COMPUTER BASED PEDAGOGY AND PUPILS'

ACADEMIC PERFORMANCE IN SCIENCE IN PUBLIC PRIMARY SCHOOLS OF MUMIAS WEST SUB COUNTY, KAKAMEGA COUNTY

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DECLARATION

This research proposal is my original work and has not been submitted or presented for any other degree or award in any other institution of learning

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This research proposal has been submitted for examination with our approval as University Supervisors.

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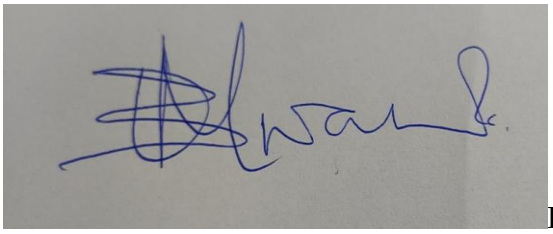
Signature  Date **5th August 2020**

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DEDICATION

To “Father Deepen” my inspiration and the oasis of strength. Peris our anchor, my adoring wife Hannah, sons Dick, Tony and Sam to whom pursuit of knowledge is sacrosanct

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Actualizing an enormous task such as this can never be attributed to one individual however endowed; this research project is a typical manifestation of the invincible power of teamwork, cooperation and dedication. I am eternally grateful to my supervisors Dr. Mwanda and Dr Ngaruiya for picking me up every time I faltered and walking me through this journey. My special gratitude to the chairpersons, (Prof Odundo then and currently Prof.Gatumu) faculty and entire staff of the department of Education Communication and Technology for nurturing me. I thank my colleagues 'the medtech pioneers 2016" for being good company and to my family Adams and Hannah for taking this to fruition.

ABBREVIATION AND ACRONYMS

AR Augmented Reality

CAL Computer Assisted Learning

CAI L Computer Assisted Interactive Learning

CBP Computer Based Pedagogy

CIM Conventional Instruction Methods

CLT Cognitive Load Theory

CMC Computer Mediated Communication

ICTInformation Communication and Technology

INSETIn-Service Education and Training

KENET Kenya Education Network Trust

KESSP Kenya Education Sector Support Programme

KICD Kenya Institute of Curriculum Development

KCPE Kenya Certificate of Primary Education

MoE Ministry of Education

STEMScience, Technology, Engineering and Mathematics

TSCTeachers Service Commission

VR Virtual Reality

ABSTRACT

Computer invention being one of the most epoch-making invention of the 21st century, computers have fundamentally altered every aspect of people's lives, including the education domain. The purpose of this study was to establish the influence of the computer-based pedagogy (CBP) on pupil's academic performance in science in public primary schools of Mumias West sub county, Kakamega County. The study sought to examine the following: use of computer-based pedagogy (CBP) on pupils' performance in science; relevance of computer-based pedagogy on effective teaching and learning of science; influence of teachers' attitude towards computer-based pedagogy (CBP) on pupils' performance; and in public primary schools in Mumias West sub county, Kakamega County. The study employed a descriptive research design. The data was analyzed with the help of a computer program, SPSS version 23 and Microsoft Excel. The sample consisted of eight science teachers, 8 head teachers, one SCQASO and 312 class eight pupils from the 8 primary schools sampled for the study. A total of 329 participants from the anticipated 384 respondents participated in the study representing a return rate of 86%. Two sets of questionnaires for science teachers and pupils were used to collect data for the study. Head teachers and SCQASO were interviewed. On the use of computer-based pedagogy in schools on pupils' performance the study established that there was a lower usage of CBP in public primary schools of Mumias West Sub-county in Kakamega County. Unavailability of ICT resources in public primary schools was a major hindrance toward computer-based pedagogy in the teaching of science in public primary schools.The major learning outcomes created when science teachers use computer based approaches in teaching sciences included: pupils became more interested

to learn if materials from the internet were used in teaching; computer programs helped in saving time in classroom activities; weak pupils become more interested to learn if teachers use a computer in teaching; computer based teaching motivated pupils to learn and participate in classroom activities; computer based teaching provided greater attention and discipline of pupils in the learning process than the traditional way of teaching; computer based teaching application did not inhibit teachers' creativity; use of computers in education increased the amount of human interaction; use of computer technology in classroom activities helped to improved pupils' scores.

Teachers'skill level in IT had a significant influence in predicting the attitude of science teachers in the use of computer-based pedagogy in the teaching of sciences in public primary schools in the sub-county. Majority of the science teachers had a positive attitude toward CBP. Teachers' positive attitudes toward CBP could be attributed to their vision of technology itself, their experiences with it and cultural conditions surrounding its introduction in schools and its subsequent diffusion into their educational practice. Use of computer-based technology required high administrative support in terms of acquisition of necessary devices and materials such as the projector, laptops, internet and others that complement the approach. All pupils in schools using CBP had a positive attitude towards the approach compared to traditional approaches. CBP as a teaching approach aroused pupils' interest in learning science, made learning more enjoyable, led to greater pupils' involvement, encouraged commitment in the subject and enable pupils to grasp science concepts easily which further translated to pupils registering improved scores in sciences.In order to enhance the use of computer based pedagogy (CBP) on pupil's academic performance in science in public primary schools, the recommendations were

in three folds: at government level through the Ministry of National Treasury and Ministry of Education should allocate adequate funds for in its national budgetary allocations for acquisition of CBP materials like a projector, laptop, desktop, photocopier, digital camera, science software/CD ROM and internet connectivity in all public primary schools; the school level through its BOM by mobilizing funds for the acquisition of CBP materials; and at teachers level by co-opting pupils in the use of CBP programs/practices for any meaningful science activity in order to make science lessons more interesting, more involving and more rewarding to the pupils.

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CHAPTER ONE

INTRODUCTION

1.1Background of the Study

The innovation of computers opened up a new world order not only in the education sector's teaching and learning process but in all other spheres of life as well. Shamsideen (2015), rightly opined "Society is rapidly transforming into one which is based on information requiring its citizens to be familiar with information-based resources and manipulations. Being one of the most epoch-making invention of the 21st century, computers have fundamentally altered every aspect of people's lives, including the education domain. "According to Arslan (2003), "The growing complexity of education each day, the rise of the information to learn, the need for qualified and modern education require the use of computers as a tool in education. The use of technology in education will provide that the education will be carried out in accordance with the needs of the era as well as that the highest appropriate yield will be received from education." The computer which is one of the technological capabilities and a basic element of culture in our century has become a tool whose use is rapidly spreading (Odabasi, 2006).

