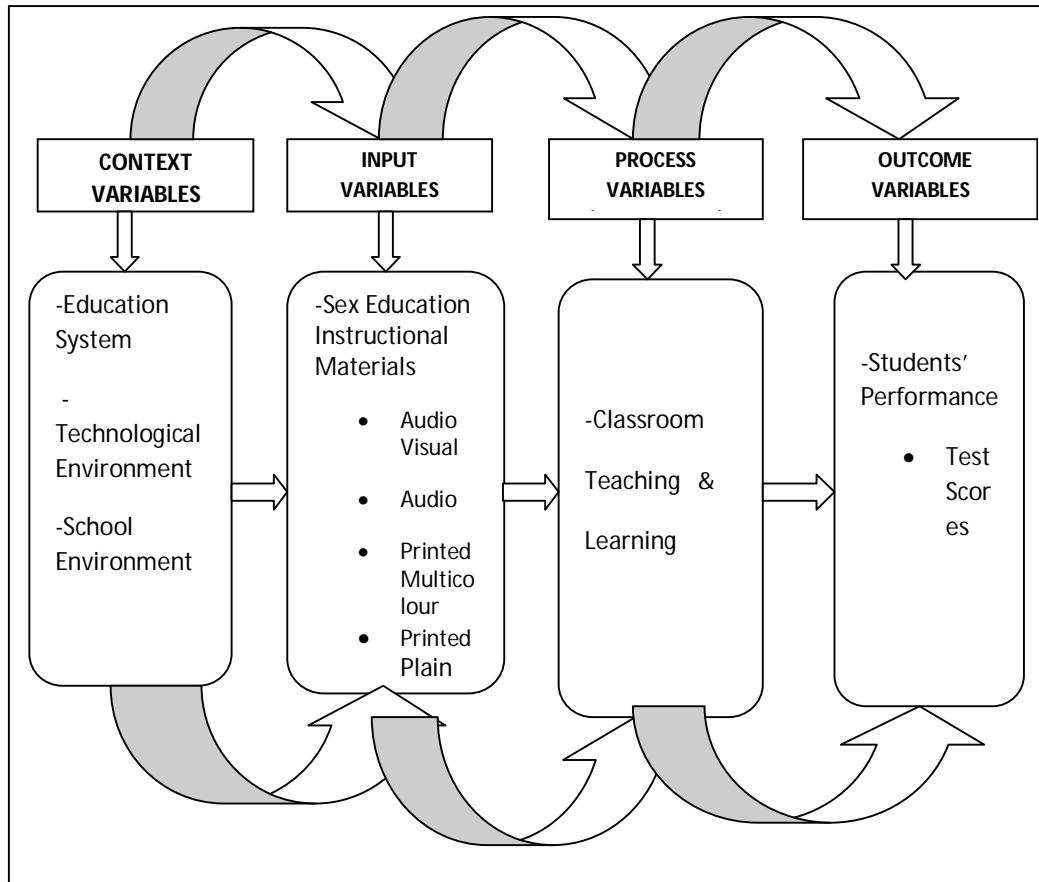
Figure 1.3: Conceptual Framework of the Study

Source: Adapted from Stufflebeam (1971)

1.13.2 Input Variables

Input variables in fact the independent variables, they involve the provision of sex

education information enriched using different levels of multimedia including: audio

visual, audio aided, printed multicolour and printed plain. It was assumed that, if the

information on sex education is properly provided and students are well motivated through different levels of multimedia enrichment, the outcome could be an increased level of student's awareness and thereafter resulting in behavioural change Motivation is an important factor here; according to the Information Motivation Behavioural Skills (IMB) theory as created by Fisher and Fisher, information, motivation, and behavioural skills are important determinants of whether or not health behaviour such as safe sex practice is performed (Fisher & Fisher, 1992). The aim of this study was to assess the way provision of information through multimedia enriched technology could influence behavioural change through learning among youths.

Since 2010, it was planned by UNICEF that by the year 2015, 50% of young people should receive the knowledge on sex and reproductive health this is because childhood and adolescence are important stages for human development and for this reason, it is necessary to provide quality information on sex education (UNICEF, 2009). According to UNICEF (2009) the provision of sex education from early childhood favours the acquisition of information and knowledge necessary to develop the skills and attitudes needed for a full and healthy life as well as reduction of sexual and reproductive health risks. As for Tanzanian context, this was initiated since 2004 but the situation is still worsening (BEST, 2010; Mwambete *et al.*, 2006).

This study adopted The Information Motivation Behavioural Skills (IMB) and Cognitive Theory of Multimedia Learning (CTML) models to introduce the use of multimedia technology in the facilitation of sex education for better knowledge dissemination, comprehension, and in the long run behavioural change among

youths (Fisher & Fisher, 1992; Mayer, 2005). As they are deeply discussed in chapter two, the former believes on information, motivation, and behavioural skills as important determinants of learning and behavioural change the later assumes that words and graphics (multimedia enriched materials) are more conducive to learning rather than just text or graphics alone. This is the main focus of the present study.

1.13.3 The Process Variables

The student's gender and academic ability variables are indicated as process (intervening) variables. These were controlled in the process as they could affect the relationship between the independent and the dependent variables. Students' ability was taken as displayed in the national Form two examination results. These were compared to their performance in different multimedia levels that were the key variables in this study. This is due to the fact that different students learn differently when exposed to different media because of their natural learning styles. Again, teachers are very important stakeholders in the process of implementing the teaching and learning in schools (Lubuva, 2012). This experimental study was done only to students but the study recommends further study to be done to teachers to assess their knowledge and ability to prepare as well as teach by using multimedia technology. Tanzanian secondary school teachers have been teaching sex education using traditional printed plain instructional materials that are prepared by the Ministry of Education (URT, 2010).

1.13.4 Output Variables

Output variables are the dependent variables that were not manipulated in the study. The outcome of this study after learning sex education information through

multimedia was indicated by test scores It is the expectation of this study that if the situation of Tanzanian teachers is taken into consideration such that they are well trained, provided with the required facilities, and acquire competences for employing multimedia technology in the process of teaching and learning this could lead to enhanced performance among learners, and in the long run reduced number of STDs, early pregnancies as well as school dropouts. Likewise, the ability to use multimedia technology is believed to solve complex problems across subjects and disciplines. According to Kozma, (2011) the ability to use technological tools and resources, search for, organize, and analyze information; to communicate effectively in a variety of forms; to collaborate with others of diverse skills and backgrounds; and to think critically, innovatively, and creatively are very crucial for teachers.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter provides firstly, an overview of the theoretical frameworks that illuminate the areas of the study, including the information motivation behavioural skills model and the cognitive theory of multimedia learning. Secondly, the related literature to the study is discussed and finally the chapter concludes with a statement indicating what remains to be studied.

2.2 The Information Motivation Behavioural Skills Model

The Information Motivation Behavioural Skills (IMB) model as created by Fisher and Fisher (1992) was an attempt to apply social psychological information, methodologies, and techniques to address health problems. The model has been used as a basis for understanding several health problems including: human immunodeficiency virus (HIV) risk and prevention across populations, risky behaviours among adolescents, people who are severely mentally ill, homosexual men, and injection drug users (Bryan, Fisher, Fisher, & Murray, 2000).

The model has also been used as a basis for understanding and promoting adolescent contraception (Byrne, Kelley, & Fisher, 1993). Recently, the IMB model has been articulated as a general model of health behaviour change and has received much support in that context (Crowell, 2004). The model postulates that "Health related information, motivation, and behavioural skills are important determinants of whether or not health behaviour such as safe sex practice is performed (Fisher & Fisher, 1992)."

Information targets the cognitive domain by presenting knowledge to support the behaviour change. Prevention information which is among the contents of this study includes specific facts about STDs transmission and prevention. Motivation focuses on the affective domain and provides the opportunity to develop favourable attitude toward new behaviour. Motivation to engage in preventive acts determines whether well informed individuals will be inclined to act on what they know about prevention. Prevention motivation includes personal motivation to practice preventive behaviours, such as attitudes toward practicing specific preventive acts; social motivation to engage in prevention, such as perceptions of social support for performing such acts (Fishbein & Ajzen, 1975); and perceptions of personal vulnerability (Rosenstock, 1996).
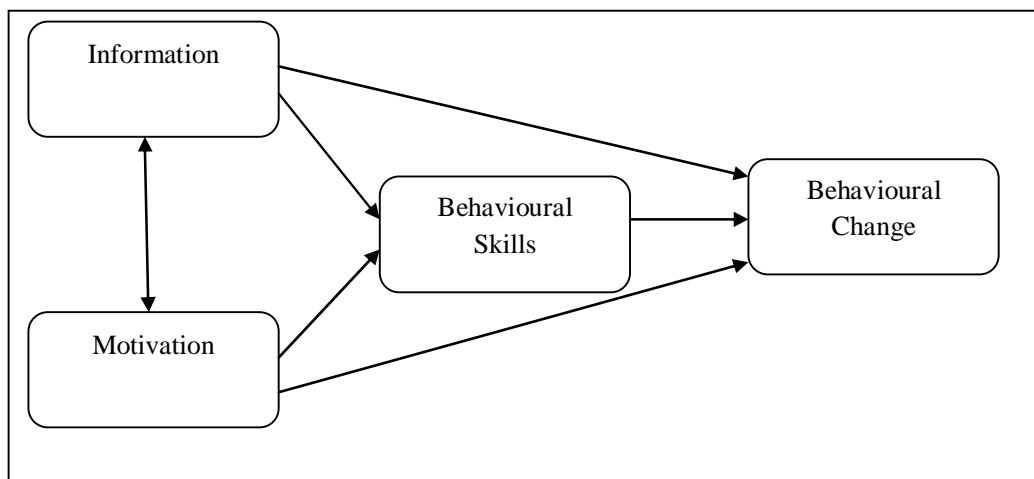
Figure 2.1: Information-Motivation-Behavioural Skills Model
Source: Fisher and Fisher (1992)

Behaviour addresses the psychomotor domain, with return demonstrations and practice (World Health Organization, 2003). The behavioural skills component of the IMB model is composed of an individual's objective ability and perceived self

esteem concerning performance of the sequence of preventive behaviours involved in the practice of prevention (Bandura, 1989). Diagrammatically, the IMB model consists of three determinants of behavioural change, namely information, motivation, and behavioural skills (Figure 2.1).

2.3   Approach to Promote Health Behaviour

The IMB model specifies a three step approach to promoting preventive behaviour. First, elicitation research is conducted with a subsample of a target population to empirically identify that population's deficits in prevention information, motivation, and behavioural skills. Second, empirically targeted interventions are designed on the basis of elicitation research findings and then delivered to address a population's prevention information, motivation, and behavioural skills deficits and to capitalize on the population's strengths in these areas.

Finally, an evaluation research is conducted to determine whether the intervention has had significant sustained effects on the information, motivation, and behavioural skills provided. Sexual behaviour and STD/HIV status evaluation among adolescents have been conducted in several areas in the African context. For example, Mensch, Hewett, Gregory and Helleringer (2008) conducted an evaluation in Malawi to investigate on premarital sex and prevalence of HIV and other STDs in young women after training on Family Life Education. In this study girls were asked as to whether they ever had sex with boyfriends or married men. According to researchers this was an outcome of a similar evaluation done in Uganda and Kenya , Mensch, Hewett, Gregory and Helleringer (2008)

The IBM model has proved to be effective in several studies. Bazargan, Stein, & Hindman (2010) employed IBM model in examining the predictors of risky sexual behaviour among the youth. The study revealed that the components of the IMB model clearly played a role in the design of successful interventions. Michael and Stephen (2008) applied the IMB model in a study to evaluate a motivation based HIV risk reduction intervention for economically disadvantaged urban women.

Participants completed a survey that assessed HIV related knowledge, risk perceptions, behavioural intentions, sexual communication, substance use, and risk behaviour. The women were reassessed at three and twelve week's interval. Results indicated that treated women increased their knowledge and risk awareness, strengthened their intentions to adopt safer sexual practices, communicated their intentions with partners, reduced substance use proximal to sexual activities, and engaged in fewer acts of unprotected vaginal intercourse. Similar results were expected among Tanzanian youths but opposite situations are observed. It is for this reason the assessment of effective instructional materials is been conducted.

A similar model was applied to assess the effects of prevention education, prevention personal motivation and prevention knowledge on HIV among students and found that of the three constructs had a strong positive influence of prevention behavioural skills among the students (Mongkuo, Nicole, & Angela, 2012). Likewise, Misheck, Mambwe, and Michael (2012) conducted a school based study on the application of an IBM skills model for the reduction of HIV risk behaviour among 259 learners in Johannesburg. The research examined the effectiveness of the IMB model in promoting appropriate sexual behaviour and practices that reduce the likelihood of

HIV risk behaviour amongst adolescent learners.

The study was quasi experimental with pre test post - test research design. Adolescents were tested on facts about HIV&AIDS that were relevant to sexual practices, their attitudes towards preventive behaviours, and the ease with which one could engage in a range of AIDS preventive behaviours. The post test revealed positive changes in the levels of HIV&AIDS due to the intervention. Thus, from these studies and others, the implication is that if people are well informed, motivated to act, and have the skills and confidence to take steps, they are more likely to initiate and maintain health promoting behaviours that yield positive outcomes.

However, some critiques on IMB model suggests that on its own, information are very unlikely to lead to a measurable change in behaviour (Kennedy, 2004) Information may change or improve people's knowledge of a problem or contribute to a change in their attitude towards it, but there is a gap between knowing about a problem and doing something about it. Moreover, a change is considered to be a process rather than an event that involves: precontemplation, contemplation, preparation, action, or maintenance (Mwale, 2008). The present study based on the IMB model, provided information on STDs including HIV/AIDS and later provided pre and post tests to assess how much information was acquired. Although the aim of this experimental study was to assess the effectiveness of different instructional materials in teaching sex education, and advise the ministry and other stakeholders accordingly, a recommendation for further longitudinal study was given in order make analysis on the behavioural change in the long run.

2.4 The Cognitive Theory of Multimedia and Learning

The Cognitive Theory of Multimedia Learning (CTML) assumes that, words and graphics are more conducive to learning rather than just text or graphics alone. It is based on the idea that learners learn better when they engage in relevant cognitive processes such as attending to the relevant material in the lesson, mentally organizing the material into a logical cognitive representation and mentally integrating the material with their pre-existing knowledge (Mayer, 2005). Mayer's CTML incorporates three principles on how people learn including: limited capacity working memory, active processing, information transfer and dual-coding theory.

2.4.1 The Limited Capacity Assumption

This is a proposition that humans are limited in the amount of information that can be processed in the mental systems at one time. When an illustration or animation is presented, the learner is able to hold only a few images in the working memory at any one time. Likewise, when a narration is presented, the learner is able to hold only a few words in the working memory at a time, reflecting on portions of the presented text. This conception of limited capacity in consciousness is very crucial in the learning process. It gives a way to measure someone's cognitive capacity through a memory span test.

Literature shows that, in a digit span test, one can read a list of digits at the rate of one digit per second (e.g., 8-7-5-3-9-6-4). The longest list one can recite without making an error is his/her memory span for digits (Miller, 1956; Simon, 1980). There are individual differences and on average the memory span is fairly small, approximately five to seven chunks only. Moreover, young adults can recall only 3

or 4 words or short sentences (Gilchrist, Cowan & Naveh, 2008). The recall limit is very important because it measures individual working memory which is used in mental tasks such as comprehension, problem solving, learning as well as planning. Such studies reveal individual differences in intellectual ability and the way they change with age (Cowan, 2006). In the present study one of the objectives is to assess the differential effectiveness of multimedia among students with different intellectual abilities.

2.4.2   The Active Processing Assumption

The second assumption states that, humans actively engage in cognitive processing in order to construct a logical mental representation of their experiences. Active learning occurs when a learner applies cognitive processes to incoming material. Such processes are intended to help the learner make sense of the material. Thus, according to & Moreno (2003), for meaningful learning to occur, the learner must engage in five cognitive processes namely: selecting relevant words for processing in the verbal working memory; selecting relevant images for processing in the visual working memory; organizing selected words into a verbal model; organizing selected images into a pictorial model; and lastly, integrating the verbal and pictorial representations with each other and with prior knowledge.

2.4.3   The Dual Coding Assumption

The dual processing cognitive theory (DCT) suggests that verbal and visual stimuli are processed separately but simultaneously in the working memory. This assumption proposes that, there are two mental systems in cognition, one verbal and the other non verbal, which are specialized for the linguistic and imagery processes

respectively. The distinction between the two systems suggests different pathways: one for coding words, sentences and passages in a text and the other for processing pictures and illustrations (Paivio, Khan, & Begg, 2000). In educational phenomena, pictures and illustrations are widely used in teaching, while textbooks are usually accompanied by print. The challenge is on how effective the pictorial and print representations are in achieving educational objectives (Sham, 2002).

It is also assumed that among the two cognitive subsystems, one is specific for the representation and processing of nonverbal objects and the other for dealing with the verbal code. Again, the model displays three information processing systems, namely: representational, referential, and associative processing in the working memory. According to Sham, (2002) representational system deals with the incoming information in different aspects while referential connections are assumed to link the verbal system with the non verbal system as they cannot function individually. The model is displayed in Figure 2.2.

Moreover, associative systems join words to related words and images to other images so as to form a network by linking and integrating parts into unitary entities within the brain systems (Paivio, 1986). Consequently, learning begins with words and pictures in a multimedia instructional message which can be a textbook, online presentation, or even a power point presentation. Secondly, in the sensory organs, spoken words reach the ears and are represented in the auditory sensory memory, whereas pictures and printed words impinge on the eyes and are represented in the visual sensory memory. Thirdly, from the working memory the learner selects some sounds for further processing in the verbal channel representation and some images

for further processing in the visual channel representation. Finally in the long-term memory the learner can activate prior knowledge to be integrated with the verbal and pictorial representations from the working memory and store the resulting knowledge in the long-term memory.

Figure 2.2: Dual Coding Theory Model
Source: Paivio (1971).

Moreover, associative systems join words to related words and images to other images so as to form a network by linking and integrating parts into unitary entities within the brain systems (Paivio, 1986). Consequently, learning begins with words and pictures in a multimedia instructional message which can be a textbook, online presentation, or even a power point presentation. Secondly, in the sensory organs, spoken words reach the ears and are represented in the auditory sensory memory, whereas pictures and printed words impinge on the eyes and are represented in the visual sensory memory. Thirdly, from the working memory the learner selects some sounds for further processing in the verbal channel representation and some images

for further processing in the visual channel representation. Finally in the long-term memory the learner can activate prior knowledge to be integrated with the verbal and pictorial representations from the working memory and store the resulting knowledge in the long-term memory.

Dual coding theory has been applied to many cognitive practices: Paivio (1986) presented a dual coding explanation of bilingual processing, while Clark and Paivio (1991) described the dual coding theory as a general framework for educational psychology. Furthermore, another productive application of the dual coding theory has been applied to literacy. The theory accounts for all aspects of literacy, including decoding, comprehension, and response in reading (Sadoski & Paivio, 2007), written composition (Sadoski & Paivio, 2001), and spelling (Sadoski, Willson, Holcomb, & Boulware, 2005). Moreover, according to Sadoski and Willson (2006), a large scale instructional programme to improve reading comprehension and visualizing while reading a text was successfully applied in schools.

The use of induced mental imagery to enhance student understanding and learning has gained an increasing record of acceptance (Gambrell & Koskinen, 2002; Sadoski & Paivio 2001). The general conclusion to both of these reviews is that instructions through mental images significantly enhance the reading comprehension and memory of children and adults in various ways. Numerous studies have shown, for example, that elementary age students know how to induce mental imagery and that only a brief training and teacher scaffolding is necessary for most children to effectively use mental imagery as a reading comprehension strategy.

2.5 Differential Learning Effectiveness in Multimedia Materials

Technically, multimedia is a combination of static and dynamic media in one interactive computer application; psychologically multimedia is a combination of information presented to different senses (like seeing, hearing, touching) that can be actively influenced by the user (Hasebrook, 2005). Effective learning can be viewed in three distinct phases, namely:

i. *Selecting relevant material*: occurs when a learner pays attention to appropriate words and images in the presented material. This process involves bringing material from the outside into the working memory component of the cognitive system.

ii. *Organizing selected material*: involves organizing the selected information into a coherent cognitive structure in the working memory component of the cognitive system.

iii. *Integrating selected material with existing knowledge*: involves building connections between incoming material and the prior knowledge. This process also involves activating knowledge in long term memory and bringing it into working memory (Mayer, 2014; Wills, 2008).