Arslan (2003) further states, "The use of computers in education started in the 1960s. With the advent of convenient microcomputers in the 1970s, computer use in schools has become widespread from elementary education through to university education."Additionally, Hancer and Tüzeman, (2008) state that, "Instructional computers are basically used in one or two ways; either they provide a straightforward presentation of data or they fill a tutorial role in which the student is tested on

comprehension." With shifting from the teacher-centered instruction to child-centered instruction, Aytekin et al., (2004) posited that "the role, activities, attitudes, reflections of the students become more important concern to overlook the effectiveness of technology in instruction. Technology is a main support for the students learning process nowadays. Lodhi (2019) opined that "computer technology support as a tool for effective learning and teaching process. Computer based instruction and computer programs, provides facilities and supports to students' educational life. Computers update mechanism for the education and it is not only for education, these developments affect global, cultural and economic life standards as well."

In rich countries, instructional technologies are used to take an additional step, to improve learning beyond the levels previously reached – levels already vastly superior to those reached by developing countries. In Europe for example, appropriate use of Information Communication and Technology (ICT) in school education is considered "a key factor in improving quality at educational level." The European Commission is promoting the use of ICT in learning processes through its eLearning Action Plan, one of the aims of which is "to improve the quality of learning by facilitating access to resources and services as well as remote exchange and collaboration" (Commission of the European Communities,2001).

According to Hancer and Tüzeman, (2008), "Computers and the internet in European schools are widely used in class in most countries these days. The European-wide survey of head teachers and classroom teachers found that 96% of all European schools had internet access. In no country the figure goes below 90%. Highest shares of broadband

connection in schools were found in the Nordic countries – the Netherlands, Estonia and Malta where about 90% of the schools had a broadband internet connection."

Tabassum, (2004), "To date in many countries around the world, various learning models that support ICT resources are widely used. There are several computers based educational pedagogies in application such as Computer Assisted learning (CAL), Computer Assisted Interactive Learning (CAIL), and Computer Mediated Communication (CMC) that aid learning. Computer Based Pedagogy is an interactive instructional technique, in which a computer is used to present the instructional material and monitor learning that takes place."

Ifenthaler (2012), states that, "Computer-based pedagogy (CBP) has been referred as the use of computers for instructional purposes, whereas the computer hard and software as well as the peripherals and input devices are the key components of the educational environment. The CBP may involve web-based learning environments (e.g., online adaptive learning environments, online interactive learning environments, intelligent tutoring system, learning management system, and so forth), handheld or microcomputer-based laboratory, computer simulations or animations, computer or digital games, augmented reality (AR), virtual reality (VR), and mobile or smart phone applications. CBP refers to the process of learning or pedagogical practices with the aid of digitalized content, platforms, facilitators, or environments."

Koehler et al., (2013), "Teachers need to know how CBP can enhance the representations of specific content knowledge by making the content easier to learn and strategically promote particular learning processes or pedagogical practices." Mishraand Koehler, (2006), goes further to state that "CBP should be applied as a process rather than as a

single, isolated, and discrete activity. CBP application should be based on sound teaching and learning principles and pedagogies to avoid teaching hardware and software technologies in an isolated manner. Pedagogy and computer-based learning should be considered as natural partners, where pedagogies can encourage active approaches to the process of delivery and assessment of learning." This statement is reiterated by Renshaw and Taylow (2000) by stating, "The focus of any CBP should not be on the technology itself, but on how CBP can pedagogically use to improve students' learning process .CBP using software provides differentiated instruction, in which the pupils of different intellectual abilities will have an opportunity to master a certain level of knowledge and skills. By applying the CBP, rote learning is minimized, and meaningful learning can occur."

In line with this idea, Wright (2008) stated that "academic learning accompanied by computer technology offers students much more confidence and interest in the process of exploring and learning knowledge." It can be used to develop students' skills for cooperation, communication, problem solving and lifelong learning. According to Voogt,(2008), "CBP gives students a sense of empowerment and control. Students can control the pace and repeat lessons when they feel the need to do so; thus, they can progress at a learner defined pace and move ahead when they feel that they are ready. There are drawbacks to the implementation of computers in instruction, however." They are generally costly systems to purchase, maintain, and update. There are also fears, whether justified or not, that the use of computers in education decreases the amount of human interaction (Bello, 2004).

Application of a computer based pedagogy, in teaching, depends on the general attitude of teachers towards a particular model (Huang and Liaw, 2005; Rovai and Childress, 2002), age and teaching experience (Handler, 1993; Massoud, 1991; Woodrow, 1992), application of computers in the classroom (Teo, 2008; Zhao et al., 2001), teachers' competence in its application (Yuen et al., 1999), and professional advanced training (Tsitouridou and Vryzas, 2003).Albirini, 2006 and Cavas, et al., (2009) state that, "The success of implementing new innovation of education in schools depends on teachers' attitude. It is generally believed that a teacher who possesses positive attitudes toward ICT is more motivated to integrate it into his or her teaching practices." Mumtaz, (2000) goes further to state that," Some researchers explain that these attitudes toward technology can vary from very positive to very negative depending on the combination of different factors that may influence these attitudes (Mumtaz, 2000)." While many scholarly papers tried to clearly identify these influential variables, there is still a lack of consensus about the universal factors that affect teachers' attitudes toward ICT. Self-confidence, ICT knowledge, gender and age are among the factors that are considered to be important.

Students' attitudes towards computer as postulated by Teo (2006) "have an influential role on their acceptance to use the computer as a learning tool and their future behaviors towards the computer such as using it for further study and other purposes." Similarly, Zhang (2011) stated that "students' attitudes towards the Computer Based Pedagogy (CBP) can be considered as a key predictor in terms of successful application of computer to learning." Moreover, Ajzen and Fishbein (1977) stated that "attitudes toward targets will predict multiple-act criteria, provided that the attitudinal and behavioral

entities involve the same target elements". It would seem that awareness of students' attitudes toward computers can be "a critical criterion in the evaluation of computer courses and in the development of computer-based curricula" (Woodrow, 1991). Therefore, computer attitudes should be considered as key constructs in predicting technology acceptance for use.

Science, with its sibling, technology, is already playing a key role in economic and social development (O'kello, 2015). According to Mustafina (2016), "Science is proving to be a powerful tool in promotion of social progress and efforts to provide a better standard of living for the population. Science at primary school level should nurture pupils' curiosity and allow them to ask questions and develop the skills they need to answer those questions. Primary science helps pupils to: investigate problems and learn how science works." The state of primary science teaching has consistently been of concern for many years. While pre-service primary teachers' feelings of inadequacy in teaching science have been partially addressed in some teacher education programs, there is growing evidence to suggest that many of the problems about primary science teaching may arise from school contexts (Mustafina, 2016).

As opined by O'kello (2010), "at the primary school level, the teachings of the scientific concepts introduced during pre-school education are further explored in a less formal setting. The concepts are organized and presented as units. For the first three years of the primary school (grades one, two and three), there are twelve units per year. For the upper primary classes (grades four through eight), there are seven units per year. A unit, in this context, refers to a topic to be covered in teaching. The lower primary represents a progressive transition from preschool science to a more detailed and relatively advanced

treatment of the topics in upper primary." As the topics become more detailed in the upper primary, the student is given an indication of the discipline-based structure of the secondary school.

Effective science teaching requires creativity, imagination, and innovation. There are different teaching methods employed in science education in Kenyan primary institutions. Twoli (2006) pointed that "teachers can use various teaching methods to achieve instructional objectives in sciences, which are broadly categorized as teacher-centered or conventional and pupil-centered methods."Twoli (2006) identified various teaching methods including "the lecture, demonstration, practical or laboratory experiments, project work and field trips for teaching sciences in primary schools." At primary school level most of the science teachers use lecture and demonstration methods in their teaching. Lecture method is often used to deliver a large amount of information to the students in a short period (Berry, 2008). Demonstration teaching method is a useful method of teaching because it improves students' understanding and retention (McKee, Williamson, and Ruebush, 2007). According to Al-Rawi (2013), "the demonstration is effective in teaching skills of using tools and laboratory experiment in science. However, the time available to perform this demonstration is very limited in a classroom setting."

Cisse (2020) states that, "Policy makers and development experts seeking to improve the quality of education are interested in the role technology can play. Not only do they want to use technology to directly aid learning, but they also want to ensure that students in developing countries – and poor communities everywhere – get the same exposure, and same education benefit, from technology as do their counterparts in wealthier parts of the world." Bringing computers into the schoolroom is seen by experts as one way to do this.

"Having access to computers in the classroom allows students to learn not only about relevant course and research material but to learn about computers themselves – instead of penmanship, students practice typing skills; instead of library skills, students practice web research. Technology also has the power to transform teaching by ushering in a new model of connected teaching" (Wamakote and Hennessy, 2010).

Cisse (2020) further states that "Africa has largely leapfrogged through several technological innovations – such as the landline phone – in the last 20 years. Typically, leapfrogging can accelerate development by skipping over a technology that may be inefficient, expensive, and environmentally unfriendly. But in the case of education technology, leapfrogging creates a few problems – at least in the short term – that mean ICTs will not necessarily improve educational access until fundamental challenges are addressed." Additionally, Richardson et al., (2012) states that. "By 2011, all private schools (100%) and almost all public (99.7%) schools in Egypt were reported to have access to computer and computer accessories." Nigeria on its part launched an ICT-driven project known as School Net (Federal Republic of Nigeria, 2006) which was intended to equip all schools in Nigeria with computers and related communication technology tools for integration. Empirical data also (Kituyi and Tusubira, 2013 and Richardson et al., 2012) show that Rwandese, Tanzanian and Ugandan governments have not been left behind and have endeavored to revolutionize their classroom pedagogical approach through adoption and integration of ICT.As postulated by Cisse (2020), "the rapid pace of development has also led to the spread of ICTs without the infrastructure to support widespread adoption. Many developing countries lack consistent access to energy. ICT can be instrumental in supporting education in developing countries, but an

important starting point to achieve that transformation is ensuring that ICT users have access to consistent electricity and teachers with basic technological training."

ICT policies in the East African Community began taking shape in the early 2000s.The East African Community (EAC) countries have formulated national ICT policies and most of them have drawn out plans for ICT integration in schools. In their ICT for education policies, all the East African countries expressed the need for integrating ICT in both formal and informal education (Wamakote and Hennessy, 2010).According to the infoDev report, quoted in Farrell and Isaacs (2007), "the initial ICT policies were comprehensive and included all sub-sectors of the education system. However, the formation of the policies has been a long and complicated process. In Kenya, for example, the earliest known ICT policy dates back to the 1980s and by 2000 it had not been completed. These ICT policies, nonetheless, were and still are comprehensive and stress access to ICT tools and internet connectivity." There is also a stated commitment to "invest in ICT infrastructure in schools with deliberate plans to ensure that the digital divide between rural (poor) and urban (rich) schools does not escalate and that children with special needs are catered for as well."

Farrel (2007) stated that, "The Ministry of Education (MoE) developed Kenya Education Sector Support Programme (KESSP) in 2005 that featured ICT as one of the priority areas, with the aim of mainstreaming ICT into the teaching and learning process; however universal implementation is quite a problem." The realization of achieving the computer-based pedagogy and learning is expressed in the national ICT strategy for education and training, the policy document for ICT in education (MoEST, 2006). These include, among others, (i) equipping education institutions with digital equipment to

stimulate integration of ICT in education and (ii) supporting initiatives that provide digital equipment to educational institutions, with priority to secondary schools. The expected outcome of these measures was to improve equipping of educational institutions with digital infrastructure up to 80% in secondary schools.

Kenya's new 2.6.3.3.3 curriculum that is replacing the 8.4.4 curriculum has an integrated science learning area that combines concepts of physics, chemistry, biology and environmental studies (MOEST report, 2017). The Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA) has started working with the Ministry of Education to enhance the uptake and persuasion of Science, Technology, Engineering and Mathematics (STEM) courses right from the lower levels of education. Established in 2004 to provide In-Service Education and Training (INSET) for mathematics and science teachers in Kenya and Africa, CEMASTEA has since been tasked by the Ministry of Education to roll out the STEM model schools intervention program, which was first launched on 2nd September, 2016.

Wasonga (2019) notes that, "CEMASTEA has consequently pushed support for the schools as they develop across various levels of the program, supplying teaching and learning equipment such as robotics kits, laptops, cathode ray oscilloscopes, LCD projectors, digital cameras, white-boards, light microscopes, among others alongside sensitizing principals and chairpersons of the STEM school boards of management. In addition, 306 teachers from the STEM schools have been trained per year since 2017. It purposes to improve the quality of teaching mathematics and science education by enhancing pedagogical skills of teachers which in turn is expected to help young Kenyans in schools develop and acquire relevant core competences such as communication and

collaboration, critical thinking and problem solving, creativity and imagination, citizenship, self- efficacy, digital literacy and learning to learn. In line with Kenya's Vision 2030 of providing a globally competitive quality education, training and research to her citizens for development and individual well-being, the Ministry of Education endeavors to improve the quality of education in Kenya." Thus, CEMASTEA carries out INSET for mathematics and science teachers at the basic level of education; developing innovative teaching approaches and conducting seminars and workshops for school leaders funded by the Ministry of Education.