Multimedia instructional materials have been found to enhance learning irrespective of the subject area and context because of interactivity where learners become active participants in the experience. Generally, instructional materials comprise of any physical medium via which instruction is presented to learners (Dubey, 2014). These include every physical means of instructional delivery, from live instructor to textbooks and such items as charts, kits, magazines, newspapers, pictures,

recordings, slides, transparencies, videos, workbooks, electronic resources such as software, CD-ROMs, as well as online services. Since 1995, rapid advances in computers and other digital technology including internet, have led to increased interest in their use for instructional purposes. For instance, a survey of more than 750 learners from the training industry revealed that the percentage of training delivered via such technologies as CD-ROM and internet rose from less than 6 percent in 1996 to 22 percent by 2000 (Somon, 2004). From this point of view several forms of instructional media (multimedia) can be combined together by teachers in the classroom for the purpose of enhancing the teaching and learning process.

Most researchers agree that multimedia has a considerable impact on various aspects of education. (Mayer, 2014; Sweller, 2005; Sternberg, 2003; Leung & Pilgrim, 2010). Multimedia learning systems aim at helping learners to construct knowledge structures about a subject matter and updating their knowledge about a specific topic. They also allow multiple ways of self regulated learning that lead to more elaborate and better applicable knowledge systems. (Mayer, 2005; Schnotz, 2005).

According to Cognitive Theory of Multimedia Learning when a learner receives a multimedia presentation where words and pictures are presented, the spoken words involve the learner's ears while printed words and pictures involve the learner's eyes If the learner pays attention some of the incoming words are represented in the learner's working memory as sounds and some of the incoming pictures or printed words are represented as images in the learner's working memory where integration occurs resulting into meaningful learning (Mayer, 2003). Three types of instructional

materials were compared with learning outcomes as follows:

2.5.1   Plain Printed Instructional Materials and Learning Outcomes

These involve paper based instructional materials. It is the traditional way of conveying information in most Tanzanian schools and colleges. The font colour in such study materials is black and mostly the readability of the material is low (Kessy, 2012). This type of media conveys information through the eyes of the reader. Research shows that printed texts can only be improved to enhance learning by highlighting with different colours or adding textual cues such as underlining, italics, and boldface (Armbruster, 2010).

2.5.2   Audio Instructional Materials and Learning Outcomes

Audio is an electrical or other representation of sound. Such materials are primarily for hearing and include spoken words, audio cassette tapes, audio compact discs (CDs), and the machines on which they are played. These materials are frequently used in schools to present music, stories, poetry readings, and speeches. Students can record and listen to themselves with the help of tape recorders and similar devices. Lectures can also be recorded for later uses. In this study a lesson on sex education was presented through a CD for a group of students.

2.5.3   Audio Visual Instructional Materials and Learning Outcomes

These are materials designed for both seeing and hearing. They include motion pictures, television, and videotape. There is integration of several forms of media hence the term "multimedia" (Mayer, 2008). Multimedia takes the advantage of both the auditory (ears) and visual (eyes) channels in the working memory to deliver

content most effectively (Paivio, 1986; Sternberg, 2003). Multimedia instruction challenges teachers to develop a new facilitative teaching culture, to improve learning and use communication technologies to teach more effectively. A good example is video conferencing, an effective multimedia teaching where a single facilitator can teach several classrooms at the same time (Hovenga, 2011).

The main belief about multimedia is that the combination of graphics, video, sound, animation and text can provide superior ways of presenting information than any of these media alone (Rogers & Scaife, 2010). There is a general assumption that "the sum is greater than the parts" (Wertheimer, 1924). Many claims have been made about the added value gained from being able to interact with multimedia in ways not possible with single media such as easier learning, better understanding, more engagement and more pleasure.

Jyotsna, Suresh, and Santosh (2013) conducted a study on the *Pedagogic Effectiveness of Print, Interactive Multimedia, and Online Resources*. The study aimed at assessing the pedagogic effectiveness of the three modes of learning including: a self-instructional unit print, face-to-face tutorial support, interactive multimedia CD-ROM, and interactive multimedia on the web with online support. These were assessed in terms of achievement scores and responses to various learning activities. The results from this study revealed that, instructional content provided through interactive multimedia CD-ROM for self-learning was more effective than the printed model and online learning. Moreover, it was also shown that interactive multimedia CD resulted in higher academic achievement and was

more pedagogically effective than self learning through print with face to face support or web-based learning with online learner support (Jyotsna, Suresh, & Santosh, 2013).

Additionally, Adam (2012) studied *The Impact of Multimedia and Redundancy Theories on the Efficiency of History Presentations.* The Multimedia Principle assumes that, people learn better from words and pictures than from words alone, while the Redundancy Principle believes that people learn better from graphics and narration than from graphics only, narration only, and on screen text only. The study employed a quasi experimental post test control group design to determine if more learning occurs during a presentation that incorporates either the multimedia or the redundancy principle.

A two-tailed independent sample *t*-Test was used for data analysis. Later, the students completed a 24-question multiple choice post-test based on the presentation to provide data that would determine if either the multimedia principle or the redundancy principle would improve learning efficiency. Results indicated that, when compared to a control group, the redundancy principle did not have any statistically significant impact on learning, but the inclusion of the multimedia principle showed a statistically significant improvement.

Moreover, Mayer (2005) revealed that written texts have unique processing requirements, with words initially being captured by the visual channel and then converted to sounds in the auditory channel. In addition, students understand technical machines or natural occurrences better when they learn from text and

pictures combined. In this context, words include written and spoken text, while pictures include static graphic images, animation and video.

Studies also, tell us that, the use of both words and pictures allows the brain to process more information in the working memory (Sweller, 2005). Far back in 1950, Day and Beach conducted one of the earliest surveys of the research literature comparing visual and auditory presentations of information, and revealed that: meaningful, familiar material is more effectively presented orally, whereas meaningless and unfamiliar materials should be presented visually. Likewise, Mayer and Gallini (1990) performed three experiments dealing with scientific devices. In these studies, a no-illustration (control) condition was compared to two illustration conditions. One presented static pictures of a device with labels for each step and the second displayed the "on" and "off" conditions of the machine with labels for each part and step. It was found that parts-and-steps pictures improved student's conceptual information recall and problem solving, mostly for low prior-knowledge students.

Petitt (1994) compared learning information that was presented in a traditional classroom lecture, where little text is written on the board, to learning the same information presented via computerized multimedia based instruction. The students were in higher education, industry, and the military. The information learned included biology, chemistry, foreign languages, and electronic equipment operation. The control group learned the information via traditional classroom lecture, while the comparison groups learned the information via computer-based multimedia. The

researcher measured learning using tests of achievement. It was found that learning was higher when the information was presented via computer-based multimedia systems than traditional classroom lectures.

Reid and Beveridge (1990) conducted a computer-based experiment dealing with illustrated texts. One hundred eighty students were directed to study three illustrated science topics presented by computer. The length of the text ran from 232 to 245 words. The computer recorded the time that students spent on the sentences and pictures. Additionally, it recorded at which point in the sentences the student first looked at the picture. Findings were that more difficult topics were associated with more time looking at pictures and less successful students spent more time looking at the pictures than did their more successful counterparts. It was concluded that illustrations are more effective to poor students and clarifying difficult concepts.

Moreover, Leung and Pilgrim (2010) in the study entitled *Multimedia Animations to Enhance Learning Complex Concepts in Data Communications* identified the problems associated with the teaching of data communications and described a learning system to facilitate instruction. The study consisted of three components: a series of printed lecture notes, a computer-managed learning system and a series of animated multimedia demonstrations. Through experimental method they found out that the multimedia component is particularly useful for students to learn physical processes and abstract concepts that are best presented as simulated animations. The use of animations also helped the lecturer in the classroom, if they are conveniently embedded in the power point presentation.

2.6   Gender, Academic Ability and Learning in Different Multimedia Levels

2.6.1   Gender and Multimedia Technology

Debates around the relationship between gender and technology provide a starting point for a discussion on learning in relation to gender and multimedia technology. Historically, the existing power relations in society determine the enjoyment and benefits from ICTs (Anita, 2008). The important questions are who benefits from ICTs and how does this affect performance among men and women. The ways girls and boys interact with computer technology reflect their background differences. Kori (2003) investigated on how girls and boys interacted with technology and found that, girls and boys interact differently with computers, they think about computers differently, have different motivations for using computers, approach computers differently, have different preferences, and have shown differences in the ability to use various interaction styles.

Also, the study found differences in preference between girls and boys including: the types of games preferred, what aspects of the games were important to them, and to what degree the games were a part of their social environment. Unfortunately, it was also found that, many electronic games are designed by men, for the young male market. Gender prejudices could be found in many electronic games that involve violence and use women as objects to be rescued. This in itself is a major problem because electronic games are often a gateway for children to become involved with multimedia technology. Not only is it important to develop products that are appropriate for both genders, it is also imperative that the products developed do not promote the negative stereotypes of either gender.

Milan, Harun, and Zuzana, (2012) conducted a study titled *"The Attitudes of Slovakian and Turkish High School Students to the ICTs used in Biology."* This study was focused on finding the gender differences in computer and technology attitudes. The sample consisted of 518 students from 9 high schools using a questionnaire survey. Data was evaluated with the factor analysis with ANOVA, Pearson's chi-square test, and Pearson's product moment correlation analysis. Results revealed that most students had positive attitudes towards ICTs. However, there were differences between boys and girls; boys had a more positive attitude towards the use of technology in biology lessons than girls did.

Moreover, Passig and Levin (2001) conducted a study titled *"The Interaction between Gender, Age, and Multimedia Interface Design Education and Information Technologies."* According to the researchers, Multimedia Learning User-Interface includes what connects the media with the learner; it is the means of interaction between the two. The study examined the degree to which the different components of the interface create a positive emotional reaction to the media among boys and girls. The detection of the most suitable interface for boys and girls was expected to make it possible to prepare multimedia learning experiences that appeal to both genders.

F test was used to examine the assumption that there are differences among boys and girls in different age groups regarding covert time-on-task and intrinsic satisfaction of various multimedia educational interfaces. The findings regarding covert time-on-task and intrinsic satisfaction indicated significant differences with multimedia

learning interfaces among boys and girls in the different age groups (Passig & Levin, 2001). It was also revealed that there are interface elements that draw girls to interact with multimedia contents, and other multimedia elements that appeal to boys.

Another study was conducted by Passig (1999) examined whether there are gender differences in learning from different designs of multimedia interfaces. Ninety children took part in the study including 44 girls and 46 boys. Computers were set in such a way that each child could read the story alone, and act in their way thus the reading experience became personal, easy, enjoyable, and interesting (Chu, 1995). The three computer programmes were chosen which were designed differently in terms of colour, quality of animations, sounds and interactivity. After the activity, respondents were asked to respond to a questionnaire which examined the time taken on the task. It was assumed by the researcher that differences would be found among boys and girls in learning interest with multimedia interface. It was revealed that boys and girls differ in time on task and multimedia learning interfaces. Girls preferred a colourful screen filled with drawings than boys.

Additionally, girls were more aware of colours than boys. The boys were more aware of movements on the screen. It was also found that boys significantly prefer green colour while girls prefer red and yellow and also girls were more inferior to boys as far as technological media like computer are concerned. It is therefore suggested that when designing educational multimedia, teachers must be sensitive to gender issues and make sure that the products developed are suitable for children of both genders (Inkpen, 2002).

2.6.2   Multimedia Technology and Academic Ability

It is argued that, aging is accompanied by a decline in intellectual ability (Morris & Venkatesh, 2000). Many studies have been conducted on aging and intellectual differences in the psychology literature including differences in abilities, traits and academic performance. For example, Hassan and Abdullah (2011) carried out a study on *"The Impact of Teacher's Age, Gender and Experience in the Use of Information and Communication Technology in Language Teaching."* The study employed a mixed-method approach of investigation, which applied both qualitative and quantitative methods. The survey was administered to 46 in-service language teachers working at Najran University, Saudi Arabia. Ten out of these participants were interviewed. The results indicated that there is no significant difference in using ICT between the two groups of teachers in terms of their age and experience. However, the results indicated that there was a difference between male and female teachers in using ICT in language teaching. Female teachers reported less use of ICT in their instruction than male teachers

Additionally, Cowan, Morey, AuBuchon, Zwilling and Gilchrist (2010) compared 7-8 year old and 11-12 year old children and college students using a version of the array memory procedure. There were two different shapes but participants were instructed to retain only items of one shape. The task was to indicate with a mouse click whether that "child" was in the correct seat, belonged in a different seat, or was missing entirely from the memory array and a click on the door sent the child to the principal. It was revealed in this study that seven year old children allocate attention the same as adults unless there is memory overload.

Moreover, for simple materials the capacity limit increased from age 7 to adulthood, whereas the ability to focus on the relevant items and ignore irrelevant ones stayed constant across that time. Generally, essential body physiological processes decrease with age, older people are less able to process complex information tasks including technology like multimedia and computers (Birren, Woods & Williams, 1980). Also, Myers and Conner (1992) reveal that older people have a more difficult time adapting to changes like in new technology.

Moris and Venkatesh (2000) made a study on *Age Differences in Technology Adoption Decisions.* For a period of 5 months 118 workers were introduced to a new software system. Younger worker's technology usage decisions were found to be more strongly influenced by attitude towards using the technology while older workers were strongly influenced by subjective norms and perceived behavioural control. Generally, results suggested that there are clear differences with age in the importance of various factors in technology adoption.

2.7 Differential Effectiveness of Printed Plain and Multimedia Enriched Instructional Materials

Different results were obtained when effectiveness of printed text was compared with an interactive multimedia CD ROM. This was done at Indira Gandhi National Open University by Dikshit, Garg and Panda (2013). The study involved 60 students from a computer course which were divided into three treatment groups and learned through printed text, interactive multimedia CD ROM and online learning. The objective of the study was to test the effectiveness of print, interactive multimedia

CD-ROM, and online learning. An achievement test with 50 multiple-choice questions based on the content of the module was provided by the researchers for all the three groups after learning. It was revealed that, learning through interactive multimedia CD resulted in higher academic achievement and more effective followed by online self-learning and the least effectiveness was the printed instructional mode of content (Dikshit *et al.,* 2013).

The effectiveness of printed multicolour instructional materials has also been assessed differently by different researchers. Mayer, Hegarty, Sarah, and Julie (2005) conducted a study to assess learning in computer-based animation and paper-based illustrations with printed text (printed in multicolour). The former consisted of computer based narration and animations while the later consisted of a text and illustration placed the right hand side of the paper. Both groups were given similar information on how toilet tank works for 60 minutes. It was assumed that the computer group will outperform the printed multicolour paper group because students in the computer group expend less effort in perceiving the presentation than in the paper group. It was revealed in a post test that students who learned from computer-based animation did not score significantly better than students who learned from paper-based printed multicolour text.

2.8 Multimedia Enriched Instructional Materials, Learning Styles, and the Brain

As technology becomes more accessible, educators should also be creative on how multimedia applications can be used as strong instructional tools. Again, educators

need to design instructional materials effectively; a combination of different multimedia enrichment levels at the same time considering students' learning styles (Cole, 2008). For instance, from a constructivist learning perspective, the integration of multiple intelligences and multimedia is an excellent way to actively involve students in learning (Orey, 2010). Literature reveals that human brain activities are quite similar to computers. It is capable of coordinating the senses, acquire, process, and link information to help people learn (Alick, 1999). All modern computers are multimedia in nature; meaning that the software installed in the system is capable of combining text, graphics, audio, and video with links and tools that help a user navigate, interact, create, communicate, learn and survive, both academically and socially (Hofstetter, 1997).

The strong relationship between computers and the brain has stimulated studies related to such knowledge in order to come out with better ways of combining them in the teaching and learning process. Hofstetter (1997) pointed out that, since the human brain and multimedia applications work in similar ways, it makes sense to incorporate school subjects with technology in order to stimulate better learning. He further insisted that, Computer Technology Research (CTR) supports the effectiveness of multimedia as a powerful tool in ensuring student's ability to remember and retain information.

The knowledge of students' learning styles is a crucial step in a providing a quality education and offering them different opportunities to portray their multiple intelligence strengths. Knowing that the brain behaves very much like a computer, where data is constantly entered, stored, linked and retrieved, it only makes sense to

integrate computer software and applications to stimulate students' intelligences and learning behaviours (McKenzie, 2004, Dave, 1999). Current research suggests that the brains of today's students are perfectly wired to navigate through multimedia applications. Studies further suggest that students learn better when engaged in lessons involving well-developed multimedia resources (Alick, 1999). Consequently, multimedia empowers teachers to structure lessons that reach all students' ability, a situation not met in the traditional classroom. Multimedia empowers students to take an active role in their own learning. Furthermore multimedia helps both teacher and students develop all the multiple intelligences necessary for quality learning.

Brain studies therefore, suggest that, students are engaged in activities that draw upon their multiple intelligence strengths. Hence, teachers must recognize these implications and adapt their instruction to meet the individual needs of all learners. Understanding the ways in which learners learn best will help in designing appropriate multimedia applications for optimal individual student learning.

2.9   Synthesis of the Review and Knowledge Gap

The review of literature in this chapter concentrated largely on the theoretical framework and empirical review including comparison of multimedia enriched instructional materials and gender, age, intellectual ability and printed ones. Most studies showed heightened effectiveness of learning in multimedia enriched presentations as compared to plain text (Jyotsna, Suresh, & Santosh, 2013; Adam, 2012; Mayer, 2005; Mayer & Gallini, 1990). These studies concluded that illustrated, computerized and audio visual materials are effective for improving the level of reading comprehension among learners especially to difficult terms.

Additionally, the studies conducted by Petitt (1994); Reid and Beveridge (1990) and Leung and Pilgrim (2010) compared plain text, traditional classroom lectures and multimedia in their effectiveness to reading comprehension. Results showed that more difficult topics were associated with more time looking at pictures compared to written texts. Moreover, Mayer (2005) indicated that students understand lessons better when they learn from text and pictures combined. Besides, the study by Passig and Levin (2001) showed that boys and girls differ in time on task and in intrinsic satisfaction with multimedia learning interfaces as well as differences in colour preferences. Most of the studies that compared learning at different school levels as well as gender, age, intellectual ability and colour preferences revealed that boys are better than girls in terms of technology adaptability. Also, boys had a more positive attitude towards the use of ICT than girl. It was also indicated that age is related to technology use. That is, older people are less able to process complex information tasks like multimedia and computers compared to young people.

Nevertheless, the above studies did not involve sex education instructional materials in secondary schools but involved office workers and advanced school levels. They neither involved secondary level students nor aimed at respondents' behavioural change. This study is therefore intended to contribute knowledge on this gap.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents and discusses the research design and methods employed in data collection to meet the specific research objective of the study. The chapter is organized in several sections. The first section deals with the study context where the justification for the study context and the quantitative paradigm are presented. Section two describes the approach used in the study, section three presents the research design employed, while section four and five constitute the target population, the sample and sampling techniques involved. Finally, pilot testing, validity and reliability of instruments, ethical considerations taken, and data analysis procedures are highlighted in the last sections of this chapter.

3.2 Study Context

The study was conducted at Benjamin William Mkapa secondary school, Ilala Municipality, Dar es Salaam region as shown in Figure 3.1. Dar es Salaam city is located between latitudes $6^0.36^{'}$ ^{and} $7^0.0^{'}$ degrees south of the Equator and longitudes $39^0.0^{'}$ and $33^0.33^{'}$ east of Greenwich. The city is bounded by the Indian Ocean on the east and by the Coast Region on both south, and north sides (Mutasiwa, 2004). As revealed by Mutasiwa, Dar es Salaam region is one of the 30 regions of the United Republic of Tanzania.

Administratively, Dar es Salaam has three districts, namely, Ilala, Temeke and Kinondoni. The selection of the school was based on the fact that it qualified for the principles of experimental studies as stipulated by Leary (2012).
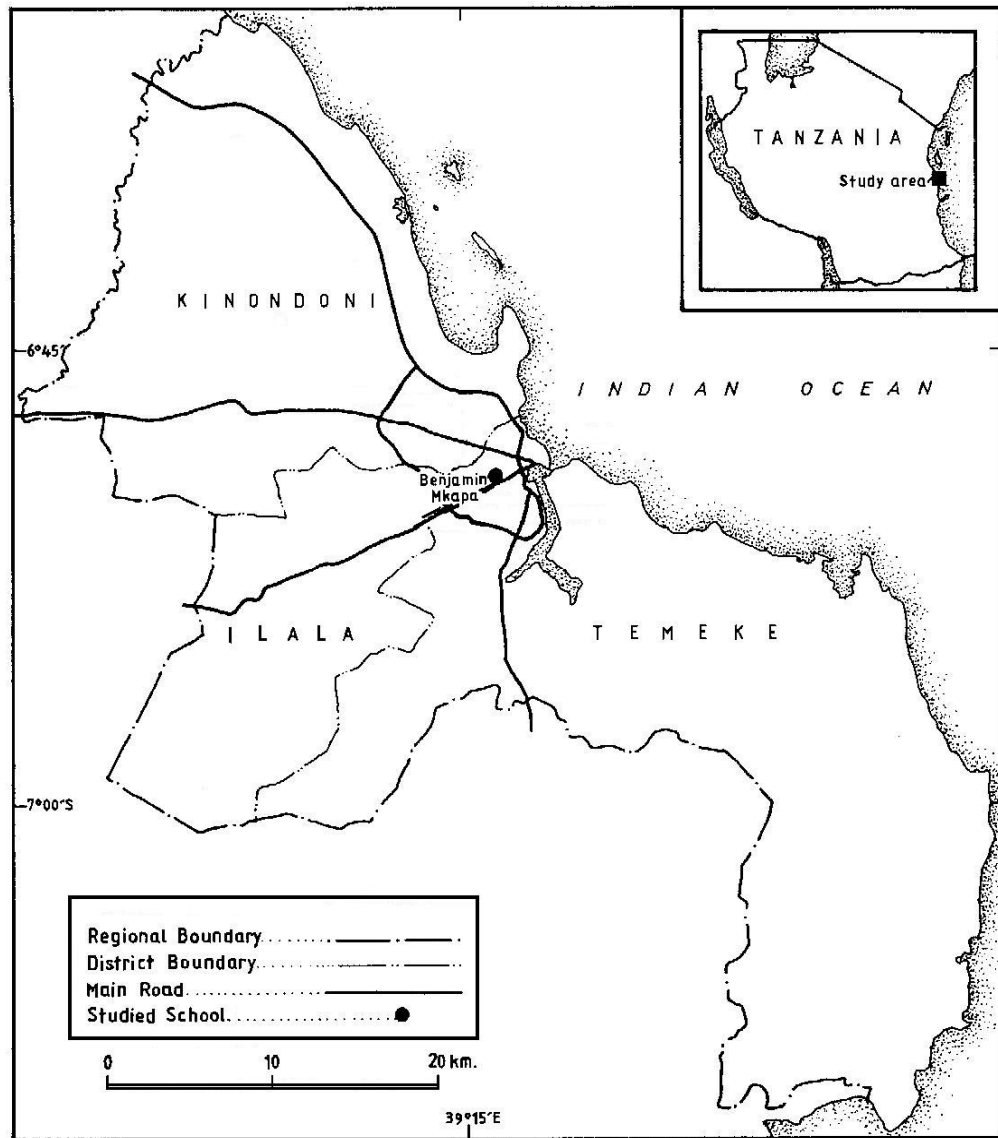
Figure 3.1: Location of the Study School in Dar es Salaam

Source: URT (2004)

Firstly, the list of resourced schools was obtained from the ministry of education and vocational training, secondly, Benjamin William Mkapa secondary school was chosen among such schools because it had extra qualities compared to the rest because the school had enough infrastructure including electricity, computers and

computer laboratories used for teaching and learning purposes. Also, furniture and other equipments like extension cables, lightning, speakers, big sized laboratories that were well ventilated with adequate seating for big number of students and safety precautions like fire extinguishers.

Furthermore, the school environment was calm enough to eliminate any uncomfortable situations such as noise that could affect the experimental results. Calmness was also enhanced by firstly, the absence of other students except form three students who were the participants and secondly, the experiment was conducted on Saturday and the school is situated a distance from Kariakoo market place. . Moreover, the large school population enabled the researcher to get enough sample for the quantitative approach.

3.3 Philosophical Orientation of the Study

This study employed quantitative paradigm as opposed to qualitative one. While the former is interpretive, the later is based on positivism theories (Trochim, 2000). Positivist paradigm emphasize on experimentation and observation as means of understanding human behaviour, true knowledge being based on experience of senses and ensuring distance between the subjective biases of the researcher and the objective reality of the research (Cohen & Crabtree, 2008). According to positivism, events are caused by other circumstances. In the present study the variations in student's performance were caused by the variations of the treatment; and generalization of observation of the particular phenomenon to the world at large whereby the results obtained may be generalized to other students who did not participate in the study (Trochim, 2000). Hence, this experimental study sought to

predict and explain relationship between the key variables different levels of multimedia enriched instructional materials and learning outcomes that were measured by performance in the test.

3.4 Research Design

Research design refers to the overall strategy that a researcher chooses to integrate the different components of the study in a coherent and logical way, thereby, ensuring that he/she effectively addresses the research problem and objectives (Ary *et al.*, 1996). This study used experimental research design to examine the effectiveness of multimedia enrichment in learning. Experiments are powerful techniques for evaluating cause and effect relationships. In the present study, the researcher manipulated the levels of independent variables (multimedia levels of enrichment) and then measured the outcome (participant's performance in each treatment). The factors that might affect the results were controlled including absence of other students and teachers. Only research assistants were involved. Also participants were randomly sampled and assigned to each of the treatment and control groups.

The experimental design in this study had the following features: Firstly, a pre-test evaluation was conducted to three experimental groups and a control using printed plain instructional materials so as to assess the prior knowledge of the learners on the topic selected. Secondly, the participants were provided with information on sex education using four different instructional material texts including audio-visual, audio aided, printed multicolour as well as printed plain. The four treatment conditions were the independent variables while the dependent variable were post-

test scores obtained from student's performance which was provided after each presentation. The study measured the knowledge the learners could exhibit on completion of each instruction. The factors that might affect the results were controlled including absence of other students and teachers. Only research assistants were involved during the experiment.

3.5 Target Population

Population is the totality of units which have one or more characteristics in common that are of interest to the researcher (Omari, 2011). It includes the entire group of individuals or objects to which researchers are interested in generalizing the conclusions. The target population of the study consisted of all 438, 827 form three students in Tanzania during the academic year 2013. The students involved in the study were 215 form three students. The selection of form three classes was based on the fact that the topic of interest that is *"Relationship between HIV, AIDS, and STDs"* was not yet covered in form one and two and the students were old enough to decide on their willingness to participate in the experiment.

3.6 Sample and Sampling Technique

The term sample has been defined by Creswell (2009) as a group of units selected from a larger group called population. By studying the sample it is hoped to draw valid conclusions about the larger group. Literature from different authors reveals that, a sample size of 30 is enough for an experimental study (Leary, 2012; Creswell, 2009; Trochim, 2000). This study used purposeful, stratified and random sampling. Firstly, the experimental school was selected on purpose; only the school with

enough facilities for the experiment and a conducive environment was deemed fit for the experimental study. Secondly, only form three students were selected purposefully because the topic "*Relationship between HIV, AIDS, and STDs*" is allocated to the four groups so it was new to all of them.

Thirdly, this was followed by purposive sampling where two groups, girls and boys were used to obtain the experimental groups. This was followed by random selection whereby students from both groups were arranged alphabetically, shouted number 1, 2, 3, and 4, and girls and boys who shouted "one" were allocated to treatment group number 1, those who shouted "two" were allocated to treatment group number two and similarly for those who shouted "three" and "four" were allocated to groups three and four respectively. Each student was allocated randomly to the four groups as indicated in Table 3.1. All available girls and boys in Form Three were involved in the study.

3.7   Experimental and Control Groups

3.7.1   Audio Visual Experimental Group

Firstly, the group was given a 40 minutes pre-test and thereafter received instruction from a multimedia enriched instructional material projected from a DVD. The material consisted of textual material, coloured pictures, and audio narration. Hence, the students from this group were able to view and hear information at the same time. This information was presented simultaneously for 40 minutes on a screen by a power point projector after which a 40 minutes post-test was provided so as to get the knowledge gained by the students.

Table 3.1: Experimental and Control Groups

Group #	Total Participants	Treatment Groups	Instructional Materials
1	54	Audio Visual	Viewed and listened to verbal DVD enriched with illustrations
2	54	Audio Aided	Listened to audio CD without illustrations.
3	53	Printed Multicolour	Read printed text with multicoloured pictures
4	54	Printed Plain	Read printed text as a control
Total	**215**		

3.7.2 Audio Aided Experimental Group

This group received audio aided information after completing a 40 minutes pre-test. Audio aided instructional materials consisted of textual information, and an audio narration from a CD displayed on a screen by a computer projector. Here before doing the post test the audio aided group was enabled to hear and read the target information but this time it lacked the pictures and illustrations found in the audio visual treatment.

3.7.3 Printed Multicolour Experimental Group

The third group received information on printed paper materials after completing a 40 minutes pre-test. Students were able to read textual information enriched with coloured pictures (Appendix II). These instructional materials resemble the audio visual except that the information was not displayed on a screen and no computer technology was involved. Likewise, a 40 minute post-test was provided to measure knowledge gained.

3.7.4 Printed Plain Control Group

This group received information in a traditional model, so it was a control group. The instructional materials consisted of printed black and white paper based information which the students were able to read for 40 minutes after doing a pre-test like the rest of the groups (Appendix I). No computer technology was involved, and the pictures were missing. That is why it was named "printed plain control group" as opposed to "printed multicolour" likewise a 40 minutes post-test was provided to assess the gained knowledge.

3.8 Research Instruments

Research instruments were based on the instructional objectives of the sub topic "*Relationship between HIV, AIDS, and STDs*" Two types of instruments were involved in the study namely: matching items and multiple choice items.

3.8.1 Matching Items

The test items consisted of a column of key words presented on the left hand side of the page and a column of options placed on the right hand side of the page (CITL. 2016).Ten matching item questions covering the whole topic concerned were provided to all treatment groups. Respondents were required to pair items in the left column to items in the right column as indicated in Table 3.2 as an example and the full test is presented in Appendix V.

Table 3.2: Examples of Matching Items

	Column A	Matching		Column B
1	Sexually Transmitted Diseases	……B…….	A	Hepatitis B
2	Genital warts symptom	……C……	B	STDs
3	An infection of the liver	……A……	C	Pink reddish warts cauliflower membranes

3.8.2 Multiple Choice Items

Multiple choice questions are assessment type in which respondents are asked to select the best possible answer out of several choices from a list. In this study ten multiple choice items covering the topic under study were provided to respondents in each treatment group (Kehoe, 1995). In the present study, the items consisted of five alternative answers ranged from a, b, c, d, and e as exemplified below. Respondents were needed to circle the letter of the most correct answer; one question has been provided as a sample and the rest are found in Appendix V.

Candidiasis includes infections in the following body areas:

    a) Genitals, mouth, and breasts

    b) Breasts, mouth, and feet

    c) Breasts, mouth, and liver

    d) Breasts, liver, and genitals

    e) Genitals, hand palms, and liver

3.9 Pilot Testing of the Instruments

Pilot testing involves conducting a preliminary test of the design and data collection instruments in order to identify and eliminate problems hence allowing opportunity to make corrective adjustments before collecting the actual data from the target population (Creswell, 2009). The pilot study was conducted to similar students in Perfect Vision Secondary School in order to assess clarity leading to improving the instruments if there was anything that required improvement or any unnoticed ambiguities. Moreover, the participants were asked to comment on the effectiveness

of the presentation mode (multimedia) as compared to traditional printed materials. They were also asked to indicate anything that made them feel uncomfortable. Overall the participants were happy and positive about multimedia instructional materials and thus expressed a feeling of freedom and comfort during their participation in the experiment.

3.10 Validity and Reliability of Instruments

3.10.1 Validity of the Instruments

The aim of conducting validity is to assess the extent to which the tools used in a research measure what they claim to measure. This study provided a pre-and post-test to participants in order to obtain the expected result, that is, the differential effectiveness of printed plain and multimedia enriched instructional materials. So the validity of the test items was assessed beforehand. It aimed at measuring the extent to which the test items covered the entire range of the instructions provided. Specifically, it assessed the adequacy with which the test items represented the sampled content area to be measured (American Psychological Association, 1974; Carmines & Zeller, 1979).

Hence, the researcher adapted the following steps in the process of test items validation as guided by Carmines and Zeller (1979): Firstly, the entire domain of content related to the phenomena was identified in collaboration with the subject teachers. This study involved a sex education topic on the "*Relationship between HIV, AIDS, and STD*". Secondly, test items associated with the same content were prepared then the subject teachers were involved to assess if at all the test items covered the sub topic as it is indicated in the syllabus. Subsequently, the teachers

were asked to judge on how well each item of a test corresponded to the defined content domain that the item was written to reflect and how well the items represented the content domains to which they are judged to correspond. It is important to also note that the instruments were firstly written in English and later on translated into Kiswahili as the respondents were more fluent in Kiswahili.

3.10.2 Reliability of the Instruments

Reliability refers to the consistency of a measure; the extent to which a measurement procedure gives the same answer whenever it is carried out (Elmes *et al*., 1999). In the present study the reliability of the test instruments was done by calculating the Cronbach's alpha coefficient after collecting data from the pilot study which was equal to Cronbach alpha coefficient of $\alpha = 0.84$ depicting high reliability coefficient with high consistency between test items and objectives.

3.11 Ethical Considerations Taken Into Account

Ethics are defined as morals, rules, or norms for conduct that distinguish between acceptable and unacceptable behaviour and between right and wrong (Resnik, 2005) Hence, research ethics are methods and procedure for deciding how to act and for analyzing complex problems and issues in a particular study Individuals should be treated as autonomous agents and the investigator must ensure that the subject has received a full disclosure of the nature of the study, the risks, benefits and alternatives, with an extended opportunity to ask questions (Resnik, 2005). In this study the participants had moral and legal rights so it was important for the researcher to avoid violation of their rights. This was important because the study involved investigating human body parts and behaviour hence there could have been

a number of ways through which participants could have been harmed physically, psychologically, emotionally and even being embarrassed. Hence, the following ethical issues were taken into account to ensure that no violation of basic ethical principles in experimental studies occurred.

Firstly, research clearance was sought from the Open University of Tanzania and the Regional and Ilala Districts Administrative Secretaries were informed.

Secondly, the head of the school and students were informed of the purpose and value of the study and their willingness to participate was established.

Thirdly both the students and teachers were informed about the nature of the study which displayed STD and HIV symptoms in pictures and audio visual.

Fourthly, all the aspects of the research that were likely to affect their willingness to become participants were disclosed ahead of time including the use of computers, projectors, and the type of pictures involved in the study. These involved the pictures showing sexually transmitted diseases in different body organs and HIV/AIDS victims as shown in Appendices II.

Fifthly, participants were encouraged to get involved fully and answer all the questions freely because it was the practical part of the topic concerned.

Again, it was also stated clearly that they could withdraw from the study at any time without giving any reason.

Finally, participants were informed that their information would be kept confidential, that their identity will not be revealed in any way in the resulting report, and that only the researcher had to keep such information. The code of conduct for research ethics warns researchers not to harm anybody physically, psychologically or otherwise.

CHAPTER FOUR

4.0 DATA ANALYSIS AND PRESENTATION

4.1 Introduction

The purpose of this study was to assess how plain printed and multimedia enriched instructional materials differ in their effectiveness in the provision of sex education in Tanzanian secondary schools, their comprehension and their effect on student's academic performance. It was assumed that the effectiveness of any instructional material depends on the content quality, structural variations, and textual enrichment of the materials used in the teaching and learning process. The effectiveness of four types of instructional materials was assessed in this study, namely audio visual, audio, printed multicolour, as well as printed plain which was done through pre and post tests.

4.2 Data Analysis Procedure

Independent t-test was used to evaluate the first three hypotheses to compare the differences in effectiveness between the traditional printed plain instructional materials and audio visual, audio aided as well as printed multicolour sex education instructional materials; while a two-way between-groups analysis of variance was used to explore the impact of sex on performance in different levels of multimedia presentations namely audio visual, audio, printed multicolour, and printed plain. Moreover, correlation analysis was used to assess the strength and direction of the linear relationship between performances in the audio visual, audio aided, printed multicolour, as well as printed plain instructional materials and student's academic performance in the national examination.

A total of 215 Form Three students were the subjects in the study, of whom 97 and 118 were females and males respectively as shown in Table 4.1. The subjects in the different experimental groups were randomly allocated after the pre-test and stratification by sex. It was thus assumed that the effects of pre-testing were equally spread in all the treatment groups.

Table 4.1: Participants in the Different Modes of Instruction

Mode of Instructional Materials	Participants					
	Male		Female		Total	
	N	%	N	%	N	%
Audio Visual(DVD)	31	57.4	23	42.6	54	100
Plain Audio(CD)	33	61.1	21	38.9	54	100
Printed Multicolour	29	54.7	24	45.3	53	100
Printed Plain	25	46.3	29	53.7	54	100
Total	**118**	**54.9**	**97**	**45.1**	**215**	**100**

4.3 Pre and Post-Tests Results in the Different Presentations

Among the 215 students involved in the study, 54 were taught using audio visual only, 54 used audio materials, 53 printed multicolour materials and 54 printed plain instructional materials. Table 4.2 shows the differences between pre-test and post-test scores. The best performing group was the audio visual treatment group while the worst performance was the printed plain treatment group. Thus the mean performance for students taught by audio visual was 56.76 (N=54, SD=16.112), followed by audio material (M=52.31, N=54, SD=17.258); then printed multicolour (M=49.57, N=53, SD=17.583); and the least in performance was printed plain instructional material (M=45.54, N=54, SD=17.583). These differences are visually illustrated in Figure 4.1.

In terms of change in scores from pre-test to post-test, it was the audio group that gained most, followed by audio visual, then printed plain, and lastly the printed multicolour group.

Table 4.2: Within Group Mean Differences Between Pre-test and Post Test Scores

	Treatments	N	Mean Scores	Mean Score Differences	Std. Deviation
Group 1	Audio visual Pre-test	54	41.78		15.54
				14.98	16.11
	Audio Visual Post-test	54	56.76		
Group 2	Audio Aided Pre-test	54	36.76		18.91
				15.56	17.26
	Audio Aided Post-test	54	52.31		
Group 3	Printed Multicolour Pre-test	53	36.79		17.07
	Printed Multicolour Post-test	53	49.57	12.77	17.24
Group 4	Printed Plain Pre-test	54	31.39		15.91
	Printed Plain Post-test			14.15	
		54	45.54		17.58
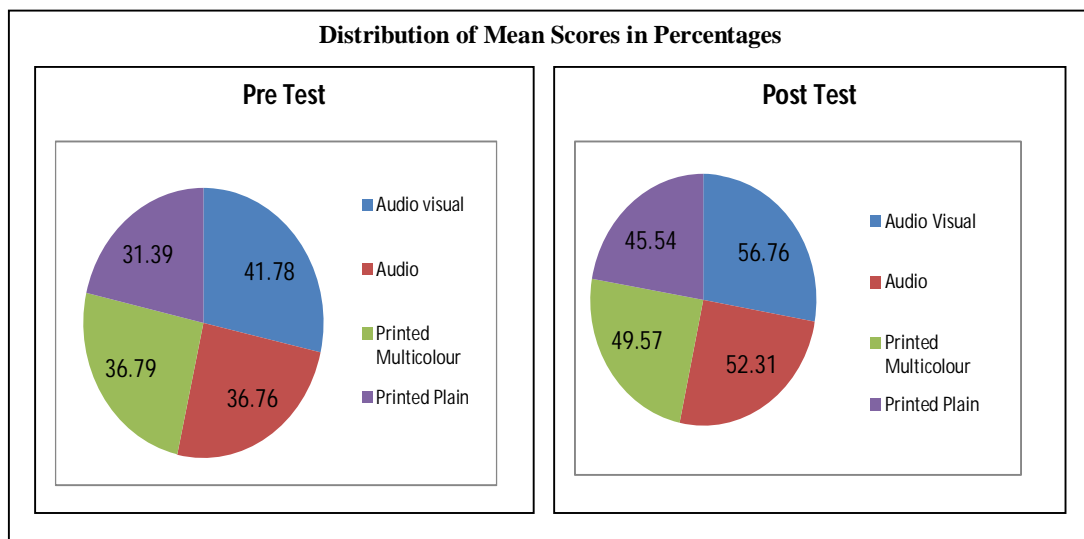
Figure 4.1: Pre-test and Post-Test Mean Scores in Pie Chart

4.4 Testing of the Hypotheses of the Study

The study had five objectives and five concomitant hypotheses. It was hypothesized that there would be a significant difference in effectiveness between printed plain and audio visual; printed plain and audio assisted; printed plain and printed multicolour sex education instructional materials. It was also assumed that gender differences would be significant in performance in the different levels of multimedia enrichment as well as significant differences in effectiveness in different levels of multimedia enrichment among students with different levels of academic abilities. These hypotheses were systematically tested one by one.

4.4.1 Differences in Students' Academic Performance Between Treatment Groups

Student performance in the four different instructional materials (treatment groups) namely: audio visual, audio, printed multicolour and printed plain was assessed aiming at obtaining the most effective mode of presentation. The instructional materials had different levels of multimedia enrichment and it was expected that the audio visual group would perform better, followed by audio group, then printed multicolour and the least was expected to be printed plain instructional materials.

4.4.2 Differences in Students' Academic Performance Using Printed Plain and Audio Visual Treatment Groups

This hypothesis assessed the differences in effectiveness between printed plain and audio visual instructional media materials. It was assumed that there would be significant differences in academic performance between printed plain and audio visual media groups of subjects of which the later group was expected to perform

better. The rationale here was that the audio visual materials had additional information by using two sensorial modalities-visual and hearing.