Mumias west Sub County has been the National champions in KCPE National ranking by mean for years. Keen analyses of the pupils' performance however indicate that the performance in science is not impressive as compared to the other examinable subjects. The teaching of science in Mumias West Sub county primary schools has largely been with the use of the conventional/Traditional Instruction Methods (CIM) such as lecture, discussion, experiments, assignments field trip. The pupils' achievement in subject mean scores in science in KCPE has consistently remained weak as compared to the other examinable subjects for the seven years under scrutiny.There is need for learning institutions and especially primary schools of Mumias West Sub-county to embrace and integrate technological-based learning paradigms with traditional paradigms as a method of choice for science instruction. This ultimately will help develop powerful learning environment that intrinsically motivate pupils to learn and participate effectively and meaningfully in classroom activities.

According to Albirini, (2006), "Studies reviewed under the use of computer in teaching and learning in schools has shown that the most frequent uses of ICT were word

processing, internet research, email, and power-point, educational software compact discs (CDs) while the least frequent uses were palm top computers, web page design, online discussion groups, and virtual excursions. Unfortunately, much of the early research on computer uses in education has ignored the systematic study of ways in which computers can be used by the teachers in teaching-learning process. Studies focused on the most frequent ways of using computers, on the frequency of computer use, on the strength of teachers employing use of computers, or on its effect on students' achievement; thus, overlooking the conceptual or contextual aspects of ways of computer use in teaching-learning process." In addition, much of these studies have been conducted in very few schools that have been selected purposively as "technology rich schools" at the expense of others thus limiting the generalization of the research findings. Studies reviewed under the relevance of computer-based technology have shown that "information and communication technology can help to overcome the shortcomings of science education that is taught traditionally through the involvement of teachers in using the computers productively." These studies opted to focus on the effects of several computer assisted techniques as opposed to CBP among a certain category of learners other than primary schools. Studies conducted outside Africa for example, have shown that computer assisted techniques has boosted learners' academic achievements as opposed to a study conducted in Ghana.

The literature reviewed has shown that positive teacher's attitudes influence frequent use of computers. Although there are numerous researches on the positive impacts of computer based approaches in foreign countries and in institutions of higher learning including institutes of technology, polytechnics and universities; there is very little on the

effects of CBP in Africa. More so, few studies have been conducted based on the effects of CBP and how it impacted on teachers' attitude towards use of computers in the teaching of science concepts in the public primary schools in Mumias West Sub County in Kakamega County as observed in the third objective of the study. Students' attitudes towards computer have an influential role on their acceptance to use the computer as a learning tool and their future behaviors towards the computer. The present study aimed at determining primary schools' pupils' attitudes toward CBP instruction in relation to gender, prior experience with computers and different school types. In addition, the study examined differences of selected computer activities both in teaching and learning of science concepts in class eight.

1.2 Statement of the Problem

Very little is known about the application of CBP in teaching sciences in public primary schools in Kenya. Research into their effectiveness has not been carried out yet. Since the computer-based teaching methods cannot be applied without a sufficient number of computers in the classroom; a possible reason for its minimal and inadequate representation in science teaching and the teaching of other subjects (Drakulić et al., 2011). The ministry of education states that, "Considering that a MoE project ICT equipment for schools purchased computers for 142 schools in support of the ICT in education strategy; Kenya Education Network Trust (KENET), currently funded by the Kenyan Ministry of Education and the ICT Trust, established permanent high-speed internet infrastructure in 22 School Broadcasting Free Software Licenses providing free access to Microsoft Corporation's operating software for schools and higher education institutions in order to reduce the cost of buying and using computers." The company was

to work with the organizations involved in supplying computers to the institutions to install the software on the machines (Farrell, 2007). It is to be expected that computers, and thereby the CBP teaching method, are going to get their proper place in the Serbian educational system.

Mumias west Sub County has been the National champions in KCPE National ranking by mean for years. Keen analysis of the student performance however indicates not so impressive performance in Science as compared to the other examinable subjects. The teaching of Science in Mumias West Sub county Primary Schools has largely been with the use of the conventional/traditional Instruction Methods (CIM) such as lecture, discussion, experiments, assignments field trip. The students' achievement in subject mean scores in science in KCPE has consistently remained weak as compared to the other examinable subjects for the seven years under scrutiny. The student academic performance in science in Mumias West public primary schools over the seven years under scrutiny is weak compared to the pupils' performance in other examinable subjects as shown in the table 1.1 below.

Table 1. 1: Analysis of KCPE Performance by Mean Score

SUBJECTS/YEAR	2013	2014	2015	2016	2017	2018	2019
ENGLISH	53.79	54.10	58.60	55.97	54.88	53.66	
KISWAHILI	59.74	57.55	60.40	60.56	57.67	56.05	
MATHEMATICS	53.93	56.01	57.06	55.02	54.05	52.78	
SCIENCE	52.30	55.25	54.37	54.38	52.67	52.28	
SOCIAL STUDIES /CRE	54.22	55.59	54.93	55.42	53.48	52.65	

Source: Mumias West Sub County Examinations' Office

From Table 1, it is evident that science is poorly performed. This may imply that pupils are not learning sufficiently through the conventional /traditional instruction methods. Therefore the implementation of science curriculum could be having contributing factors that are rooted in how the teaching and learning process is implemented. Lack of empirical studies on CBP in this area leaves a gap in knowledge that needs to be filled. This study therefore, seeks to determine the effect of computer-based pedagogy on pupils' performance in science in public primary schools of Mumias West Sub County, Kakamega County. It is not only important but urgent to carry out this study so as to leverage on the widely documented transformative nature of computer-based pedagogy in enabling learning and maximising the utilization of the available resources for greater and enhanced interest in learning as well as learning outcomes.

1.3 Purpose of the Study

The purpose of this study was to establish the influence of the computer-based pedagogy (CBP) on pupil's academic performance in science in public primary schools of Mumias West Sub County, Kakamega County.

1.4 Research Objectives

The specific objectives of this study are:

i. To establish the impact of frequent use of computer-based pedagogy (CBP) on pupils' performance in science in public primary schools of Mumias West Sub county, Kakamega County.
ii. To examine the relevance of computer-based pedagogy on effective teaching and performance of pupils in science in in public primary schools of Mumias West Sub County, Kakamega County.

iii. To establish the influence of teachers' attitude towards computer-based pedagogy (CBP) on pupils' performance in science in public primary schools of Mumias West Sub county, Kakamega County.

iv. To investigate the influence of pupils' attitude towards computer-based pedagogy on their performance in science in in public primary schools of Mumias West Sub County, Kakamega County.

1.5 Research Questions

i. What is the influence of regular use of computer-based pedagogy (CBP) on pupils' performance in science in public primary schools of Mumias West Sub county, Kakamega County?

ii. What is the relevance of computer-based pedagogy on effective teaching and performance of pupils in science in in public primary schools of Mumias West Sub County, Kakamega County?

iii. How do the teachers' attitudes towards computer-based pedagogy (CBP) influence pupils' performance in science in in public primary schools of Mumias West Sub County, Kakamega County?

iv. How the pupils' attitudes towards computer do based pedagogy (CBP) influence their performance in Science in public primary schools of Mumias West Sub County, Kakamega County?

1.7 Significance of Study

The findings of this study will greatly benefit the Ministry of Education in policy formulation and implementation on matters relating to technology in education. The study will provide insight to the Kenya Institute of Curriculum Development (KICD) in

setting purpose and activities in teaching of science in primary schools. It will also help the Teachers Service Commission's (TSC) organize seminars, workshops and INSETS to improve teaching pedagogies in the teaching of science. The study will also help science teachers in preparation in the use of computers for pedagogical purposes. The study will also provide more knowledge for improving teaching theory and learning using CBP.

1.8 Limitations of the Study

The findings of this study were limited by the size of number of the selected schools in Mumias West Sub County Primary Schools who were targeted for the study, the differences in learner's characteristics of the selected schools as well as the dynamic and varied learning environments in the selected schools.

1.9 Delimitations

The study was carried out in eight public primary schools of Mumias West Sub County, Kakamega County in the two educational zones of South Wanga and Mumias central. The study involved teachers of science and pupils in standard 8 in the eight public primary schools in Mumias West Sub County.

1.10 Basic Assumptions

The study assumed that all schools computers and projectors for CBP. The study also assumed that the necessary infrastructure such as electricity connectivity and classrooms are in place and that the teachers in the schools have the prerequisites computer knowledge to deliver the computer-based teaching.

1.11 Definition of Terms

Academic achievement or (academic) performance –Is the outcome of education or the extent to which a student, teacher or institution has achieved their intended goals.

Computer-assisted learning (CAL) –is any use of computers to aid or support the education or training of people.

Computer based pedagogy (CBP) – Is any programme aimed at integrating the use of digital technologies in the teaching and learning process in public primary schools in Kenya.

Pupils' academic performance– refers to learners' scores from evaluation tests both the formative e.g. CATS, RATS and the summative e.g. K.C.P.E

Science– refers to one of the examinable subjects in the primary school cycle of the 8:4:4 education curriculum.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This section reviewed literature under the following sub headings: Use of computer based pedagogy (CBP) on pupils' performance in science; relevance of computer based pedagogy on effective teaching and learning of science; influence of teachers' attitude towards computer based pedagogy (CBP) on pupils' performance; and in public primary schools in Mumias West Sub County, Kakamega County. The review looked at studies and projects done in developed countries, in Africa and finally in Kenya.

2.2 Use of Computer Based Pedagogy (CBP) on Learners' Performance

Hadley and Sheingold (2011) found teachers in the United States of America used computers in multiple ways and reported changes in teaching practice, including: presenting more complex material to students, giving students more individual attention, allowing students to work more independently, and becoming more of a coach and facilitator in the classroom. Glennan and Melmed (1996) quoted in Hadley and Sheingold (2011) examined five "technology-rich schools" of Santa Monica, California, in which curriculum and instruction had been changed, and the school days were reorganized to make effective use of technology. These schools were considered to be "representative of the best practices across the nation," and they demonstrated that technology could be used to restructure the learning experience for students and improve learning outcomes. Harris (2000) revealed that the highest percentage of use of computers and the internet was for preparing instructional materials. Lowest percentage of use of computers and the internet was for instructional use for students. The teachers used word processing

primarily for preparing instructional materials, instructing students in the classroom and interactive lab. The second highest use was for web searching. This study aimed at establishing how teachers used the computer applications such as word processing and internet for web searching for instruction in class to influence pupils' performance as part of computer-based pedagogy as envisaged in the first objective of the study.

Wallace (2001) developed a conceptual framework as to how teachers used internet in their teaching and how they used material resources. The results stated that teachers made use of internet by transforming it into a resource which fit into their own teaching methods. Furthermore, Kellenberger and Hendricks (2000) and Martin Ofori-Attah (2005) identified that the computer use by teachers was divided into three main components namely, for teaching purposes (to impart knowledge, create variety, and to give confidence to teachers), administration purposes (in preparation of job-related materials and to ensure safe-keepings of data and information about students), and personal purposes (to engage teachers' free time in a beneficial and fruitful manner).

In a study of 12 United Kingdom schools, Valentine et al., (2005) found that home-school computer uses were poorly linked (e.g., only 10% of students visited their school's website regularly, and many students and parents were unaware of their schools' information and computer technology facilities); however, there were modest positive associations between home use of computers for educational purposes and attainment in English and mathematics at some (though not all) school grades. A larger study of 15 to 16 year-olds, conducted in Germany, found no overall relationship between frequency of home use and mathematical. Another large study, using longitudinal panel data collected in the United States of America, found positive associations between computer game play

and educational achievement but mixed relationships (varying between genders and demographic groups) for educational uses of computers (Hofferth and Moon, 2012). Jackson, et al., (2006), in a study of low-income American adolescents, also reported no link between home internet use (mainly for information-seeking rather than interpersonal communication) and school mathematics attainment, but did find that more time online was associated with higher grade point averages (GPAs) and higher reading scores. This study is related to the present study as they both focuses at uses of computer in teaching of various disciplines in school and how this translated to learners' performance.

Durkin and Conti-Ramsden, (2012) examined the relationship between frequency of computer use (for leisure and educational purposes) and educational achievement; in particular examination performance at the end of compulsory education and level of educational progress two years later. Participants were 49 young people and 56 typically developing (TD) young people. At around age 17, the two groups did not differ in frequency of educational computer use or leisure computer use. There were no associations between computer use and educational outcomes in the typically young developing group. In the young people group, after being controlled for, educational computer use at around 17 years of age contributed substantially to the prediction of educational progress at 19 years. The findings suggested that educational uses of computers were conducive to educational progress in young people. The present study also looked at the educational uses of computers for educational progress among leaners.