The results indicated as predicted that the mean performance for audio visual media of instruction (M=56.76, N=54, SD=16.11) with highest and lowest scores of 85 and 20 percent respectively, was higher than that of printed plain media (M=45.54, N=54, SD=17.58), which had 90 and 10 percent maximum and minimum scores respectively (Table 4.3)

An independent t-test was conducted to evaluate the hypothesis that there would be a significant difference in effectiveness between printed plain and audio visual sex education instructional materials (independent variables) on performance (dependent variable). The results of the t-test are displayed in Table 4.3.

Table 4.3: T-test to Compare Students' Academic Performance of Printed Plain and Audio Visual Subjects

Performance	t-Score	df	Sig. (2-tailed) P-value	N	Mean Scores	SD	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Printed Plain Post-test	3.458	106	0.001	54	45.54	17.583	3.245	4.788	17.656
Audio Visual Post Test	3.458	105	0.001	54	56.76	16.112	3.245	4.787	17.657

These findings revealed that the mean score for audio visual instructional materials was significantly different statistically from that of printed plain instructional materials at 0.001 level t(106)=3.46, p= 0.001. The 95% confidence interval for the

difference in mean was quite wide, ranging from 4.79 to 17.66. The calculated eta squared (η^2) statistics of 0.10 indicates a small effect of size.

Thus, the hypothesis that "there is a significant difference in effectiveness of students' academic performance between printed plain and audio visual instructional materials" is accepted as the audio visual instructional materials proved to be more effective than printed plain materials.

4.4.4   Differences in Academic Performance Between Printed Plain and Audio Aided Treatment Groups

The second hypothesis examined the differences in effectiveness between printed plain and audio instructional materials. It was assumed that the audio aided group of respondents would perform better than the printed plain group. The rationale was that audio aided materials may be better stored than the printed which consists of visually accumulated information that may destruct the visual field.

As predicted the results indicate that the mean performance for audio aided mode (*M*=52.31, *N*=54, *SD*=17.26), with highest and lowest scores of 95 and 15 percent, respectively, was higher than that of printed plain mode (*M*=45.54, *N*=54, *SD*=17.58), which had 90 and 10 percent maximum and minimum scores respectively (Table 4.4).An independent *t*-test was conducted to evaluate if there was a significant difference in effectiveness between printed plain and audio aided media of instructions (independent variables) on performance (dependent variable). The results are as displayed in Table 4.4.

Table 4.4: T-Test to Compare Academic Performance of Printed Plain and Audio Aided Subjects

Performance	t- Score	df	Sig. (2-tailed) P-value	N	Mean Scores	SD	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Printed Plain Post-test	2.022	106	0.046	54	45.54	17.583	3.353	0.131	13.425
Audio Post Test	2.022	106	0.046	54	52.31	17.258	3.353	0.131	13.425

The findings revealed that the mean score for audio media of instruction (M=52.31, N=54, SD=17.26) was significantly different statistically from that of printed plain media (M=45.54, N=54, SD=17.58) at 5% level: t (106) =2.02, p=0.05. The calculated eta squared = 0.04 was of moderate effect.

Thus, the hypotheses that "there is a significant difference between printed plain and audio aided instructional materials" is accepted as the audio instructional materials were found to be more effective than printed plain materials.

4.4.6 Differences in Academic Performance Between Printed Plain and Printed Multicolour Treatment Groups

This hypothesis assessed the differences in effectiveness between printed plain and printed multicolour as modes of instruction. It was predicted that the subjects with printed multicolour media would perform better than the printed plain group. The results from descriptive statistics (Table 4.5) indicate that the mean performance for

printed multicolour media (*M*=56.76, *N*=54, *SD*= 17.24) with highest and lowest scores equal to 85 and 20 percent respectively was higher than that of printed plain media (*M*=45.54, *N*=54, *SD*=17.58) which had 90 and 10 percent maximum and minimum scores respectively.

Moreover, an independent sample *t*-test was conducted to evaluate if there is any significant difference in effectiveness between printed plain and printed multicolour instructional materials (independent variables) on performance (dependent variable). The results were as displayed in Table 4.5.

Table 4.5: T-Test to Compare Academic Performance in the Plain Printed and Multicolour Printed Modes

Performance	t-Score	df	Sig. (2-tailed)	N	Mean Scores	SD	Std. Error Difference	95% Confidence Interval of the Difference	
t-test for Equality of Means									
			P-value					Lower	Upper
Printed Plain Post-test	1.197	105	0.234	54	45.54	17.58	3.367	-2.647	10.705
Printed Multicolour Post-test	1.197	105	0.234	53	49.57	17.236	3.366	-2.645	10.703

The independent sample *t*-test shows that the mean score for printed multicolour media of instruction was not statistically different from that of printed plain media at 5% level: *t* (105) =1.20, *p*=0. 23. The calculated eta squared = 0.01 was a small effect of size. These results reject the hypothesis that "there is a significant

difference in effectiveness between printed plain and printed multicolour instructional materials."

4.4.6 Differences in Academic Performance Between Audio Aided and Audio Visual Treatment Groups

This hypothesis examined the differences of effectiveness between audio and audio visual media of instruction. It was assumed that the audio visual group of subjects would perform better than the audio aided group. Results indicate that the mean performance for the audio visual group (M=56.76, N=54, SD= 16.11) with highest and lowest scores of 85 and 20 percent respectively was higher than that of the audio media (M=52.31, N=54, SD= 17.58) which had 95 and 15 percent maximum and minimum scores respectively (Table 4.6).

Table 4.6: T-Test to Compare Academic Performance in the Audio Aided and Audio Visual Modes

	t test for Equality of Means								
Performance	t-Score	df	Sig. (2-tailed) P-value	N	Mean Scores	SD	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Audio Aided Post-test	2.022	106	0.046	54	52.31	17.583	3.353	0.131	13.425
Audio Visual Post Test	3.458	105	0.001	54	56.76	16.112	3.245	4.787	17.657

Results from the independent sample t test shows that the mean score for audio visual instructional materials was statistically different from that of the audio aided instructional materials at 5% level: t(106)=2.022, p= 0.05. Eta squared = 0.037 is a moderate effect of size.

Thus, the hypothesis that "there would be a significant difference in effectiveness between audio and audio visual media modes of instruction" is accepted as the audio visual instructional materials proved to be more effective than the audio aided materials.

4.4.7 Differences in Academic Performance Between Audio Visual and Printed Multicolour Treatment Groups

This hypothesis examined the differences of effectiveness between audio visual and printed multicolour as modes of instruction. It was assumed that although both audio visual and printed multicolour media had illustrations, the audio visual group of respondents would perform better than the printed multicolour group because of the added technology in accessing information via two sensorial modalities.

Results indicate as predicted that the mean performance for audio visual (M=56.76, N=54, SD= 16.11), with highest and lowest scores equal to 85 and 20 percent respectively, was higher than that of printed multicolour media *(M=52.31, N=54, SD= 17.58)* which had 95 and 15 percent maximum and minimum scores respectively (Table 4.7).

Table 4.7: T-Test to Compare Academic Performance Means of Printed Multicolour and Audio Visual Modes

	t-test for Equality of Means							
Performance	**t-score**	**df**	**Sig. (2-tailed)** **P-value**	**N**	**Mean Scores**	**Std Deviation**	**Std. Error Difference**	**95% Confidence Interval of the Difference**
								Lower	**Upper**
Printed Multicolour Post-test	1.197	105	0.028	53	49.57	17.236	3.366	-2.645	10.705
Audio Visual Post Test	3.458	105	0.001	54	56.76	16.112	3.245	4.787	17.657

Results from the independent sample t test shows that the mean score for audio visual instructional materials was statistically different from that of printed multicolour mode of instruction at 5% level: $t(105)=2.022$, $p= 0.03$. Eta squared = 0.037, is moderate effect of size. Thus, the hypothesis that "there would be a significant difference in effectiveness between printed multicolour and audio visual media" is accepted as the audio visual instructional materials proved to be more effective than the printed multicolour group.

4.5 Gender Differences in Academic Performance in Different Instructional Materials

This hypothesis aimed at assessing the differences of performance by gender (dependent variable) in different levels of multimedia enrichment (independent variables). Result from descriptive statistics showed that on average boys scored higher than girls in the audio visual (57.4%), audio aided (61.1%), and printed multicolour (54.7%) while girls scored higher only in the printed plain mode of instruction (53.7%) as displayed in Figure 4.2.
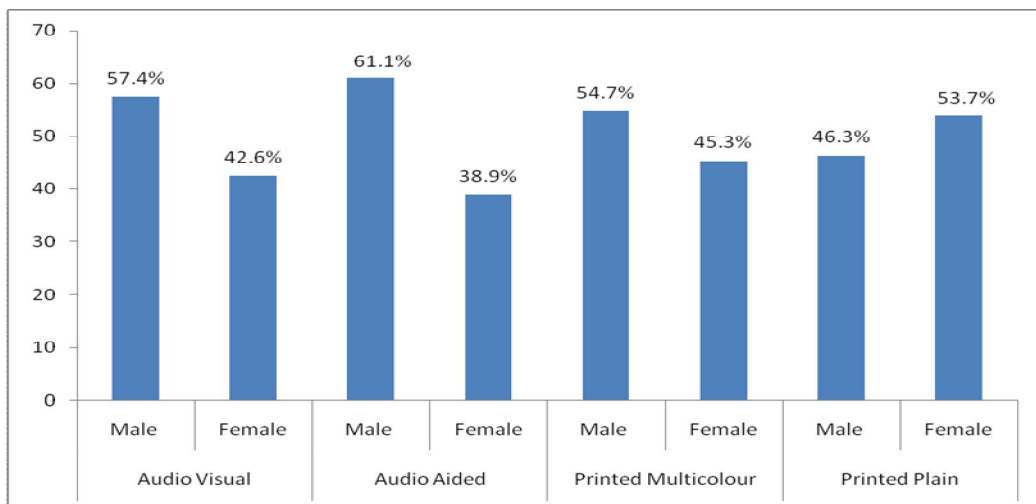
Figure 4.2: Gender Performance in Different Multimedia Levels

A two-way between-groups Analysis of Variance (ANOVA) was conducted to explore the impact of sex on performance in different levels of multimedia presentations namely audio visual, audio, printed multicolour, and printed plain (Table 4.8).

Table 4.8: Comparison of Academic Performance by Gender in Audio Visual, Audio, Printed and Printed Multicolour Groups

Tests of Between-Subjects Effects						
Dependent Variable: Performance						
	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4791.127[a]	7	684.447	2.354	0.025	0.074
Intercept	545712.413	1	545712.4	1876.724	0.000	0.901
Sex	506.905	1	506.905	1.743	0.188	0.008
Treatments	3589.526	3	1196.509	4.115	0.007	0.056
Sex Treatment	680.045	3	226.682	0.78	0.507	0.011

a. R Squared = .074 (Adjusted R Squared = .042)

According to Pallant (2011), the first thing to check in two-way between-groups ANOVA is the possibility of interaction effect. In the present study, the interaction effect between sex and multimedia levels was not statistically significant, F (1, 207) = 0.780, p = .507. However, there was a statistically significant main effect for experimental instructional media groups, F (3, 207) = 4.12, p = .007 and the effect of size was a moderate partial eta squared = .056 (Table 4.8). Moreover, the results revealed that there was a statistically significant difference in mean scores among the four instructional materials at 5% level F (4.115) p= 0.056.

Post-hoc comparisons using the Least Significant Difference (LSD) test indicated that the mean score for the audio visual group (M = 56.13, SD = 15.530) was significantly different from the printed plain group (M = 47.20, SD = 16.143) p=

.001 as well as the printed multicolour group (M = 53.45, SD = 17.014) p= .030. Nevertheless, the same group (M = 56.13, SD = 15.530) did not differ significantly from the audio group (M = 53.18, SD = 16.715) p=.177.

The analysis also revealed that the performance mean scores between student sex was not significant at 5%, meaning that the main effect for sex, F (1, 207) = 1.743, p = .188, did not reach statistical significance. Thus, the hypothesis that "there is a significant gender difference in performance in different levels of multimedia instructional media" was rejected.

4.6 Differences in Multimedia Effectiveness among Students with Different Academic Abilities

This hypothesis sought to assess the relationship between student performance in different levels of multimedia enrichment as dependent variables and their academic abilities (independent variable). Academic abilities were obtained from National Examination of Tanzania (NECTA) Results. Correlation analysis was used to assess the strength and direction of the linear relationship between audio visual media and academic ability; audio media and academic ability; printed multicolour media and academic ability as well as printed media and academic ability. The results are displayed in Tables 4.9- 4.10

4.6.1 Relationship Between Sex, Academic Ability and Performance in the Audio Visual Instructional Media

The relationship between audio visual media and subject academic ability was investigated using Pearson Product-Moment Correlation Coefficient. As conditioned

by Pallant, (2011), preliminary analysis needed be performed to ensure that there was no violation of the assumptions of normality, linearity and homoscedasticity. The correlation analysis was conducted and result displayed in Table 4.9.

Table 4.9: Correlation Between Sex, Academic Ability, and Performance in the Audio Visual Instructional Media (N = 54)

	Variables	Correlation Between the Variables		
		1	2	3
1	Post-test Media Scores	0.0		
2	Academic Ability	0.604**	0.0	
3	Sex	0.046	0.011	0.0

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

Results in Table 4.9 reveal that there was a strong and positive correlation between subject's academic ability and audio visual performance, $r = 0.60$, $n = 54$, $p = .00$. Thus, high scores in audio visual variables are associated with high academic ability. However, there was no correlation between audio visual media scores, academic ability and student's sex, r= 0.04, n=54, p=0.65. Thus, there is no relationship between sex and performance in audio visual mode of instruction.

4.6.3 Relationship Between Sex, Academic Ability and Performance in the Audio Instructional Media

The relationship between audio media of instruction and subject's academic ability was investigated using Pearson Product-Moment Correlation Coefficient. Preliminary analysis was performed to ensure that there was no violation of the assumptions of normality, linearity and homoscedasticity. The correlation analysis

was conducted and result displayed in Table 4.10.

Table 4.10: Correlation Between Sex, Academic Ability and Performance in the Audio Instructional Media (N = 54)

	Variables	Correlation Between the Variables		
		1	2	3
1	Post-test Media Scores	0.0		
2	Academic Ability	.661**	0.0	
3	Sex	-0.064	0.02	0.0

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

Results in Table 4.10 reveals that there was a strong, positive, and significant correlation between academic ability and audio performance, $r = 0.66$, $n = 54$, $p =.00$. Thus, high scores in one of the variables are associated with high scores in the other. But, other results reveal that there was no correlation between sex of respondents and performance in the audio media, r= -0.064, n= 54, p=0.65. Thus, there is no relationship between sex and performance in audio mode of instruction

4.6.5 Relationship Between Sex, Academic Ability and Performance in the Printed Multicolour Instructional Media

The relationship between printed multicolour mode of instruction and subject's academic ability was investigated using Pearson product-moment correlation coefficient. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. The results were displayed in Table 4.11.

Table 4.11: Correlation Between Sex, Academic Ability and Performance in the Printed Multicolour Instructional Media (N = 53)

		Correlation Between the Variables		
	Variables	1	2	3
1	Post-test Media Scores	0.0		
2	Academic Ability	0.0185^{**}	0.0	
3	Sex	-0.25	-0.131	0.0

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

Results in Table 4.11 reveal that there was no correlation between performance of subjects in printed multicolour media of instruction and subject's academic ability, r = 0.019, n = 53, p =.00. Consequently, there was no association between printed multicolour as a medium of instruction and subject's academic ability. Also, the correlation between printed multicolour and sex of subjects was small, negative, but significant, r= -0.25, n= 53, p=0.07, meaning that the performance in the printed multicolour group was related to performance by sex.

4.6.7   Relationship Between Sex, Academic Ability and Performance in the Printed Plain Instructional Media

The relationship between printed plain mode of instruction and subject's academic ability was investigated using Pearson Product-Moment Correlation Coefficient. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. The results were displayed in Table 4.12.

Table 4.12: Correlation Between Sex, Academic Ability and Performance in the Printed Instructional Media (N = 54)

		Correlation Between the Variables		
	Variables	1	2	3
1	Post-test Media Scores	0.0		
2	Academic Ability	.377**	0.0	
3	Sex	-0.089	-0.12	0.0

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

The results in Table 4.12 reveal that there was a moderate, positive, but significant correlation between printed plain media of instruction and subject's academic ability, $r = 0.377$, $n = 54$, $p = .005$. Therefore, high scores in one of the variables are associated with high scores on the other. The correlation between sex and performance in printed plain media was small, negative, and not significant, r = -0.09, n=54, p=0.52. These results mean that sex and performance in the printed plain media are not related.

CHAPTER FIVE

5.0 DISCUSSION OF THE FINDINGS

5.1 Introduction

This experimental study was set out to investigate the differences in effectiveness between learning in the traditional printed plain instructional materials and learning in multimedia enriched instructional materials. The effectiveness of the four formats of instructional materials was assessed including audio visual, audio, printed multicolour as well as printed plain materials. This chapter provides an overview of the findings as presented and analyzed in the previous chapter; it then discusses the findings and their implications to Tanzania.

The chapter is organized into four consecutive sections. Firstly, the effectiveness of different multimedia levels in learning is discussed through a comparison of the four types of media selected for this study namely audio visual, audio, and printed multicolour and printed plain instructional material. Secondly, the superiority of audio visual instructional materials and the possible effects of colour in learning are also discussed. The chapter concludes by a discussion on gender differences in performance in different levels of multimedia enrichment as well as the relationship between student's academic abilities and their performance at different levels of multimedia enrichment.

5.2 The Effectiveness of Different Multimedia Types on Performance

There is an assumption that information presented through multimedia improves learning because of its enrichment through text, graphics, animation, pictures, video displays, and sound because of the leaners' ability to use more of their senses. The

present study assessed the effectiveness of different levels of enrichment in learning including audio visual, audio only, printed multicolour as well as printed plain instructional materials. The audio visual instructional materials consisted of information presented in DVD in the form of text, sound, and multicoloured pictures on the screen. For audio instructional materials the same information was presented in a DVD with the information in a text only displayed on a screen and the pictures missing in the context. The information on the printed plain materials was produced in black prints on hard copies just as the case with traditional books are used in classrooms today while the printed multicolour text was similar to printed plain but had additional enrichment of multicoloured pictures with illustrations of each learning tasks.

The effectiveness was measured by the student's scores in each mode and the results indicated that that the mean performance for the group of audio visual media of instruction was highest, followed by performance in the audio group and the third was performance of students in the printed multicolour group. The printed plain group showed the least scores in performance. This implied that respondents comprehend information better and retained more of it when audio visual media was used compared to the rest of the multimedia types used for instruction.

These findings are similar to other studies revealing better performance when audio visual media are used compared to others. For instance, Nalliveettil and Ali (2013) in their study on *The Usefulness of Audio-Visual Aids in Teaching English as a Foreign Language Classroom"* revealed that, integrating audio-visual resources with the prescribed course content had a positive impact on the learning process. Students

found these resources useful in understanding difficult concepts given in the course books. It was also found that the use of these aids enhanced retention. Additionally, Florax and Ploetzner (2010) discovered similar findings in learning as measured by retention tests in which students received instructions through an integrated text and audio visual assisted technology.

Moreover, Mayer and Moreno (2003) found that learners achieved better learning outcomes when audio visual materials were synchronized rather than in printed text. Again, Petitt (1994) compared text-based instructions with standard audio visual systems in an industrial setting. The post-hoc test of the study showed significantly better results in audio visual mode of learning than the text-based instruction. Likewise, Moeller, and Reitzes (2011) did a study titled "*Integrating Technology with Student-Centred Learning*" and suggested that teachers should include audio visual technology in their classrooms so as to reduce difficulties and failures among learners.

The enhanced performance in an audiovisual condition found in this study can be generalized to all form three students in Tanzania. It is the assumption of this study that if students understand sex education better the frequency of early pregnancies will be reduced and the number of STDs will be reduced among youths. This is because they will practice safer relationships among themselves which is also a concern of sex education program. It should also be noted that the use of audiovisual instructional materials can be applied in other curriculum programs in Tanzanian education system and in all levels of education from pre primary to university levels programs.

5.2.1   Enhanced Effectiveness of Audio Visual Media Instructional Modes

The enhanced effectiveness of the audio visual media can be explained by the Brain Laterization Theory which contends that *"Individuals have different brain dominance which helps them to understand concepts, thinking, behaving, speaking, and functioning"* (Sperry, 1981). The cerebral cortex of the brain is the part that houses rational functions. The cortex is divided into two, the left and the right hemispheres. The left side of the brain is specialized for language and processing of information in a logical and sequential order while the right side is more visual and processes information intuitively, holistically, and randomly.

Moreover, the left part of the brain turns data from the external world into language and requires sequential processing where data is processed one bit at a time. Individuals from this group prefer reading information written in text and note taking. This process is always time consuming. To help left-brained students, information should be presented in a very logical sequence for example, numbered lists. They also prefer typed or printed directions as well as responding well to verbal instructions, that is, talking and writing (National Institute of Neurological Disorders and Stroke (NINDS), 2007; Sperry, 1981). This is further elaborated in Figure 5.1

Furthermore, students, who are right-brained, prefer visual concepts such as pictures, drawings, and manipulating objects. Such students process information quickly as images through olfactory, emotional, auditory, taste and tactile senses. They also respond well to demonstrated instructions, and may not be able to follow written instructions without a visual demonstration.
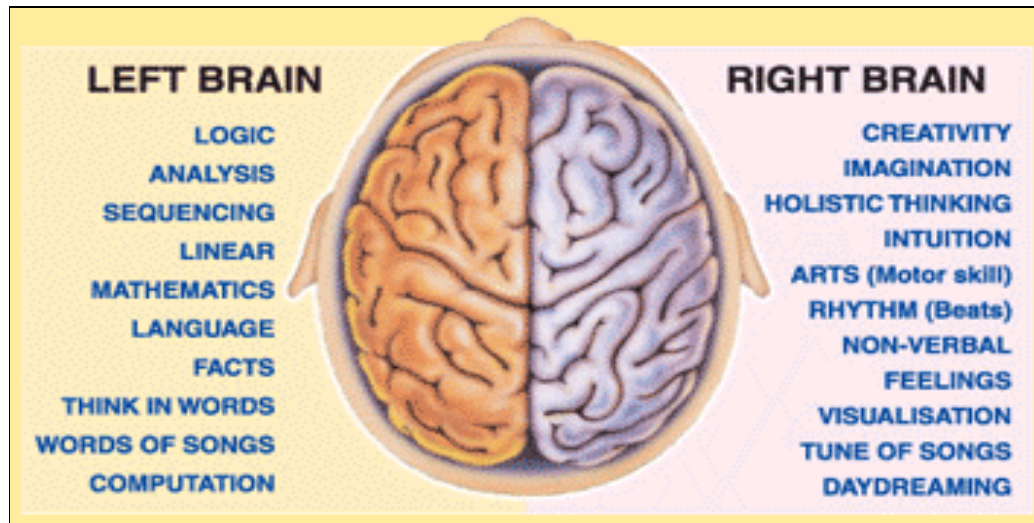
Figure 5.1:   Left and Right Brain Functions

Source: Sperry (1981)

Additionally, right-brained individuals need all three senses to be involved. They seem to prefer more audio visual learning so to help them learn better, so the teacher needs to pair music with learning, visual text and provision of hands-on activities (Sperry, 1981). However, some individuals exhibit both right and left-brained traits these are known as middle brained. Students who are middle brain oriented can have strong qualities from either hemisphere. Learner's dominant brain type has a very significant effect on their study skills, homework habits, and grades.

This situation is not only found in The United States of America; Tanzanian classrooms consist of similar heterogeneous types of students who learn differently. The results obtained from Benjamin William Mkapa students represent the whole of Tanzania. Not only that we have both left and right brained students in classrooms but also we have students with different disabilities. For this reason, Tanzanian teachers need to adjust teaching methods from lecturing only or using plain printed

only books to employing multimedia enriched materials (Sousa, 1995). Historically, the students' performance has been declining yearly. The teachers in collaboration with other curriculum stakeholders could put into consideration the brain dominance theory and prepare multimedia enriched instructional materials so as to raise performance as well as reduce early pregnancies and STDs as well as practice safer relationships.

5.3 Contiguity Principle of Learning by Using Multimedia

The contiguity principle of multimedia learning states that "*The maximization of learning is obtained by integrating words and graphics for instructional purposes*" (Clark & Mayer, 2011). In accordance with this principle, instructional designers should consider the student's working memory limits. This can easily be achieved in a multimedia mode of instruction that includes both visual and audio information presented simultaneously. Specifically, words should be spoken at the same time as they are illustrated. As stated by Clark and Mayer (2011), people learn better when corresponding words and pictures are presented near rather than far from each other, on the page or screen.

The rationale for simultaneous presentation is to reduce the brain's extraneous processing. Moreover, Mayer's cognitive theory of multimedia learning states that, "*meaningful learning occurs when students are able to make connections between corresponding visual, verbal and audio representations in the working memory*" (Mayer, 2008). Learners are more likely to be able to hold corresponding visual and verbal representations in the working memory at the same time as coordinated simultaneously. In contrast, with successive presentations, the limitations on

working memory capacity makes it less likely that corresponding visual and verbal representations will be in working memory at the same time.

Therefore, the principle cautions on the way multimedia enriched information should be combined. Narration should be presented with each corresponding part of video information, not before or after the video has taken place, as doing so can cause confusion or memory overload to the learner. For instance, in an experimental study conducted by Mayer, Hegarty, and Campbell (2005) students who learned from a sequentially narrated text and animation did not score significantly better than did students who learned from a paper-based printed text. Several factors may contribute to the situation; one of them is the assumption that the printed media presentation could reduce extraneous processes such as attending to sequence of movements found in the text and animations. This could be better if both text and animations were presented together as in the multimedia mode (audio visual) which is the main concern of this study.

This study aimed at assessing the effectiveness of different multimedia types. From the results the group with audiovisual type of instructional material performed higher than the rest. Here the contiguity principle further instructs teachers on the detailed practical use of multimedia. Teachers are advised to make sure that words and pictures in multimedia instructional materials are presented near or simultaneously rather than far from each other. Unfortunately, the Tanzanian situation is worse. There are neither pictures nor illustrations to be labelled. The topics in sex education program have a lot of terminologies that need illustrations but both the biology and civics books prepared by the ministry of education are in printed plain (URT 2010;

TIE 2011). It is the expectation of the researcher that the results and recommendations of this study will improve the situation

5.4 Text in Audio Assisted Versus the Traditional Printed Materials

In the present study, the audio assisted instructional materials had similar information with the printed plain media but had an additional technology where the information was displayed on the screen as opposed to the hard copies in the printed plain. In both situations the subjects were able to read the text but in the audio they had an added advantage of hearing the narrations. Common sense tells us that words mean the same thing whether they are presented as narration, on screen or printed on a paper. One might also believe that using a screen is a new and an interesting teaching method to learners; hence they may become motivated to learn and perform better. This was the case in this study.

The results revealed that the mean performance for the audio aided media group of respondents was higher than that of printed plain media, meaning that respondents understood concepts better through audio than printed mode of instruction. Similar conclusions were also revealed by other researchers such as Richard and Moreno (2002) in several studies titled "*How Lightning Forms; How Brakes Works*; and *How Plants grow*". They found that when words were presented through the auditory channel, students were able to transfer better what they had learned to new practical situations than when they learned through printed visual texts. In addition, Anne, Nadir, and James (2012) showed that adding audio content to books increased students' performance as opposed to just printed books.

Such results are also explained by the modality principle of multimedia learning which states that *"deeper learning occurs when information is explained by audio narration instead of text only"* (Clark & Mayer, 2011). They also recommended having words in audio format instead of visual text on screen when presenting graphics and words simultaneously because words are necessary either for memorization of steps in a procedure, or with complex functions such as mathematical formulas.

Nevertheless, some results from other studies are quite different. In a study done by Mousavi, Low, and Sweller (1995), students learned to solve geometry problems more productively from printed text than from combined audio and printed text which involved both the visual and the audio senses. Thus, as revealed in this study the audio group outperformed the printed plain one. But being educational practitioners we must bear in mind that, sometimes situation may change, students may learn better in textural information than in audio mode and vice versa. We need to be flexible and ready to change the mode of instruction accordingly. Additionally, according to the cognitive theory of multimedia learning, visual channel may be overloaded when learners use their visual cognitive resources both to read the on-screen text and watching at the same time (Mayer, 2002). These results have a lesson to teachers that a method may be applicable in one situation but not in another.

However, in some societies, like Tanzania, teachers use the curriculum materials prepared by Tanzania Institute of Education (TIE) most of which are printed materials and are also instructed to employ a given teaching method. The results from this study should open eyes to all stake holders so as to be more creative and

flexible to adopt the new technology of multimedia in both teaching and learning.

5.5 Possible Effects of Coloured Instructional Materials on Students' Academic Performance

Printed multicolour instructional materials were also used in this study. They consisted of a text displayed on hard copies but enriched with multicoloured pictures. In such materials students were able to view the real pictures of the information presented in text form. These instructional materials resembled the audio visual ones but the latter were presented on a projected screen and the students were able to view, hear, and see at the same time. In the former, students could not hear narrations but were able to view printed text enriched with different coloured pictures. Results revealed that the mean score for printed multicolour media of instruction group was greater than that of the printed plain, suggesting that students comprehended more from the printed multicoloured materials than the printed plain ones.

These results were similar to other studies which found that students comprehend academic content better from instructional texts that are combined with pictures than from plain texts only. Whereas early studies focused on the mnemonic function of pictures, combined with narrated text (Levie & Lentz, 1982; Levin, Anglin, & Carney, 1987), recent studies deal with the explanatory function of pictures. For example, Mayer and his colleagues found that students understood technical devices or natural phenomena better when they learn from text combined with pictures than plain text materials (Mayer, 1997, 2001; Mayer & Moreno, 2002). In other cases, however, it was revealed that adding pictures to a text can have detrimental effects

on learning as they may lead to cognitive overload or the pictures may become too decorative (Sweller, Van Merrienboer & Paas, 1998).

Although multimedia enriched instructional materials are of great benefit in learning and performance in particular, school teachers and curriculum developers need to know that too much of any information through the sense organs may lead to cognitive overload and confusion to learners. There are many causes of overload, including sensory information coming from several sources at the same time like too many colours through the eyes, noisy environments, fluorescent lighting, socializing in noisy large groups, being touched or the feel of clothes on the skin, weather changes, and sometimes strong aromas. Hence, care must be taken in the preparation of instructional materials so that we do not overload and confuse the learners.

5.6 Psychological Influence of Colours in Effective Learning

Colours are related to emotions and feelings as revealed by different scholars. For example, the blue colour seems to be connected with comfort and security, orange is perceived as distressing and upsetting, yellow colour is considered as cheerful and purple as noble (Ballast 2002; Mahnke 1996). Moreover, red colour is described to have both positive and negative feelings such as active, strong, and passionate, but on the other hand aggressive, bloody, violent and intense.

Again, a study by Sarah (2009) reported that there are three basic principles of colour namely: hue, saturation, and value that are associated with learning. Hue is the wavelength of a colour and determines its label such as orange and green; saturation is the intensity of a colour, while value is the colour brightness. The three

factors determine how people perceive colour and thus their association with learning. Thus, in a classroom environment including the instructional materials when each of these colours is used they may affect students' emotion positively or negatively as well as the learning process as described by the studies.

Moreover, a study by Luscher (1972), revealed how colours affect readers psychological feelings and moods. He emphasized that, as soon as colour enters our sensory system, it stimulates the pituitary and pineal glands. Certain hormones are then triggered, to produce a variety of physiological responses. Thus, colour has been found to have a direct influence on our thoughts, moods and behaviour. In this study different colours were included in the audio visual, and printed multicolour instructional materials and all of them enhanced the learning process among the learners. That is why in chapter six the researcher recommends to teachers, curriculum developers and policy makers on the preparation and use of multimedia enriched instructional materials because they enhance learning as well as retention

Naz and Helen (2004) conducted a study titled *"Colour-Emotion Associations: Past Experience and Personal Preferences"* to 98 college students where several colours were used in the study. The results revealed that green colour attained the highest number of positive emotion (95.9%), including the feelings of relaxation, happiness, comfort, peace, and hope. Green was also associated with nature and trees, and thus creating feelings of comfort and soothing emotions. The colour yellow was seen to be energetic and elicited positive emotions (93.9%) including happiness and excitement because it was associated with the sun and summer time. The next highest number of positive response was given for the colour blue (79.6%), followed

by red and purple (64.3% each). Blue was associated with the ocean and the sky thus inducing relaxing and calming effect. The colour red was also associated with love, romance, evil, and blood. Hence, among the intermediate hues, the blue-green elicited the highest number of positive results on performance.

The good results obtained in green colour may be applied in Tanzanian classrooms, the curriculum materials like the books we use for teaching students as well as school environment. Again, these results may be used to induce positive emotions like in the classroom walls, planting green plants around the school compound as well as making green colour as background of our instructional materials. This can be achieved by training book publishers, school heads as well as teachers because in some ways they are involved in the process of curriculum development as well as the management of school environment.

5.7 The Effects of Pictures in Instructional Media on Students' Academic Performance

The presence of a screen as an added technology was sensed more on audio visual instructional materials as compared to the audio only. Although in both cases students were able to view and hear narrations at the same time, the audio visual materials had an addition of pictures which were not present on the audio materials. Results indicate that the mean performance for audio visual group was statistically significant higher than that of audio media. This might have been contributed by the recall and recognition superiority of pictures over text content a situation termed as "picture superiority effect (PSE) by Hockley, (2008).

According to Hockley, the memorial representation of pictures is more elaborate, distinctive, and meaningful than the representation of words. Similar results have been revealed by other authors too. For example Treichler (1967) showed that people generally remember only10 percent of what they see and 50 percent of what they see and hear. Moreover, Day and Beach (1950) as quoted by Mayer (2005) support the view that a combined visual and auditory presentation leads to more efficient comprehension than either alone. It is generally accepted that an item studied as a picture will be better remember than an item studied as a word.

Moreover, conventional wisdom amongst many memory theorists holds that pictures are better remembered than words on recognition tests (Ally & Budson, 2007; Anderson, 2009; Brady, Konkle & Oliva, 2008). Additionally, Paivio's Dual Code Theory (Paivio & Csapo, 1973) explains that when pictures are studied, they elicit their verbal label and thus two codes are stored in the memory. In contrast, words do not automatically elicit a picture and have relatively impoverished memory representations. This situation has also been supported by other scholars who explain that pictures are more memorable because processing of pictures in the brain needs extra attention and effort also it takes longer time to name a picture than to read a verbal label of a picture (Noldy, Stelmack, & Campbell, 1990).

Pictures should be incorporated in instructional materials with caution, Levie and Lentz (1982) studied the use of static pictures accompanying text in children's stories. Their findings suggested that pictures that are coloured and decorative do not help children construct mental models of the story situation. On the other hand, coloured pictures that illustrate actual scenes from a story or help organize complex

scenes that may be difficult to imagine, improve the child's memory of the story. On the contrary, when source material is entirely in text form as in printed plain instructional materials, students might have difficulty in constructing mental models because they lack knowledge about the concepts.

Furthermore, a study done by Hasselbring, (1994) on using media for developing mental models and anchoring instruction revealed that decoding printed plain text takes considerable effort, depriving learners of mental resources they could otherwise use to comprehend the information more deeply. Additionally, Ramsey (1996) states that up to 30 percent of the population are not able to visualize a concept from a text description so the use of multimedia enriched materials can help learners construct better mental models by illustrating concepts that are difficult to imagine from a text description alone.

5.8 Active Processing Theory of Multimedia Learning and Effective Academic Instruction

One of the assumptions by Mayer (2005) cognitive theory of multimedia learning is that Meaningful learning occurs when learners engage in active processing within the channels. This engagement includes selecting relevant words and pictures, organizing them into coherent pictorial and verbal models, and systematically integrating them with each other and with appropriate prior knowledge. This is the essence of constructivism in cognitive psychology. These active learning processes are more likely to occur when corresponding verbal and pictorial representations are in the working memory at the same time as shown on Figure 5.2. This situation is missing in audio only materials of this study. The audio visual sample group was

able to organize words and pictures while the audio group received mere words. The right column of Figure 5.2 represents the auditory (verbal) channel and the left column represents the visual (pictorial) channel. The figure indicates that words are transmitted to the cognitive system through the ears and pictorial information is transmitted through the eyes.

In the cognitive process of organizing words, learners mentally arrange the selected words into a coherent mental representation in the working memory (verbal model). In the cognitive process of organizing images, the learners mentally arrange the selected images into coherent mental representations in the working memory (pictorial model). In the cognitive stage of integration, the learner mentally connects the verbal and pictorial models, as well as the appropriate prior knowledge from long-term memory.

This situation enhances learning and memory retention as it was revealed in this study. Students who received instruction through audio visual and printed multicolour instructional materials had similar modes that were both verbal and pictorial modes. The written words in the printed multicolour materials and the narrations in the multimedia materials reached the brain through verbal channel while the pictures in both materials took their way through the pictorial channel. This was reflected in the enhanced performance as opposed to printed plain instructional materials.

Normally, Tanzanian teachers apply verbal modes of instruction that have traditionally played a larger role than pictorial modes of instruction. According to

Mayer (2005), verbal modes of instruction are based on words and include spoken words, such as lectures and discussions, and printed text such as the text portion of textbooks or on-screen text, while pictorial modes of instruction are based on pictures and include static graphics such as photographs, illustrations, figures, and charts, and dynamic graphics such as animation and video. It is therefore learned from the illustration in Figure 5.2 that, the use of multimedia is essential for learning and retention to take place.
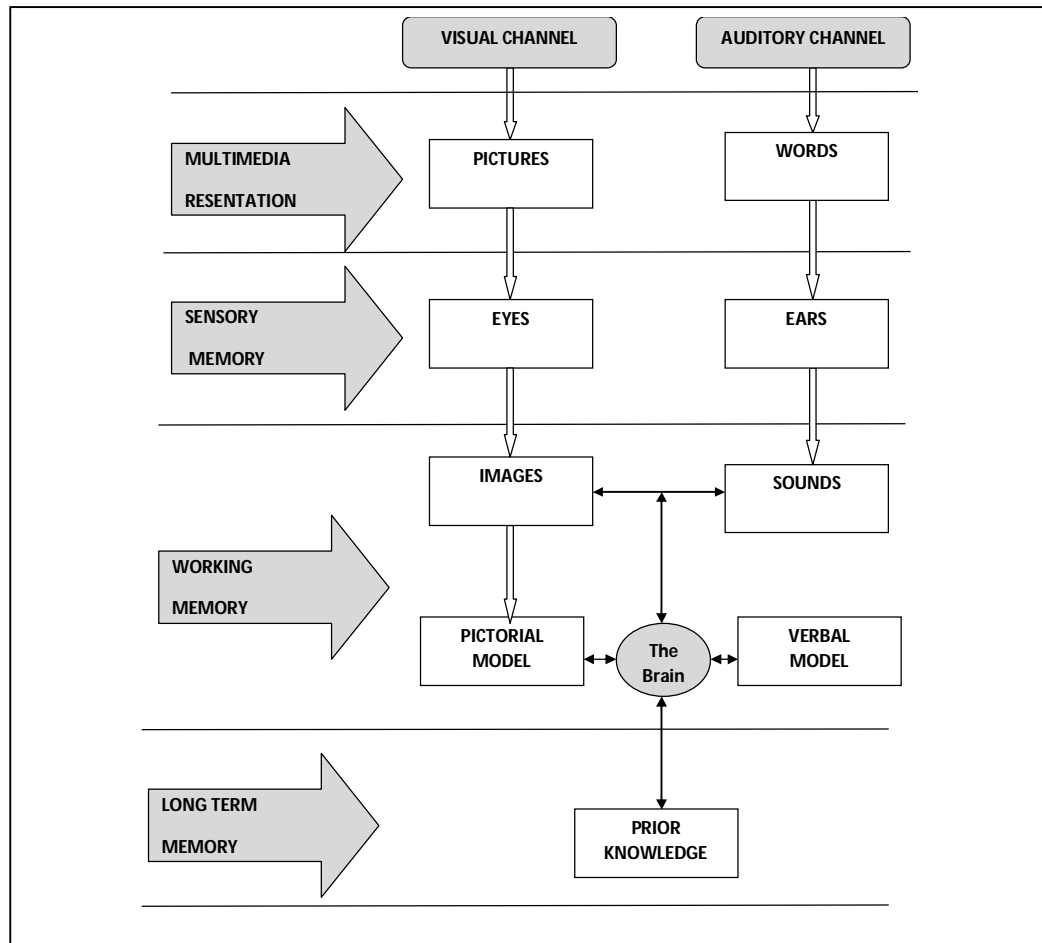
Figure 5.2:   Active Processing Cognitive Model

Source: Mayer, (2003)

In the classroom situation, when teachers introduce concepts to learners they should bear in mind that such concepts are integrated to prior knowledge in the learners long term memory. Hence, there is a need for teachers to allow learners to think deeply, make reflections as well as contextualizing the newly introduced concept so as to integrate with previous ones as stated in the constructivism theory (Elliot, Kratochwill, Cook, & Travers, 2000).