Omur (2008) in Turkey investigated the manner and frequency of primary school science teachers' use of computer. Results demonstrated that improving the computer literacy of science teachers seemed to increase science teachers' computer use and consequently

increase their integration of computer applications as an instructional tool. Internet, email, and educational software Compact Discs (CDs) were found to be used frequently in the classrooms. Dawson (2008) while examining the extent to which science teachers perceived that their pre-service education prepared them to use ICT in their teaching role, found that the most frequent uses of ICT were word processing, internet research, email, and power-point while the least frequent uses were palm top computers, web page design, online discussion groups, and virtual excursions. The present study also focused on the same respondents who were science teachers and their most frequent uses of computers in school.

Bhalla (2013) examined a comprehensive investigation of 300 Central school teachers' use of computers in India. A questionnaire was constructed that listed essential dimensions for teachers' use of computers: Computer Aided Learning (CAL), Computer Managed Instruction (CMI), and Computer Assisted Instruction (CAI). The findings revealed that teachers often used computers to update subject knowledge and teaching skills, develop lesson plans, prepare additional instructional material, notify relevant information via internet and prepare question banks. They sometimes used computers for showing something in the class, showcasing students' work on school-website, preparing test papers, simulations, games, students' assignments. They had either rarely or never used computers for presenting entire lesson, students' classroom presentations, tutorials, sharing information with parents, publishing homework, giving tests to students –either offline or online, maintaining students' records, and individualized instructions. The analysis indicated that amongst the three categories of computer use, CAL was the most popular category of computer use whereas CAI was the least popular among teachers.

The results help to demystify seeming inconsistency and variation with regard to computer use among teachers. The identification of comprehensive ways of computer use empowers stakeholders with vital information and may assist implementation of appropriate measures to fully infuse computers in teaching-learning process. The present study also uses a similar research collection tool which was a questionnaire that listed essential dimensions for teachers' use of computers across several schools in Mumias West Sub County in Kakamega.

Mathevula and Uwizeyimana (2014) quantitative study investigated the impact of ICT equipment availability and accessibility and teachers' training in ICT use on the integration of ICT into the curriculum related activities by teachers. The data used in the research was collected by means of structured questionnaires, from 146 participants in twelve secondary schools located in the Groot Letaba Circuit, Mopani District Municipality in Limpopo Province, South Africa. The findings revealed that, with the exception of a TVs, photocopiers and laptop/desktop computers, there is a scarcity of ICT resources available at schools for ICT integration, and that the teaching and curriculum administration functions of most teachers have been negatively impacted by a lack ICT equipment and/or insufficient use of these ICT resources for those schools who have them. In addition, while some teachers had received some form of ICT training, it was evident that such training has had minimal or no impact at all on the abilities and confidence of teachers to use ICT in their teaching. These factors that negatively influence teachers' readiness for, and confidence in, using ICT; need to be dealt with by the various stakeholders including, and especially, the Department of Education and the school management and private partners. The present study makes an attempt to identify

teacher factors that influence their attitude toward the use of computer in teaching of science in primary schools in Mumias West Sub County in the county of Kakamega.

The New Partnership for Africa's Development (NEPAD) found that 55% of secondary students participating in the first phase of the NEPAD e-schools initiative reported no experience with the use of computers and most schools did not provide learning opportunities or teacher training (Adomi and Kpangban, 2010). Computers were very unevenly spread within African countries, typically being concentrated in relatively few schools that already had the basic infrastructure to support them. Furthermore, in many developing countries such as Zimbabwe, computers may not be used to their potential or might even be stored away due to a number of factors, including weak school infrastructure, a lack of teacher training for ICT or general anxiety related to their use (Konyana and Konyana, 2013).

Odhiambo (2013) investigated the use of information communication technology (ICT) in teaching and Learning in Rachuonyo South District secondary schools. The result indicated that ICT has not been successfully integrated in teaching and learning in schools. In general, students are capable and motivated users of computers. Some students had the skills to use new kinds of applications and their ICT skills are wider although not necessarily adequate. Teachers' skills were more heterogeneous. The large majority of teachers had sufficient skills for everyday and routine working practices, but many of them still have difficulties in finding a meaningful integration of ICT into teaching and learning. Most teachers reported that the use of ICT in learning and teaching was slow in the past years and proposed upgrading of students computer labs and accelerating internet connectivity in the schools. Further, teachers' good ICT competence

helps them to adopt new pedagogical practices and integrate ICT in a meaningful way. The results also showed that students were capable and motivated users of new technology and their ICT skills are wide, although not necessarily adequate; the working habit might be ineffective and wrong. Some students have a special kind of ICT related adaptive expertise, which develops in a beneficial interaction between students and teachers, and individual interest and activity. The most common goal to student use of ICT is challenged by the internet, digital communication and the need to filter information. Since students' ICT skills can be translated to increased creativity, which include innovation and productive workforce, to develop capacity to ICT which support the country's knowledge base. In trying to unravel the uses of computers in relation to CBP in the teaching of science in schools, it is imperative in the present study to examine the skill levels of science teachers and pupils in primary.

Studies reviewed under the use of computer based pedagogy in teaching and learning in schools has shown that the most frequent uses of ICT were word processing, internet research, email, and power-point, educational software compact discs (CDs) while the least frequent uses were palm top computers, web page design, online discussion groups, and virtual excursions. Unfortunately, much of the early research on computer uses in education has ignored the systematic study of ways in which computers can be used by the teachers in teaching-learning process. Studies focused on the most frequent ways of using computers, on the frequency of computer use, on the strength of teachers employing use of computers, or on its effect on students' achievement; thus overlooking the conceptual or contextual aspects of ways of computer use in teaching-learning process. In addition, much of these studies have been conducted in very few schools that

have been selected purposively as “technology rich schools” at the expense of others thus limiting the generalization of the research findings.

With regard to educational computer use being an influential factor and that any gains in these respects are in turn advantageous to educational progress; it must be stressed that this hypothesis has not been tested directly in the present study. It is the intention of this study to test this hypothesis as seen in the first objective of the study. Research findings have further indicated that using home computers for educational purposes by learners may make a positive contribution to their educational progress during an important transition phase in adolescence. This is striking because the condition itself appears to be stable in adolescence. It was the intention of this study to ascertain if the same findings could be replicated with pupils in teaching and learning of sciences in public primary schools in Mumias West Sub County in Kakamega County.

2.3 Relevance of Computer Based Pedagogy on Effective Teaching and Learning

As postulated by Kash, (2000) and Chang, (2002), the computer-based instruction makes teaching techniques far more effective than those of the traditional teaching methods as it is used for presenting information, testing and evaluation and providing feedback. It makes a contribution to the individualization of education. It motivates students and gets them to take an active part in the learning process. It helps to develop creativity and problem solving skills, identity and self-reliance in learners. CBP provides drawings, graphics, animation, music and plenty materials for the students to proceed at their own pace and in line with their individual differences. It serves to control lots of variables having an impact on learning, which cannot be controlled by means of traditional educational techniques.

Kayri et al., (2012) investigated the effects of a visual didactic material developed in a computing environment on students' academic success. In the experimental study, the effects from computer-assisted education on the success of students taking the course of electrical installation project drawing were researched. According the results of the scale developed by researchers, was the academic success of the group that had received a visual training CD as a supplement to the traditional education was higher than the success of the group that had learned only with the traditional education system. It was observed that the students of the group that possessed private didactic software during a process of approximately one month, asked the instructors for less help. This shows that the visual education CD contributed to the development of the individual competences of the students. This study looked at the effects of a computing materialwith regards to educational outcomes among students. This objective is being addressed as stated in the second objective off the study.

Hussain et al., (2017) carried out a study on the effects of information and communication technology on the students' academic achievement and retention in chemistry. Fifty students of 9th grade were selected randomly from Kohsar Public School and College LatamberKarak. The students were grouped into equivalent groups based on pretest score. In order to collect data, pretest posttest equivalent groups design was used. Mean, standard deviation and independent samples t-test were applied through SPSS for data analysis. Based on statistical analysis, it came to light that information and communication technology positively affects students' academic achievement and retention and ICT was found more compelling, effective and valuable in teaching of chemistry when contrasted with conventional techniques of teaching. It is recommended

that information and communication technology should be used in teaching chemistry for enhancing students' academic achievement at secondary level. Both studies look at the effects of a computer-based approach in the teaching of a science on students' academic achievement.

Basri (2018) study in Saudi universities investigated and explored the adoption of information communication technology by the universities and the impact it makes on the university students' academic performance. The study also examined the moderators' effect of gender, GPA, and student majors on the relationship between ICT and academic achievement. By using a quantitative research approach and a sample size of 1000 students, data were collected about the ICT adoption in universities and the relative performance of students belonging to four Saudi universities. Structure equation modelling was chosen to determine the validity of the research model. The Analysis of Moment Structures (AMOS), specially used for structural equation modelling and path analysis, was used as the research tool. The findings reveal that there exists a relationship between ICT adoption and academic performance in a conservative environment. An additional finding also stated that ICT adoption resulted in the improvement of the performance of female students more than the male. However, students' IT major was found to be making no impact on students' academic achievement.

A study conducted by Bilal and Kasim (2001) showed that information and communication technology can help to overcome the shortcomings of science education that is taught traditionally through the involvement of teachers in using the computers productively. Roblyer and Schwier (2003) stated that the use of technology in education was able to increase productivity, motivation and information literacy, to provide a

unique teaching ability as well as to support teaching and learning. Research by Khairul,Anuar, Abdul and Rahman (2011), showed the development of Computer-Assisted Teaching and Learning in education improved the understanding of students with special needs.

Studies also indicated positive outcome of use of CAL in teaching chemistry generally (Ezeudu andEzinwanne, 2013; Garanga, Amadalo, Wanyonyi, Akwee andTwoli, 2012). Henriques (2002); Dori and Barak (2000) as reported in Kargiban and Siraj (2009), maintain that the use of computer enhances learning of the subject and develops interactive learning environment resulting in students improved achievement, an assertion supported by Akcay, Feyzolu and Tuysuz (2003) as well as Ezeudu and Ezinwanne (2013). Cotton (1991) found out that computer assisted instruction (CAI) enhances mastery exponentially with users learning as much as 40% faster and retaining learned content better which ultimately lead to more positive attitude and achievement than conventional methods of instruction. Other benefits include increased attendance, motivation and collaboration among students. Bhukuvhani, Zezekwa and Suusuma (2011) citing Funkhouser (1993) reported significantly higher test score for students who used CAL related instructional tools than students who did not, implying that the tool also improved their problem solving capabilities. This observation was also supported by Knuth and Rodriguez (2000) who also advises teachers to use CAL for discovery learning and in developing students' higher-order thinking skills. According to the researcher, CAL tools that enable visual representations enhanced instruction of chemistry concepts by providing easier and clearer illustrations than those a teacher could

make. The current study replaced CAL with CBP as a method of instruction in the teaching of science as opposed to Chemistry as seen in Tuyuz' study.

Tareef (2014) investigated the effects of the computer-assisted learning on the achievements and problem-solving skills on the educational sciences students. The result showed that experiment group's students with computer-assisted learning methods increase their problem-solving level, achievement and show a higher performance more than the control group student. A significant difference was found at the end of the application on behalf of the experiment group between the educational statistics achievements of the control group who had traditional instruction methods and the experiment group who had computer-assisted learning. This study showed that, computer-assisted learning method was more effective on the students' educational statistics achievements than the traditional instruction methods.

Owusu, Appiah, Monney and Wilmot (2010) conducted a study on the effects of computer-assisted instruction on performance of senior high school biology students in Ghana. A science class was selected in each of two randomly selected schools. The pretest-posttest non-equivalent quasi experimental design was used. The students in the experimental group learned science concepts (cell cycle) through the CAI, whereas the students in the control group were taught the same concepts by the conventional approach. The conventional approach consisted of lecture, discussions and question and answer teaching methods. Mann–Whitney U tests were used to analyze students' pretest and posttests scores. The results indicated that students that were instructed by the conventional approach performed better on the posttest than those instructed by the CAI. However, the performance of low achievers within the experimental group improved

after they were instructed by the CAI. Even though the CAI group did not perform better than the conventional approach group, the students in the CAI group perceived CAI to be interesting when they were interviewed.

Studies reviewed under the relevance of computer-based technology have shown that information and communication technology and other computer-based teaching techniques can help to overcome the shortcomings of science education that is taught traditionally through the involvement of teachers in using the computers productively. These studies opted to focus on the effects of computer-based approaches other than computer-based pedagogy among a certain category of learners other than primary schools. Studies conducted outside Africa for example have shown that CAL has boosted learners' academic achievements as opposed to a study conducted in Ghana. It's the intention of this study to ascertain if this scenario is replicated in Kenyan public primary schools and the reasons as to why as envisaged in the second objective of the study.

2.4 Teachers' Attitude on use of Computer Based Pedagogy and Students' Performance

Research shows that if teachers perceive computer programs as either satisfying their own needs or their student's needs, it is likely they would implement it in school. Teacher's adequacy, skills, and attitudes influence successful implementation of ICT in schools (Keengwe and Onchwari, 2011). If teacher's attitudes are positive towards use of computers, then they can easily provide useful insight about implementation.