5.9 Differences in Multimedia Effectiveness Among Girls and Boys

The study had also intended to assess the ways in which performance in different levels of multimedia enrichment differs among girls and boys. Both were exposed to similar instructional materials, equal time allocation as well as the same test questions after instruction. In other words, they were in the same situation. Results revealed that there was a significant difference in mean scores among the four media of instructional materials between girls and boys. Boys scored higher than girls in three different media modes namely: audio visual, audio aided and printed multicolour, while girls scored higher only in printed plain. Boy's highest score was obtained in the audio aided mode and the lowest score was obtained in the printed plain while girls scored highest in the printed plain and poorly in the audio aided mode. On the average, boys performed better than girls.

Many studies have given results similar from what was obtained in this study. For instance, Passig & Levin (2000) in a study on "*gender preferences for multimedia interfaces*" examined the gender differences in the preferences to varying designs of multimedia learning interfaces. It was assumed that design characteristics add to the interest in learning among both boys and girls. The research findings indicated that

there was a significant difference in the level of satisfaction between boys and girls, depending on the design of the learning interfaces. The study further indicates that girls, compared to boys, were in an inferior position concerning their image of control of technologies and do not reach their full potential.

Also, the work done by Ron (2006) discovered that gender differences in terms of information technology skills among primary school students in a city school district in Western Australia remained the same from 1985 to 1991. Another research by the Higher Education Research Institute (HERI) (2000), reported that female students were half as likely as male students to rate themselves as computer-skilled (23 percent female versus 46 percent male). The male student's dominance in the use of computer in school is also evident in most of the 21 countries being studied by Reinen and Plomp (1993) based on the country's rankings in terms of IT skills. Moreover, research by Meelissen (2005) showed that girls seemed to have a lower self-efficacy compared to boys especially in more complicated computer tasks.

Historically women have been lagging behind in adapting to new technological skills because of gender discrimination in different cultures (Wajcman, 2009). On this view, technology tends to be thought of in terms of industrial machinery, military weapons, the tools of work, and war; overlooking other technologies that affect most aspects of everyday life. This conception of technology is therefore cast in terms of male activities (Wajcman, 2009), thus quite masculine. However, Gillwald, Milek and Stork (2010) reveals that, to a large extent, gender inequities in access and usage of ICTs is great and that it requires policy interventions in other areas that would allow women and girls to enjoy the benefits of ICTs equally. This would

include policies and programmes that sensitize the education of girls, and particularly their participation in mathematics, science and engineering. Many of the barriers for women relate to cultural norms and practices that are difficult to legislate away because large numbers of women are among those most marginalized from ICTs.

According to Passig, (2003), there is a great amount of studies that pin point the gender gap in science and technology, from kindergarten to universities. He added that, gender gap in computer usage, science and learning at kindergarten levels is explained in many societies by social, environmental and even genetic factors. Studies have shown that there is a great deal of gender differences in time on task, intrinsic satisfaction, interest and usage preference of multimedia based learning programmes. This suggests the need of either developing gender free interfaces or addressing specific genders. Thus, one can close a great deal of the technology gap that seems to hold back girls from extensively using computers.

Generally, this may be explained by the trend of boys and girls in different levels of education; the way they choose subjects of interests in the lower levels, their family economic situations, as well as culture. Boys are more likely to develop interest in the physical sciences and engineering than girls. In contrast, girls are more likely to develop an interest in biological and social sciences, languages and reading than boys (Eccles, Wigfield, & Schiefele, 1998). These different preferences in boys and girls become more intense during the secondary school years, the time in life when adolescents must choose school subjects, academic, and career paths. Several studies have shown that such choices are influenced by such psychological factors as their

hierarchy of interests, ability self-concepts, domain specific self-efficacy beliefs, and the perception of costs and benefits of getting involved in different activities (Eccles &Wigfield, 2002).

International researchers have systematically reported that women were more likely than boys to aspire to careers in health and biology-related careers. In contrast, men are more interested in pursuing scientific and technological studies and less interested in studies related to the provision of care and nurturance (Kiefer & Shih, 2006).

5.10 Students' Academic Abilities and Multimedia Learning

This study aimed at assessing whether there was any relationship between multimedia levels of enrichment and the subject's academic abilities. The ability was obtained from formal examination results which were then correlated with performance scores from different multimedia mode of instruction. Results displayed by different modes of instruction had different variations. First of all, it was revealed that there was a strong and positive correlation between performance in the audio visual mode of instruction and subject's academic abilities. This meant that, high scores in audio visual were associated with high scores on academic subjects. Moreover, the relationship between performance in the audio mode of instruction and subject's academic ability was investigated using Pearson product-moment correlation coefficient. It was revealed that there was a strong and positive significant correlation between the two variables. Thus, high scores in audio mode of instruction were associated with high student's academic ability.

Additionally, the relationship between the two printed modes of instruction and subject's academic ability were analysed and revealed that there was no correlation between performance in the printed multicolour mode of instruction and student's academic ability. Similarly, the correlation between printed plain mode and academic performance was found to be only moderate. Consequently, variations of performance in the two printed modes of instruction were not associated by student's abilities.

Gardner (1983) reveals that, learners have different abilities for mental problem solving skills, reasoning, perceiving relationships, calculating, and learning quickly. Learners with high academic abilities are considered to be intelligent. According to Gardner's Multiple Intelligence Theory human beings have nine different kinds of intelligence that reflect different ways of interacting with the world. Each person has a unique combination of intelligences including verbal/linguistic, logical/mathematical, musical, bodily/kinaesthetic, visual/spatial, naturalist, intrapersonal, interpersonal, emotional and existential intelligence. Likewise, learners have variable learning skills including visual, auditory, and kinaesthetic. That means some learners are more receptive to listening and visual stimuli and some function well independently, but not in group settings.

The results obtained from this study may be explained differently. It is obvious that with added technology such as audio visual and audio modes of instruction, more learning modalities are involved. Considerable research has shown that students learn more effectively when the instruction is consistent with their cognitive learning style modes (Gagne, 1985). Multimedia enables learners to organize the information

in a manner that reflects their learning styles, thereby improving the retention and retrieval of knowledge (Norman, Genter & Steven, 1976).

The way students review multimedia instructional material mirrors the way they think, learn, and remember. Students move between text, and visual images and sound, stopping for a time to interpret, analyse, and explore (Mayer, 2005). The results further, indicates that students with high abilities were associated with learning through audio visual as well as audio but it is not necessarily the causality of their high performance in either of the situations. Likewise, students with low intelligence were associated with the printed models of instruction; again the correlations did not mean the causality. From literature one can learn that when information is presented using both the visual and auditory channels, working memory can handle more information overall (Miler, 2005).

Moreover, using multiple channels can increase the amount of information that the brain can process (Sweller, 2005). The multimedia learning theory and the learning style model may explain the association between student's high abilities and the audio and audio visual presentations. Mayer, (2005) in elaborating the multimedia learning theory revealed that words and pictures are better than words alone meaning that people learn better from words and pictures than from words alone. In this context, words include written and audio text, while pictures include static images in the multicolour mode, and animations in the audio visual mode.

Research tells us that the use of both words and pictures lets the brain process more information in working memory (Sweller, 2005). We would therefore expect high

performance in the printed multicolour but in this study there was no correlation between multicolour and students ability. The printed plain mode is the traditional method used in our school books today and the books are printed in black colour. Several authors have shown that such text books have poor readability because they are read in a linear fashion and contradict how mental models are built (Glenberg & Langston, 1992; Kessy, 2012; Gilliland, 1972). Thus, there is an association between the mode of instruction and students performance.

Moreover, the association between intelligence and multimedia is explained by the fact that students have different learning styles. According to Felder (1998), "students learn in many ways-by seeing and hearing; reflecting and acting; reasoning logically and intuitively; memorizing, visualizing, drawing analogies and building mathematical models; steadily and in fits and starts". Additionally, teachers employ different teaching methods in the class. Some instructors lecture, others demonstrate while others discuss; some insists on principles and others on applications; some emphasize memory while others understanding. How much a given student learns in a class is influenced in part by that particular student's natural ability, prior preparation, but also the compatibility of his or her learning style and the instructor's teaching style.

Felder (1998) suggested 5 questions to consider to identify the different teaching styles relevant to different students' learning styles as displayed in Figure 5.3.

Student's Learning Style Questions:	Teaching Style Questions:
What type of information does the student preferentially perceive? *Sensory* sights, sounds, physical sensations, or *Intuitive* possibilities, insights, hunches?	**What type of information is emphasized by the instructor?** *Concrete* factual, or *Abstract* conceptual, theoretical?
Through which sensory channel is external information most effectively perceived? *Visual* pictures, diagrams, graphs, demonstrations, or *Auditory* words, sounds?	**What mode of presentation is stressed?** *Visual* -pictures, diagrams, films, demonstrations, or *Verbal-* lectures, readings, discussions?
With which organization of information is the student most comfortable? *Inductive-*facts and observations are given, or *Deduc*tive-principles are given, consequences and applications are deduced?	**How is the presentation organized?** *Inductively-*phenomena leading to principles, or *Deductively-* principles leading to phenomena?
How does the student prefer to process information? *Actively-* through engagement in physical activity or discussion, or *Reflectively-*through introspection?	**What mode of student participation is facilitated by the presentation?** *Active-*students talk, move, reflect, or *Passive-*students watch and listen?
How does the student progress toward understanding? *Sequentially-in* continual steps, or *Glob*ally-in large jumps, holistically?	**What type of perspective is provided on the information presented?** *Sequential-*step-by-step progression or *Global-context* and relevance?

Figure 5.3:   Models of Learning & Teaching Styles

Source: Felder, (1988)

Learning by sensing involves observing, gathering data through the senses while intuition involves indirect perception by way of the unconscious speculation and imagination. Everyone uses both styles, but most people tend to favour one over the other (Jung, 1971). The two teaching styles that correspond to the sensing and intuitive learning styles are *concrete* and *abstract* respectively. Teachers should reach both types and the material presented should be a blend of concrete

information like facts, data and observable phenomena as well as abstract concepts including principles, theories, and mathematical models.

Intuitive learners prefer conceptual, innovative, and theoretical information. They look for the meaning; while, visual ones prefer graphs, pictures, and diagrams. They look for visual representations of information. As opposed to visual learners, verbal learners prefer to hear or read information. They look for explanations with words. Moreover, active learners prefer manipulative objects, do physical experiments and learn by trying. They enjoy working in groups to figure out problems; on the other hand, reflective learners prefer to think through, to evaluate options and learning by analysis. They enjoy figuring out problems on their own. Again, sequential learners prefer to have information presented linearly and in orderly manner. They put together the details in order to understand how the big picture emerges; while, global learners prefer a holistic and systematic approach. They see the big picture first and then fill in the details.

5.11 The Role of Personalities in the Effectiveness of Teaching and Learning

One's preferred learning style is the way in which he/she learns best. Three learning styles that are often identified in most people include: auditory, visual and tactile or kinaesthetic learning styles. We need to identify ourselves with the learning styles so as to maximize performance in learning and other activities we perform daily. Ferret (2006) reveals that human beings have four types of personalities which need to be integrated with learning styles for effective teaching and learning processes. These include.

Analyzers: These are people who are logical, thoughtful, loyal and organized. During learning they perceive information abstractly while processing it reflectively. Such people are more concerned with facts, abstract ideas and people. They like models, lecturers, textbooks and individual work.

Supporters: are cooperative, honest, sensitive, warm and understanding. They perceive information by intuitions and process it reflectively. Moreover, they learn by finding meaning and interest, remaining concrete as well as being experimental.

Directors: these are people who are self directed, result oriented, and like to be leaders. These people learn best by practical application, doing things and prefer field trips.

Creators: their temperament involves being innovative, flexible, risk takers, and creative. They learn by observing, reflecting, experiencing and they are very active in the classroom. They also like games, role playing, illustrations, drawings, music and visual information. This type of assessment will help learners to identify their preferred learning style and thereafter they can use the following study tips for each learning style as revealed by Larry (2012).

Verbal learners should try the techniques that involve reading, speaking, and writing. They should find ways to incorporate more speaking and writing techniques. Like, talking one, using recordings of lessons, rhyme and rhythm and reading important information aloud. Moreover, verbal learners may be more effective by setting some key points to a familiar song or theme for recalling lists of information.

Visual learners are advised to use images, pictures, colour and other visual media to enhance their learning. For example the learner may use colour, layout, and visual words, pictures, and mind maps in place of text, wherever possible. Also such learners should make sure that they have different colour pens for highlighting key points or words.

An auditory learner is advised to use sound, rhyme, and music in learning, focus on using audio content and visualization, and use sound recordings to provide a background whereas kinaesthetic learners can use touch, action, movement and hands-on work in learning activities. They can also physically touch objects when learning different things and flashcards for memorizing information because they can touch and move them around.

Moreover, visual and auditory learners receive information in three different modalities: *Visual* sights pictures, diagrams and symbols; *auditory* include sounds and words; while kinaesthetic uses *taste*, *touch*, and *smell*. Most people learn effectively with one of the three modalities and ignore information presented in the other two. Amazingly, most teaching is verbal and the information is presented predominantly in auditory lecturing or a visual representation of words and symbols written in texts, handouts, or on a chalkboard (Barbe & Milone, 1981). Furthermore, an active learner feels more comfortable with, active experimentation than reflective observation. They do not learn much in situations that require them to be passive such as lectures while reflective learners do not learn much in situations that provide no opportunity to think about the information being presented such as most lectures. Hence, active learners work well in groups while reflective learners work better by

themselves or with at most one other person.

Additionally, when it comes to sequential and global learners, most formal education involves the presentation of material in a logical ordered progression, with the pace of learning dictated by time. When the material has been covered the students are tested on their mastery and then move to the next stage. Some students are comfortable with this system as they learn sequentially. Others, however, cannot learn in this manner. They may be lost for days or weeks, unable to solve even the simplest problems. They understand the material when they apply it to problems that leave most of the sequential learners baffled. These are the *global learners.* Sequential learners follow linear reasoning processes when solving problems while global learners make intuitive leaps and may be unable to explain how they came up with solutions (Richardson, 1984; Ferret, 2006).

Generally, this information is beneficial to teachers in the process of preparing instructional materials and strategies as well as learners in order to select the most effective learning styles. Thus, the teacher should present information in the manner that all students will benefit through their learning styles. The multimedia enriched instructional materials include almost all the learning styles as well as relevant and recommended teaching methods.

5.12 Practical Considerations for Effective Application ICT in Tanzanian Secondary Schools

The government and the Ministry of Education and Vocational Training (MoEVT) recognize the potential of ICT to act as a tool for improving education delivery,

outcomes and impact, as evidenced through the national plans, policies and strategies. According to the Tanzania Vision 2025, the government recognizes the role of education as a change agent for transformation of the economy and its potential to address most of the development challenges including those presented by education. Moreover, the ICT Policy for Basic Education (2007) stipulates that The Ministry of Education and Vocational Training will ensure an integration of ICT into the curriculum at pre-primary, primary, secondary, teacher education, as well as non-formal and adult education levels. The policy insists that ICT will be taught as a subject and be integrated as a pedagogical tool for teaching and learning in other subject areas. This is the intention of the present study, the use of multimedia technology as a pedagogical tool for instructional purposes.

The National ICT Policy of 2003 supports the fact that ICT can enhance education opportunities and advocates through the introduction of e-education system. Unfortunately, the implementation of these policies and strategies seems to be very minimal. For example there are very small number of primary and secondary schools with ICT infrastructure and there is very little government initiative to provide ICT in schools. Those with ICT have either benefited from parent contributions or donations (URT, 2003). The situation has been worsened by the Ministry of Education and Vocational Training repealing the ICT Policy for Basic Education (2007) which was well elaborated on the use of ICT in all educational levels and has been replaced by the new educational policy which says:

Sera hii ya Elimu na Mafunzo ya mwaka 2014 ni matokeo ya kuhuishwa na hatimaye kufutwa kwa Sera ya Elimu na Mafunzo (1995), Sera ya Elimu ya Ufundi na Mafunzo (1996), Sera ya Taifa ya Elimu ya Juu (1999) na Sera ya TEHAMA kwa Elimu Msingi (URT, 2014. p.1)

The new policy has very minimal explanation on how ICT will be implemented in schools. This has been indicated in only a single sentence on page 44: "Serikali itaweka utaratibu na kusisitiza matumizi ya TEHAMA katika utoaji wa elimu na mafunzo katika ngazi zote." (URT, 2014 p. 44). This statement is not elaborate enough to replace the ICT Policy for Basic Education of 2007(Nihuka, 2015).

According to URT (2003), Tanzanian ICT is concentrated in Dar es Salaam, the commercial capital, with little access in other urban and rural areas. Also, very few educational institutions have computer laboratories and other multimedia facilities as these are more prevalent in private institutions. Despite of the official secondary school computer studies syllabus for Forms I – IV developed in 1996 and issued in 1997 by MoEVT, it seems to be outdated with respect to the evolution of multimedia technology. Not only that but also, there is a shortage of well qualified professionals of ICT in Tanzania, and the government lacks a well established ICT professional profiles, and a standardised process of evaluation or certification of the different courses offered by various training centres is lacking. Additionally, access to online and distance learning for ICT is also still limited (Hare, 2007).

The Tanzanian education system is structured such that curriculum materials are centrally prepared and produced at the ministerial levels and teachers instructed to

abide to them. Most of the curriculum materials are in the printed plain mode. This is most applied in the primary, secondary as well as advanced levels of education. In higher learning institutions like universities and colleges the situation is better as they are autonomous and teachers prepare the instructional materials of their own choices and styles. However, very few teachers apply multimedia mode of instruction like power point, computers, and internet services.

ICT infrastructure including equipments and internet connectivity is also a burning issue in the education system (Hare, 2007). This raises many issues regarding interconnection policy and equipment standards for connectivity. It also means that, quality and quantity of network connections points must be assessed all the time and the relevance of ICT infrastructure must be associated with the availability of other essential services like electricity supply, basic economic services and other social necessities that too often tend to be taken for granted. In addition, there are new opportunities in applying ICT to enhance education, including curriculum development, teaching methodologies, simulation laboratories, life-long learning and distance education and teaching. This is applicable not only in ICT, but even to all subjects and specializations. If embraced appropriately and supported at all levels, these could transform the country's economy.

5.13 Online Courses and Multimedia Technology in the Future of Education

Online courses like Massive Open Online Courses (MOOCs) are open and unlimited to everyone who is willing to learn. The MOOCs technology was introduced in 2008 by Canadian educational researchers - Stephen Downes and George Siemens, and later on by Stanford University which attracted more than 100,000 participants. This

technology aims at migrating from the setting of a closed physical classroom with a limited audience to an open online environment with a massive audience (McCauley, Stewart, Siemens, & Cormier, 2010).

In MOOCs, courses are conducted in an interactive online platform using multimedia enriched materials like video lectures, reading materials, and quizzes that are produced and presented in a learning sequence. Moreover, such technology consists of discussion forums that are set on weekly basis and actively moderated by the lecturers. Student's learning progress is assessed through self-tests that are taken several times depending on learners ability and learning pace. Points are granted and collected for the final score, required for obtaining the certificate (Meinel, 2014). According to Meinel the success of MOOCs is due both to the effectiveness nature of their discussion forums and the learning tools available that allow creative exploration through, virtual laboratories, simulation programmes, experimental units and ether tools that operate on these learning platforms. Some universities have made course materials available on institutional websites, and eventually provide feedback forms or discussion possibilities only at national level (Lerman *et al*., 2008).

Today, many higher education institutions increasingly leaves the confines of national boundaries and relates to supranational frameworks and global markets like that of the European Bologna process that is European Higher Education Area which was developed by 25 European Ministers of Education that aims at Lifelong learning, employability, student-centred learning, research, and innovation to mention only a few (Meinel, 2014). However, we are living in a rapidly changing

world. These changes affect us all. The format of MOOCs is by definition open and online which is the typical mode of teaching and learning at OUT. Likewise, MOOCs allow learning to happen online across space and time due to its asynchronous and online architecture. Lifelong learners are able to use the available tools to build and manage their own learning networks, and MOOCs may provide opportunities to test such networks (Arto, 2012).

Nowadays many people including our students are using blogs, wikis, social networks, messaging systems and the like. The underlying idea is that people are comfortable with tools they consider to be their own, and they may wish to continue to use them when engaged in learning activities. Therefore it becomes important to understand the extent to which multi-tool environments are effective in supporting education and learning and to derive some guidelines on their integration in order to optimize their effectiveness for learning.

Tanzania and many other countries worldwide cannot afford to neglect this type of innovative education which has great impact to the economy. The education business is changing so fast and soon very few students will continue to gather in a single class to listen to the traditional teachers lecturing to them. Sadlak, (2014) for example, reported that:

> *"The days of teaching based on use of what symbolically could be described as "chalk and black board" belong to history. The use of on-screen projection systems, video streaming, visualizers and electronic blackboards are now common classroom aids. There is a pragmatic change in the ways students take notes, learn, take test, write papers, and communicate with*

teachers. We are working more and more in an "on-line/virtual" environment. This has been sparked by new developments in online teaching, offering courses to a large number of interested learners worldwide via the internet or tablet applications, known as MOOCs." (p.2)

There are already several forces acting on education system such that a change is inevitable in all levels of education including universities. The education model of lecturing, cramming and examination will no longer be there. These challenges impact our country and particularly OUT in several ways. Firstly, educational costs are rising due to investments in technology, teacher's salaries and administrative costs while the government can no longer afford to subsidize the institutions as they used to. Secondly, a technological revolution is another challenge in education industry. The digitally delivered courses, which teach students via the web or tablet apps, have big advantages over the traditional models. With low start-up costs and powerful economies of scale, online courses dramatically lower the price of learning and widen access to it, by removing the need for students to be taught at set times or places.

Thirdly, the government is now responsible for training and retraining workers throughout their careers because they will not survive in this storm. Worldwide the demand for retraining and continuing education is increasing among workers of all ages. Globalization and automation have reduced the number of jobs requiring middling levels of education such as the chalk and board teachers. Judd (2014)

reveals that one great lecturer in each topic will be enough rather than having many traditional teachers with poor technology.

The situation in Tanzanian is worsening especially at lower education levels. Teachers might be interested in applying technology like multimedia but most of them do not have enough facilities, including computers and electricity, leave alone the ICT skills. Some subjects like Biology, Physics, Chemistry, Geography, Languages, Mathematics, Agriculture, Forestry, and the like are quite difficult to understand. Learning and comprehending these subjects in the printed mode is very constraining to learners. This may be one of the reasons students run away from science subjects nowadays especially the girls. The following chapter gives some conclusions and recommendations to different stakeholders as far as multimedia learning is concerned.

CHAPTER SIX

6.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

6.1 Introduction

In this chapter the major issues that emerged from the study are considered in the light of consulted literature to arrive at comprehensive summary, conclusions, and recommendations for improved practice in the use of multimedia for academic instruction.

6.2 Summary of the Findings

The study set out to explore the differences in the effectiveness of instruction between the use of printed plain and multimedia enriched instructional materials. Four different types of instructional materials were involved including: audio visual, audio assisted, printed multicolour, as well as printed plain instructional materials. To achieve the goal, the study compared the differences in students' academic performance between printed plain and audio visual, audio assisted, as well as with printed multicolour instructional materials. Additionally, the study sought to know the gender differences in performance in the different multimedia levels of enrichment so as to identify whether the outcome could be influenced by the sex of learners. Moreover, the study investigated the relationship between student's academic abilities which were obtained from national examination results and their performance in different levels of multimedia enrichment.

Two theories guided the study, namely, The Information Motivation Behavioural Skills and The Cognitive Theory of Multimedia Learning. The former theory as

postulated by Fisher and Fisher in 1992, was used to explain how information, motivation, and behavioural skills are important determinants of a healthy behavioural change such as safe sex practice while the later is a cognition theory which was first advanced by Richard Mayer in 2009 and explains psychological phenomena of information processing in the multimedia context. Mayer's model was used to explain two cognitive subsystems, one specific for the representation and processing of pictures and the other for dealing with words.

In a combination the two theories showed that when information is provided in multimedia instructional materials the students become motivated to learn and understand better leading to better performance and consequently a behavioural change. Some literature on the concept of sex education and multimedia learning were reviewed both from poor and developed countries including Tanzania so as to reveal the existing gap between them and the current study.

The study was guided by five objectives. The first objective aimed at determining the differences in effectiveness between printed plain and audio visual instructional materials while the second and third objectives assessed the differences in effectiveness between printed plain and audio aided instructional materials as well as printed plain and printed multicolour instructional materials respectively. The fourth objective compared gender differences in performance in different levels of multimedia enrichment and the fifth objective assessed the relationship between student's academic abilities and their performance in multimedia. The effectiveness

the different instructional materials was measured by providing pre and post test scores before and after studying each instructional materials.

The experimental study involved total of 215 form three student respondents. Of all respondents, 97 were females while 118 were males. Four treatments and a control group were involved in the study including: audio visual, visual aided, printed multicolour and printed plain instructional materials. Each treatment of consisted of 54 subjects except for the printed multicolour group which had 53 subjects. Pre and post test items were used as tools for data collection and scores obtained from each test plus subjects examination results were compared and analysed quantitatively using SPSS version 17.0. The results were presented, discussed and analysed in line with the five research objectives as shown below.

6.2.1 Difference in Performance Between Printed Plain and Audio Visual Groups of Subjects

It was established in this study that the mean performance for audio visual mode of instructional material was higher than that of printed plain mode. Independent t-test revealed that the mean score for audio visual instructional material was significantly different from that of printed plain instructional materials at 0.001 level $t(106)=3.46$, $p= 0.001$.

6. 2.2 Difference in Performance Between Printed Plain and Audio Aided Groups of Subjects

On the differences in performance between groups tested using printed plain and audio assisted instructional materials, it was established that the mean performance for audio aided mode was significantly higher than that of printed visual plain mode at 5% level: t (106) =2.02, p=0.05.

6.2.3 Difference in Performance Between Printed Visual Plain and Printed Multicolour Visual   Groups of Subjects

With regard to the differences in effectiveness between printed visual plain and printed multicolour visual instructional materials, when an independent sample t test was conducted it was revealed that the mean performance for printed multicolour media group was higher than that of printed plain media group but the differences were not statistically significant different from that of printed plain media at 5% level: t (105) =1.20, p=0. 23.

6.2.4 Difference in Performance Between Audio Aided and Audio Visual Groups of Subjects

Likewise, independent sample t-test was conducted to compare the difference in performance between audio aided and audio visual instructional materials. It was revealed that the mean performance for audio visual group was significantly higher than that of audio assisted media at 5% level: t (106) =2.022, p= 0.05.

6.2.5   Gender Difference in Performance in Different Instructional Materials

On the gender differences in performance in different multimedia enrichments, it was revealed that boy students performed better in audio visual, audio aided, as well as printed multicolour instructional materials while female students performed better only in plain printed instructional materials. Also, a two-way between-groups Analysis of Variance was used to assess the impact of sex on performance in different levels of multimedia presentations where it was revealed that, overall, there was a significant difference between girls and boys F (4.115) $p= 0.056$.

6.2.6   Differences in Multimedia Effectiveness Among Students with Different Academic Abilities

With regard to the differences in multimedia effectiveness in students with different academic abilities, correlation analysis was used to assess the strength and direction of the linear relationship between performance in different instructional materials and their national examination results. Results revealed that there was a strong and positive correlation between student's academic abilities and performance in audiovisual instructional materials, $r = -0.60$, $n = 54$, $p =.00$. Likewise, subjects ability and performance in audio aided instructional materials was strong and positive $r = 0.66$, $n = 54$, $p =.00$. Again, there was a moderate correlation between subjects academic ability and printed multicolour ($r = 0.019$, $n = 53$, $p =.00$) while in the printed plain group of subjects there was no relationship ($r= -0.25$, $n= 53$, $p=0.07$).

In terms of sex as a variable, a relationship was only found between subject's performance in printed multicolour and the sex variable.

6.3 Conclusions of the Study

This study assessed the differential effectiveness of multimedia enriched instructional materials on sex education in secondary schools, Tanzania. Based on the research objectives, hypotheses and the findings reported, the following conclusions are drawn:

6.3.1 Effects of Different Levels of Enrichment to Student's Performance

The results from the experimental study revealed that there was a significant difference between printed plain instructional materials and different multimedia levels of enrichment. Firstly, the audio visual group of participants scored higher than the printed plain group. The mean score for audio visual group was 56.76% while that of printed plain was 45.54%. Secondly, there was a significant difference between printed plain instructional materials and audio aided instructional materials. The audio aided group of students had a mean performance of 52.31% compared to the printed plain group which scored a lower average 45.54%. Thirdly, a comparison was made between printed plain and printed multicolour where it was revealed that the former had a lower mean performance of 45.54% compared to the later which had the average score of 49.57%, but the difference was not statistically different. Generally, the performance of multimedia enriched materials was higher than that of the traditional printed plain materials.

This situation was also predicted in the conceptual framework in Figure 1, where it was predicted that the use of multimedia enriched materials would lead to higher performance of students and the long term expected outcome of learning by multimedia would be behavioural change as explained in the IMB model in Figure 2. According to the model individuals are expected to undergo behavioural change if they are fully informed and sufficiently motivated. In the context of this study it was proved that if students receive the right information on sex education through multimedia enriched instructional materials they will learn better, understand better and finally change their sexual behaviours.

According to the multimedia learning theory discussed in chapter two, words and graphics are more conducive to learning, rather than just text or graphics alone. However, the study revealed unusual results when printed plain was compared to printed multicolour. Although the later was enriched with coloured pictures, student's performance was not much higher as compared to the traditional printed plain instructional materials and the difference was not statistically significant.

6.3.2   Gender Performance in Multimedia Enriched Instructional Materials

Girls and boys performances in different multimedia levels were compared. Results revealed that boys scored higher than girls in three different media levels namely: audio assisted, printed multicolour and printed plain while girls scored higher only in audio visual.   Amazingly, when two-way between-groups analysis of variance was used to compare the differences in their performance, results did not show any significant interaction effect between gender and performance. Also, the differences in performance mean scores between girls and boys was not significant and the main

effect for gender, F (1, 207) = 1.743, p = .188, did not reach statistical significance. Generally, in this study performance in the multimedia was not influenced by the gender of the learners.

6.3.3 Association Between Sex, Academic Ability and Performance in Multimedia Enriched Instructional Media

Pearson product-moment correlation coefficient was used to analyse the relationship between student's sex, academic abilities and performance in the different levels of multimedia enriched instructional materials. Results revealed a strong positive correlation between audio visual instructional materials and student's academic abilities as well as audio aided instructional materials and student's academic abilities. Moreover, there was a moderate correlation between printed plain instructional materials and students' academic abilities. However, the findings revealed no correlation between printed multicolour instructional materials and students' academic abilities and also no correlation between student's sex and different multimedia levels except for the printed multicolour which was small, negative, but significant r = -0.25, n= 53, p=0.07.

To sum up, the results in this study four major conclusions can be drawn. Firstly, there is a high difference in performance between traditional printed plain instructional materials and multimedia enriched instructional materials. The audio visual materials proved to be the best followed by audio assisted materials, then printed multicolour, while the least was printed plain instructional materials. Further, the study revealed that although there were gender variations in performance in different levels of multimedia enrichment these variations were not statistically

significant; hence, it can be concluded that there was no relationship between performance in gender and multimedia enrichment. Moreover, correlation analysis revealed a relationship between student's academic abilities and performance in the different levels of multimedia. High performances in audio visual and audio aided instructional materials were associated with high student's academic abilities. This situation was contrary for printed plain and printed multicolour instructional materials where there was no correlation between student's performance in the two printed forms and their academic abilities.

6.4 Recommendations on the Basis of the Findings

This study has shown that there is a difference in the effectiveness between multimedia enriched instructional materials and the traditional plain printed ones. Learners learn and understand content better in the multimedia mode, especially the audio visual instructional materials. The outcomes of this study are relevant not only to secondary schools instruction but they are also applicable in other educational levels. This section presents recommendations with regard to the results and conclusions.

6.4.1   Recommendations for Future Research

Very few studies have been made in Tanzania on the comparative effectiveness of students' academic performance and the use of multimedia enriched and plain printed instructional materials. This experimental study was confined only to Dar es Salaam, Ilala district. Although the results have been scientifically presented they do not show the general national secondary school's picture. In addition, it was not established in this study whether effectiveness of multimedia instructional materials

may be influenced by the age, sex, mind set, on sexually related content of participants because the participants in this study were of approximately the same age group.

Moreover, the study did not examine teacher's skills and competencies in the preparation and use of multimedia enriched instructional materials. Furthermore, the availability of necessary school infrastructures including computers and electricity given the Tanzanian economy was also not included in this study. From the above research limitations, the following recommendations are made to guide future research in the area of multimedia and learning in Tanzanian secondary schools.

i.   The study was focused only to one district. Given the size of Tanzanian approximately 44 million people, with more than 500 secondary schools, and 30 regions it is recommended to replicate the research in other rural and urban areas so as to obtain a bigger picture of the effectiveness of multimedia instructional materials in different contexts.

ii.   It is also recommended that future research should be conducted to teachers so as to assess their willingness and competence in the preparation and use of the multimedia technology in the teaching and learning process. The study should also be extended to other stakeholders like ministerial leaders, curriculum developers as well as teacher training colleges because of their contribution to the preparation of curriculum instructional materials as well as the training of teachers.

iii. Further research should investigate how multimedia effectiveness in learning is related to the age of the learners. Is multimedia more effective to young or

aged learners? At what age should such technology be introduced? What about students with different disabilities, will they benefit the same was as normal students as far as learning using multimedia is concerned?

iv. There is also a need to conduct a study on the infrastructure needed for the preparation of multimedia instructional materials. What specific infrastructure is needed? Are the Tanzanian schools able to develop such infrastructure or should they be allocated from the ministry of education? Are there enough computers for both teachers and students?

v. The differences in performances between printed multicolour was expected to vary significantly with that of printed plain instructional materials but this was not the case in this study. Further research should be made on the factors hindering learning and comprehension of pictorial illustrations especially on sex education instructional materials.

vi. A further longitudinal study should be done after provision of sex education using multimedia enriched instructional materials so as to assess behavioural change among youths as stipulated in the IMB model.

vii. Sustainability study to investigate the necessary institutional conditions to sustain integration of multimedia for education purposes.

6.4.2 Recommendations for Policy Makers

Frequent amendments need to be made to Tanzanian education policy in order to accommodate necessary changes emanating from research results. This study investigated the effectiveness obtained in the integration of multimedia enriched instructional materials in the teaching and learning process. This must be reflected in

the policy so that teachers are trained on ICT skills necessary for the integration of multimedia in the preparation of instructional materials.

The government should allocate more funds to the Ministry of Education and Vocational Training in order to equip schools with necessary infrastructures including ICT laboratories for the implementing multimedia technology in schools. Such funds may as well assist in the purchase computers for teachers and students as well as in-service training to teachers.

As revealed in the results, the audio visual material was found to be the best quality. The study recommends such materials to be disseminated to Tanzanian secondary schools through The Ministry of Education and Vocational Training together with respective teacher's training. The researcher has already prepared audio visual materials on *"The relationship between STDs, HIV and AIDS"* and also the book titled *"Sex Education for Tanzanian Schools and Colleges"* is half-way prepared by the researcher. The book is also planned to be accompanied by an interactive DVD.

6.4.3   Recommendations for Actions by Secondary Schools and Teachers

The findings of the study suggest that using multimedia as a teaching method stimulates thinking and improves the learning environment in a classroom. Tanzanian teachers use the already made plain printed instructional materials including syllabus and text books. They need to be more creative by adding pictures, diagrams and other types of illustrations to the current instructional materials. There is a growing body of research showing that students learn in different ways. Students who are smart at remembering pictured objects benefit more from instructions with

text and visual images while they read relative to students who are adapted to text only or sounds only. Thus, information should be presented in different ways to engage students with differing learning styles. In such heterogeneous classrooms high interaction with different media of instruction are necessary for effective learning especially to subjects involving difficult concepts.

In the preparation of multimedia instructional materials teachers should select pictures that overlap with text content. Learning benefits occur when pictures and text provide congruent and supporting information. In general, the more complex the text, the more likely that pictures are helpful. However, decorative illustrations just help to make the text more attractive and marketable, but they are unlikely to enhance desired outcomes related to understanding as well as remembering. Moreover, too many pictures and sound should be avoided as such illustrations tend to create mental overload in the students memory. Hence teachers should choose illustrations with an eye toward the desired functions they are to play, namely to make the text more concrete, coherent, comprehensible, and more memorable in light of the desired learning outcomes.

As revealed in the study boys out performed girls in most of the instructional media. A mechanism is needed which will ensure that girls are given special treatment and priority as far as multimedia and ICT in general so as to reduce the gender gap and consequently balance the present situation of inequality.

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APPENDICES

Appendix I: Printed Plain Instructional Material

Introduction

My name is Hyasinta Kessy. I am pursuing a PhD in Educational Psychology at The Open University of Tanzania. I am conducting a research on *Differential Effectiveness of Multimedia Enriched and Plain Sex Education Instructional Materials.* The findings of this study will be used by the Ministry of Education and Vocational studies to improve the course on sex and relationship education. Take a few minutes to study the text and there after answer the questions provided. I assure you that the information you provide will remain confidential and will be used only for the purpose of this study. The results of the study will greatly help in the design of instructional materials for teaching Health Education in Tanzania.

Sex and Relationship Education (Printed Plain Instructional Material)

The Relationship between STDs, HIV and AIDS

Dear form three students, welcome to the lecture entitled "*Relationship between Sexually Transmitted Diseases, Human Immunodeficiency Virus and Acquired Immune Deficiency Syndrome*".

Objectives

After working through the lecture you will be able to:

1. Define the STD, HIV and AIDS

2. Describe the common STDs

3. Explain the Links between STD, HIV and AIDS

Definitions of STD, HIV and AIDS

STDs are Sexually Transmitted Diseases that are passed on from one person to another through unprotected sex (Antivirus and Vulnerability Emergency Response Team (AVERT), 2015). HIV stands for Human Immunodeficiency Virus, a virus that attacks the body immune system and leaves the body vulnerable to a variety of infections while, AIDS is a short form of Acquired Immune Deficiency Syndrome a disease of the human immune system caused by infection with Human Immunodeficiency Virus (HIV)(Centers for Disease Control and Prevention, 1999). AIDS is also an STD (Alexander, Krämer, Mirjam, & Klaus, 2010).

Common Symptoms of STDs for Girls

Some common symptoms to girls are:

1. Pus or smelly fluids coming out of the vagina

2. Sores near genitals, anus, and mouth

3. Burning during you urination

4. Itching, bad smell and unusual discharge from vagina and anus

5. Stomach ache (pain in the lower abdomen)

6. Bleeding from the vagina between menstrual periods

Remember: Sometimes symptoms don't show up for weeks or months or even years (Daniels, 1993; Spence & Melville, 2007).

Common Symptoms of STDs for Boys

Some symptoms for boys are:

1. Pus or smelly fluids coming out of the penis

2. Sores near the genitals, anus or mouth

3. Burning on urination

4. Drip or discharge from the penis

5. Itching, pain or discharge from the anus

Remember: sometimes symptoms don't show up for weeks or months (Daniels, 1993; Spence & Melville, 2007).

Some Common Types of STDs

The following are only few representatives of common STDs

1. **Syphilis**

Syphilis is a sexually transmitted infection caused by the bacterium *Treponema pallidum* (CDC 2014). The primary means of transmission is through sexual contact;

It may also be transmitted from mother to foetus during pregnancy or at birth (Kent & Romanelli, 2008)

The Signs and Symptoms

At initial stage the patient is painless, non- itching skin and no sores

Later on syphilis shows scattered body rashes on the hand **palms, soles** of the **feet** and **mucous membranes** and other body parts (Bhatti, 2007).

2. Warts

Warts are soft, wart-like growths on the skin and mucus membranes of the genitals in men and women (Bennett, Dolin, & Blaser, 2014). They are caused by virus called *Human Papilloma virus.* The infected membranes appear like pink or reddish warts cauliflower tops that appear on the genitals, the vagina, or the cervix one to three months after infection.

There is no cure for Genital warts (Bennett, Dolin, Blaser, 2014)

3. Chlamydia

Chlamydia is caused by bacteria called *Chlamydia Trachomatis* that cause pelvic infection and pneumonia (Florian, 2006; Schachter, 1986)

It affects the reproductive organs of both males and females.

It causes secretions from the cervix in females and from the urethra in males

Chlamydia is curable (Schachter, 1986)

4. Gonorrhoea

Gonorrhoea is a highly contagious sexually transmitted disease that is caused by the bacterium *Neisseria gonorrhoea* (Wallin, 1972).

Symptoms are different in men and women. In men, gonorrhoea usually begins as an infection of the vessel that carries urine and sperm (urethra).

In women, gonorrhoea infects the narrow part of the uterus (cervix).

Symptoms in males include discharge from penis and painful urination

Gonorrhoea is curable through medical treatment if done early, if not treated early it can be transmitted from mother to child (Wallin, 1972).

5. Herpes

Genital herpes is a viral infection affecting the mucous membranes of the genitals.

It is caused by the *Herpes Simplex Virus* (Workowski, & Berman, 2010; Bolognia, 2003)

One can still get the virus even when he/she use a condom.

There is no cure for Genital herpes (Bolognia, 2003)

6. Candidiasis

Candidiasis is a fungal infection which is caused by *Candida albicans* (Sobel, 2007). Candidiasis include infections like oral thrush, vaginitis, and systemic to adults and young children. Candida infections affect persons with cancer, AIDS, as well as surgery patients. Symptoms involves redness, itching and discomfort on the skin of mucosal membranes like the oral cavity (thrush), the pharynx or oesophagus, the gastrointestinal tract, the urinary bladder, or the genitalia.

7. Hepatitis B

Hepatitis B is a disease caused by *Hepatitis B Virus* which can cause chronic inflammation of the liver. It is transmitted through blood transfusions, sexual contact with an infected person, or by the use of contaminated instruments. The affected liver may develop Cirrhosis (replacement of liver tissue by fibrosis, scar tissues). There is no treatment for Hepatitis B Virus (Bernal & Wendon, 2013).

8. AIDS

Acquired Immune Deficiency Syndrome is a disease in which the immune system of the patient is weakened by HIV. There is no cure for AIDS (Institute of Human

Virology, 1996). People who have other STDs are at higher risk for contracting HIV during sex with infected partners (Kramer, Kretzschmar, & Krickeberg, 2010**).**

Links between HIV, AIDS, and STDS

i.   HIV is also an STD. STD sores make it easier for HIV to be transmitted from one person to another.

ii.   If a person is HIV positive and also have an STD, he/she is more likely to transmit the HIV infection (Cohen, Hoffman, & Royce, 1997)

The only way to prevent STD's is to abstain from ALL types of sexual intercourse.

STD increases HIV transmission

If a person has HIV and an STD:

- It brings inflammatory cells loaded with HIV to the genital tract

- It increases HIV viral shedding from mucous membranes (Wasserheit, 1992).

(Brodman, Thacker, & Kranz, 1998; CDC and Prevention, 1998).

Appendix II: Printed Multicolour Instructional Materials

Introduction

My name is Hyasinta Kessy. I am pursuing a PhD in Educational Psychology at The Open University of Tanzania. I am conducting a research on *Differential Effectiveness of Multimedia Enriched and Plain Sex Education Instructional Materials.* The findings of this study will be used by the Ministry of Education and Vocational studies to improve the course on sex and relationship education. Please, take a few minutes to study the following text and there after answer the questions provided. I assure you that the information you provide will remain confidential and will be used only for the purpose of this study. The results of the study will greatly help in the design of instructional materials for teaching Health Education in Tanzania.

The Relationship between STDs, HIV and AIDS

Dear form three students, welcome to the lecture entitled "*Relationship between Sexually Transmitted Diseases, Human Immunodeficiency Virus and Acquired Immune Deficiency Syndrome*".

Objectives

After working through the lecture you will be able to:

1. Define the STD, HIV and AIDS

2. Describe the common STDs

3. Explain the Links between STD, HIV and AIDS

Definitions of STD, HIV and AIDS

STDs are Sexually Transmitted Diseases that are passed on from one person to another through unprotected sex (Antivirus and Vulnerability Emergency Response Team (AVERT), 2015). HIV stands for Human Immunodeficiency Virus, a virus that attacks the body immune system and leaves the body vulnerable to a variety of infections while, AIDS is a short form of Acquired Immune Deficiency Syndrome a disease of the human immune system caused by infection with Human Immunodeficiency Virus (HIV)(Centers for Disease Control and Prevention, 1999). AIDS is also an STD (Alexander, Krämer, Mirjam, & Klaus, 2010).

Common Symptoms of STDs for Girls

Some common symptoms to girls are:

1. Pus or smelly fluids coming out of the vagina

2. Sores near genitals, anus, and mouth

3. Burning during you urination

4. Itching, bad smell and unusual discharge from vagina and anus

5. Stomach ache (pain in the lower abdomen)

6. Bleeding from the vagina between menstrual periods

Remember: Sometimes symptoms don't show up for weeks or months or even years (Daniels, 1993; Spence & Melville, 2007).

Common Symptoms of STDs for Boys

Some symptoms for boys are:

1. Pus or smelly fluids coming out of the penis

2. Sores near the genitals, anus or mouth

3. Burning on urination

4. Drip or discharge from the penis

5. Itching, pain or discharge from the anus

Remember: sometimes symptoms don't show up for weeks or months (Daniels**,** 1993; Spence & Melville, 2007).

Common Types of   STDs

The following are only few representatives of common STDs

1. **Syphilis**

Syphilis is a sexually transmitted infection caused by the bacterium *Treponema pallidum* (CDC 2014). The primary means of transmission is through sexual contact. It may also be transmitted from **mother** to **foetus** during pregnancy or at birth (Kent & Romanelli, 2008)

The Signs and Symptoms

At initial stage the patient is painless, non- itching skin and no sores. Later on syphilis shows scattered body rashes on the hand **palms, soles** of the **feet** and

mucous membranes and other body parts (Bhatti, 2007). This is illustrated in Figure 6.1.

Figure 6.1: Syphilis Symptoms in Different Body Parts

Source: James, Berger, Elston & Dirk (2005)

2. Warts

Warts are soft, wart-like growths on the skin and mucus membranes of the genitals and other body parts (Bennett, Dolin, & Blaser, 2014). They are caused by virus called *Human Papilloma Virus* (**HPV**). As displayed in Figure 6.2, **t**he infected membranes appear like pink or **reddish, Warts cauliflower** tops that appear on the **vagina**, **mouth**, **cervix** and even **month parts** one to three after infection. There is NO cure so far for warts (Bennett, Dolin, Blaser, 2014)

Figure 6.2:   Warts Symptoms in Different body Parts

Source: Toney & Bachmann (2010)

3. Chlamydia

Chlamydia infections cause ulcers and secretions from different body parts such as the **mouth**, **cervix** and **urethra** (Florian, 2006; Schachter, 1986). It affects the reproductive organs and others like mouth parts (Schachter, 1986). Figure 6.3.

4. Gonorrhoea

Gonorrhoea is another highly contagious sexually transmitted disease that is caused by the bacterium *Neisseria gonorrhoea* (Wallin, 1972). Symptoms are different in men and women. In men, gonorrhoea usually begins as an infection of the vessel that carries urine and sperm (urethra).

Symptoms in males include discharge from penis and painful urination.

Figure 6.3:   Mouth Parts Chlamydia Infections
Source: Florian (2006)

Other infected body parts include eyes, and the skin as displayed in Figure 6.4.

Gonorrhoea is curable through medical treatment if done early, if not treated early it

can be transmitted from mother to child (Wallin, 1972).

Figure 6.4:   Gonorrhoea Symptoms
Source: Florian (2006)

5. Genital Herpes

Genital herpes is a viral infection affecting the mucous membranes of the genitals. Figure 6.5. It is caused by the *Herpes Simplex Virus* (Workowski, & Berman, 2010; Bolognia, 2003). One can still get the virus even when he/she use a condom. There is no cure for Genital herpes (Bolognia, 2003)

Figure 6.5:   Penis and Vagina Genital Herpes
Source: Bolognia (2003)

6. Candidiasis

Candidiasis is a fungal infection which is caused by *Candida albicans* (Sobel, 2007). Candidiasis include infections like oral thrush, vaginitis, and systemic to adults and young children. Candida infections affect persons with cancer, AIDS, as well as surgery patients.

Candida Symptoms involves redness, itching and discomfort on the skin of mucosal membranes like the oral **cavity (thrush),** the pharynx or **oesophagus,** the g**astrointestinal** tract, the **urinary bladder,** or the reproductive parts (Pagano, 2015; Hopkins, 2010). Figure 6.6

Figure 6.6:   Breast and Mouth Candida

Source: Pagano (2015)

7. Hepatitis B

Hepatitis B is a disease caused by ***Hepatitis B Virus*** which can cause chronic inflammation of the liver. It is transmitted through blood transfusions, sexual contact with an infected person, or by the use of contaminated needles. The affected liver may develop **Cirrhosis** (replacement of liver tissue by **fibrosis**, scar tissues). See Figure 7.7. There is <u>no</u> treatment for Hepatitis B Virus but the liver can be replaced (Bernal & Wendon, 2013).
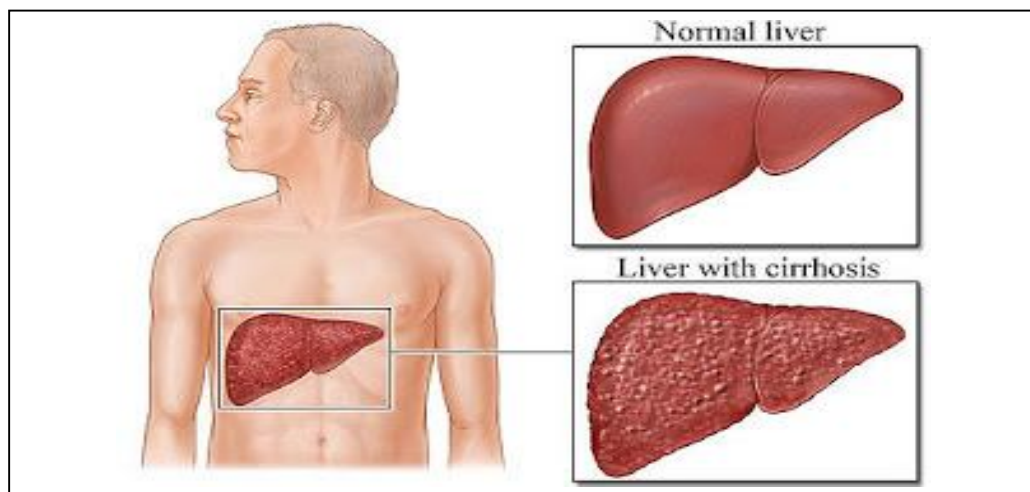
Figure 6.7:   Hepatitis- B Infection on the Liver

Source: Healthy Living (2011)

8. AIDS

AIDS stands for Acquired Immune Deficiency Syndrome is a disease in which the immune system of the patient is weakened by HIV. According to The Institute of Human Virology (1996), there is no cure for AIDS. HIV syndromes include white sores on tongue, mouth and throat, sores on legs and hands (Figure 6.8)

People who have other STDs are at higher risk for contracting HIV during sex with infected partners (Kramer, Kretzschmar, & Krickeberg, 2010).

Links between HIV, AIDS, and STDS

i.   HIV is also an STD. STD sores make it easier for HIV to be transmitted from one person to another.

ii. If a person is HIV positive and also have an STD, he/she is more likely to transmit the HIV infection (Cohen, Hoffman, & Royce, 1997)

The only way to prevent STDs is to abstain from all types of sexual intercourse.

STD increases HIV transmission. If a person has HIV and an STD, it brings inflammatory cells loaded with HIV to the genital tract and increases HIV viral shedding from mucous membranes (Wasserheit, 1992; Brodman, Thacker, & Kranz, 1998; Centers for Disease Control and Prevention, 1998).

Figure 6.8: AIDS Syndrome

Source: Dermnet (2016)

Appendix III Test Questions

A: Personal Particulars

1. Your Number: …………………………………

2. Your sex: (Tick one)

   ☐ Male
   ☐ Female

3. Your age: …………. in years

B: Test Questions

Matching Items

Please answer the following questions as far as sex education is concerned:

Match the statements in Column **A** with the corresponding item in Column **B,** by writing the correct letter on the space provided

	Column A			Column B
1	Sexually Transmitted Diseases	…… ….	A	Candidiasis
2	Warts symptoms	… ….	B	STDs
3	Bacteria causing Gonorrhoea	… ….	C	Pink reddish warts cauliflower membranes
4	Common HIV symptom to girls	… ….	D	Neisseria bacteria
5	Transmitted from mother to foetus	… ….	E	Bleeding between periods
6	Causes Chlamydia	… ….	F	Syphilis
7	Affect the mouth, intestine & vagina	… ….	G	Hepatitis B
8	An infection of the liver	… ….	H	More HIV
9	Body fluids with HIV & STDs	… ….	I	Cirrhosis
10	Infected liver fibrosis/ scar tissues	… ….	J	AIDS
			K	Stomach ache
			L	Hepatitis B
			M	Gonorrhoea
			N	Chlamydia Trachomatis Bacteria

Multiple Choice Questions

This question consists of multiple choice items on the relationship between HIV, AIDS and STDs. Each question is followed by **five** options lettered a) to d). Find out the correct option for each question and kindly circle the letter bearing that option.

1. AIDS stands for

   a) Acquired Immune Difference Syndrome

   b) Acquired Immune Deficiency Syndrome

   c) Sexually Transformed Diseases

   d) Acquired Immunity Deficiency Symptom

   e) Acquired Immunodeficiency Symptoms

2. HIV stands for

   a) Human Immunity Virulent

   b) Human Immunodeficiency Virus

   c) Healthy Immunity Virus

   d) Human Immunity Defined Virus

   e) Healthy Immunodeficiency Virus

3. All except one are ways of contracting Hepatitis B

   a) Mother to child

   b) Contact with infected blood

   c) Having sex with infected partner

   d) Injecting drugs through veins

   e) Toilet sharing

4. Which parts of the body are attacked by warts

   a) Genitals, feet and hand palms

   b) Genitals, cervix and the feet

   c) Genitals, cervix, and the mouth

   d) Genitals, hand palms and the mouth

   e) All of the above parts

5. Which among the following statements is true

   a) STD sores make it easier for HIV infection

   b) HIV/AIDS is not necessarily an STD

   c) AIDS increases the immunity of the patient

   d) STDs hinder HIV transmission

   e) HIV/AIDS and STDs are not related at all

6. Candidiasis include infections in the following body areas

   f) Genitals, mouth, and breasts

   g) Breasts, mouth, and feet

   h) Breasts, mouth, and liver

   i) Breasts, liver, and genitals

   j) Genitals, hand palms, and liver

7. Syphilis is caused by:

   a) Treponema pallidum

   b) Human Papilloma Virus

c) Neisseria gonorrhoea.

d) Chlamydia trachomatis.

e) Treponema papilloma

8. Syphilis symptoms are commonly found on the following body parts

a) Hand palms, feet soles, and mucous membranes

b) Hand palms, finger nails, and hairy parts

c) Hand palms, feet soles, and finger nails

d) Hand palms, mucous membranes, and finger nails

e) Hand palms, feet soles, finger nails and

9. The only way to prevent STD's is to

a) Abstain from sex

b) Using ARV tablets

c) Have very few sexual partners

d) Bath with disinfectant soap after sex

e) Frequent HIV tests

10. One can still get the virus even when he/she uses a condom.

a) Treponema pallidum virus

b) Human Papilloma virus

c) Chlamydia trachomatis virus

d) Herpes Simplex Virus.

e) Treponema papilloma

Appendix IV: Expected Answers

Matching Items

	Column A			Column B
1	Sexually Transmitted Diseases	B	A	Candidiasis
2	Warts symptoms	C	B	STDs
3	Bacteria causing Gonorrhoea	D	C	Pink reddish warts cauliflower membranes
4	Common HIV symptom to girls	E	D	Neisseria bacteria
5	Transmitted from mother to foetus	F	E	Bleeding between periods
6	Causes Chlamydia	N	F	Syphilis
7	Affect the mouth, intestine & vagina	A	G	Hepatitis B
8	An infection of the liver	G	H	More HIV
9	Body fluids with HIV & STDs	H	I	Cirrhosis
10	Infected liver fibrosis/ scar tissues	I	J	AIDS
			K	Stomach ache
			L	Hepatitis B
			M	Gonorrhoea
			N	Chlamydia Trachomatis Bacteria

Multiple Choice Questions

1. AIDS stands for

    a. Acquired Immune Difference Syndrome

    b. <u>Acquired Immune Deficiency Syndrome</u>

    c. Sexually Transformed Diseases

    d. Acquired Immunity Deficiency Symptom

    e. Acquired Immunodeficiency Symptoms

2. HIV stands for

    a. Human Immunity Virulent

    b. <u>Human Immunodeficiency Virus</u>

    c. Healthy Immunity Virus

    d. Human Immunity Defined Virus

    e. Healthy Immunodeficiency Virus

3. All except one are ways of contracting Hepatitis B

    a. Mother to child

    b. Contact with infected blood

    c. Having sex with infected partner

    d. Injecting drugs through veins

    e. <u>Toilet sharing</u>

4. Which parts of the body are attacked by warts

    a. Genitals, feet and hand palms

    b. Genitals, cervix and the feet

    c. <u>Genitals, cervix, and the mouth</u>

    d. Genitals, hand palms and the mouth

    e. All of the above parts

5. Which among the following statements is true

    a. <u>STD sores make it easier for HIV infection</u>

    b. HIV/AIDS is not necessarily an STD

    c. AIDS increases the immunity of the patient

    d. STDs hinder HIV transmission

    e. HIV/AIDS and STDs are not related at all

6. Candidiasis include infections in the following body areas

    a. <u>Genitals, mouth, and breasts</u>

    b. Breasts, mouth, and feet

    c. Breasts, mouth, and liver

    d. Breasts, liver, and genitals

    e. Genitals, hand palms, and liver

7. Syphilis is caused by:

    a. <u>Treponema pallidum</u>

    b. Human Papilloma Virus

    c. Neisseria gonorrhoea.

    d. Chlamydia trachomatis.

    e. Treponema papilloma

8. Syphilis symptoms are commonly found on the following body parts

    a. <u>Hand palms, feet soles, and mucous membranes</u>

b. Hand palms, finger nails, and hairy parts

c. Hand palms, feet soles, and finger nails

d. Hand palms, mucous membranes, and finger nails

e. Hand palms, feet soles, finger nails and

9. The only way to prevent STD's is to

a. <u>Abstain from sex</u>

b. Using ARV tablets

c. Have very few sexual partners

d. Bath with disinfectant soap after sex

e. Frequent HIV tests

10. One can still get the virus even when he/she uses a condom.

a. Treponema pallidum virus

b. Human Papilloma virus

c. Chlamydia trachomatis virus

d. <u>Herpes Simplex Virus.</u>

e. Treponema papilloma

Appendix V: Research Clearance Letters

THE OPEN UNIVERSITY OF TANZANIA

DIRECTORATE OF RESEARCH, PUBLICATIONS, AND POSTGRADUATE STUDIES

P.O. Box 23409
Dar es Salaam, Tanzania,
http://www.out.ac.tz

Tel: 255-22-2666752/2668445 ext.2101
Fax: 255-22-2668759,
E-mail: drps@out.ac.tz

REF: HD/E/740/T.12

Date: **11/07/2013**

TO WHOM IT MAY CONCERN

RE: RESEARCH CLEARANCE: KESSY, HYASINTA C. F.

The Open University of Tanzania was established by an act of Parliament no. 17 of 1992. The act became operational on the 1st March 1993 by public notes No. 55 in the official Gazette. Act number 7 of 1992 has now been replaced by the Open University of Tanzania charter which is in line the university act of 2005. The charter became operational on 1st January 2007. One of the mission objectives of the university is to generate and apply knowledge through research. For this reason the staffs and students undertake research activities from time to time.

To facilitate the research function, the vice chancellor of the Open University of Tanzania was empowered to issue research clearance to both staffs and students of the university on behalf of the government of Tanzania and the Tanzania Commission of Science and Technology.

The purpose of this letter is to introduce to you **Kessy, Hyasinta C. F.,** a PhD student at the Open University of Tanzania with Reg. No. HD/E/740/T.12. By this letter the student has been granted clearance to conduct research in the country. The title of his research is **"Differential Effectiveness of Multmedia Enriched and Plain Sex Education Instructional Materials."** The research will be conducted in Dar es Salaam region from 11/07/2013 to 31/12/2013.

In case you need any further information, please contact the Deputy Vice Chancellor (Academics), The Open University of Tanzania, P.O. Box 23409, Dar es Salaam, Tel: 022-2668820.

We thank you in advance for your cooperation and facilitation of this research activity.

Yours sincerely,

Prof S. Mbogo

For: VICE CHANCELLOR

THE OPEN UNIVERSITY OF TANZANIA

ILALA MUNICIPAL COUNCIL

ALL COMMUNICATIONS TO BE ADDRESSED TO THE MUNICPAL DIRECTOR

P.O. BOX   20950
PHONE NO: 2128800
              2128805
FAX NO.   2121486

MUNICIPAL DIRECTOR
OFFICE, ILALA

Ref. No. IMC/LR.6/1. VOL.III/15

DATE: 13/08//2013

The Head of School,
B.W. Mkapa
DAR ES SALAAM.

RE: RESEARCH

Refer to the above heading.

Ms. Hyasinta Kessy is a student at the Open University of Tanzania (OUT). She is intending to conduct research titled **"Differential Effectiveness of multimedia Enriched and Plain Sex Education instructural material.**

Please assist her.

Thanks in advance.

R. Salema
For: THE MUNICIPAL DIRECTOR
ILALA MUNICIPAL COUNCIL

Copy to: The Municipal Director
                Ilala Municipal Council
                DAR ES SALAAM.