Teachers' attitudes have been found to be major predictors of the use of new technologies in instructional settings (Almusalam, 2001). It has been found that less technologically capable teachers who possess positive attitudes towards ICT, required less effort and

encouragement to learn the skills necessary for the implementation of ICT in their design activities into the classroom. Therefore, teachers who have positive attitudes towards ICT itself will be positively disposed towards using it in the classroom. Moreover, Harrison and Rainer (2002) found that participants with negative computer attitudes were less skilled in computer use and were therefore less likely to accept and adapt to technology than those with positive attitudes. They concluded that changing individuals' negative attitudes is essential for increasing their computer skills. Therefore, if teachers want to successfully use technology in their classes, they need to possess positive attitudes to the use of technology. Such attitudes are developed when teachers are sufficiently comfortable with technology and are knowledgeable about its use (Afshari et al., 2009). This study looked at the attitude of teachers towards the use of a similar computer based teaching technique which was CBP with regard to teacher related factors such as age, gender, skill level and how it shaped the use of the technique in teaching of science in primary schools.

Mustafina (2016) carried out a study on the process of ICT integration in a Kazakhstani secondary school through the lens of the main facilitators of this process – teachers. This mixed-method study explored the role of teachers' attitudes toward technology integration in school through examining the factors (self-confidence, knowledge, gender and age) that influence teachers' ICT attitudes and analyzing the subsequent relationship between teachers' attitudes and their students' academic motivation. Findings showed that teachers possessed positive attitudes toward ICT in school mostly due to the advantages that technology offers such as distant learning and visualization of the material (3D programs). Moreover, the analysis showed that all four factors – confidence,

knowledge, gender and age – have the potential to influence and change teachers' attitudes toward technology. Interestingly, age and gender do not seem to have a direct influence on attitudes, confidence or knowledge. The current study intended to look at the role of teachers' attitudes toward CBP integration in the teaching of science in primary school through examining similar factors such as: self-confidence, knowledge, gender and age.

A study done in Syria (Abdulkafi, 2006) surveyed attitudes of high school English teachers who were using ICT in classrooms. The study was based on the teachers' computer attributes, competencies, access to ICT resources, cultural perceptions and personal characteristics. The findings suggested that these teachers had a positive attitude towards use of ICT in instruction. This was as a result of their vision of technology itself, their experiences with it, the cultural conditions surrounding its introduction in schools and its subsequent diffusion into their educational practice. The current study delved into teachers' attitude that were using CBP in the teaching of science as opposed to English and establish how their attitude that shaped learning outcomes in science.

Makau (1990) study in Kenya revealed that teachers expressed a negative attitude to integration of computers in teaching and learning. They found them noisy, disruptive to learning and cumbersome moving from the normal classrooms to the computer rooms for lessons. The study showed that teachers were not willing to accept change; instead they wanted to maintain their authoritarian and know it all roles. Wabuyela (2003) agreed that ICT use in education is still minimal with teachers avoiding to use these technologies. This is because of scarcity of resources and also teachers lack of ICT competencies. He recommended pre-service and in-services trainings in order to successfully integrate ICT

in classrooms. He also proposes a review of teacher preparation, staff development and a national plan to in-co-operate ICT into the curriculum.

The literature reviewed has shown that positive teacher's attitudes influence frequent use of computers. Although there are numerous research on the positive impacts of computer based approaches in foreign countries and in institutions of higher learning including institutes of technology, polytechnics and universities; there is very little on the effects of CBP in Africa. More so, few studies have been conducted based on the effects of CBP and how it impacted on teachers' attitude towards use of computers in the teaching of science concepts in the public primary schools in Mumias West Sub County in Kakamega County as observed in the third objective of the study.

2.5 Learners' Attitude towards the use of Computer Based Pedagogy and Students Performance

Hüsamettin et al., (2006) compared the effects of computer-based learning and traditional method on students' attitudes and achievement towards analytical chemistry. Students from Chemistry Education Department at DokuzEylul University (D.E.U) were selected randomly and divided into three groups; two experimental (Eg-1 and Eg-2) and a control (Cg). In teaching analytical chemistry topics, two different computer-based methods – new analytical chemistry learning software called HEHA sit (Method A) and a Microsoft Excel program (Method B)- were prepared by us and applied to Eg-1 and Eg-2, respectively. Whereas the last group (Cg) was taught by the traditional method (Method C). In the comparison of the effects of the three methods, they developed an attitude questionnaire and an achievement test related to analytical chemistry, and applied to students in all three groups. Students' attitudes towards computers were also tested by a

computer attitude test developed by us. As a result of the study, significant differences between control group and both experimental groups and between experimental groups on computer attitudes and analytical chemistry attitudes were found. Furthermore, analytical chemistry achievement in experimental groups was significantly higher from the control group. This study looked at the effects of CBP among learners generally as opposed to categorizing them into two groups.

Using new technologies contributed to positive attitudes of pupils toward ICT (Neo, 2003). For example, Haunsel and Hill (2002) found out that pupils using computers had more positive attitude towards biology and natural sciences than pupils who were educated by traditional styles. Several studies found gender differences in attitudes toward ICT. Brosnan (1998) showed that 6-11-year-old boys had more positive attitudes towards computers than girls. Graff (2003) found that girls were less likely to use computers and were less confident in using ICT than boys. Pupils' attitudes towards computer exercises were highly positive and additionally, most of students could work at their own speed and their computer literacy improved.

Bezen (2010) study was primarily concerned with the students' attitudes towards computer-assisted language learning. Its main purpose was to investigate what the students' attitudes were towards computer-assisted language learning (CALL) by also taking their attitude towards computer assisted learning (CAL) and Foreign Language Learning (FLL) into consideration. Finally, factors affecting students' attitudes and the relationships among computer assisted learning, computer assisted language learning and foreign language learning was also explored within the scope of the study. The findings demonstrate that most of the students had positive attitudes towards computer assisted

learning, computer assisted language learning and foreign language learning. Further, the study established that age, grade, gender, years of studying English and prior CALL experience affected students' attitudes. Moreover, students' attitudes towards computer assisted language learning, computer- assisted language learning, and foreign language learning are, indeed, interrelated. The current study examined the attitudes of pupils toward CBP as opposed to other computer aided techniques and its intended outcomes in science.

Teo (2006) found that students' attitudes towards computer had an influential role on their acceptance to use the computer as a learning tool and their future behaviors towards the computer such as using it for further study and vocational purposes. Similarly, Zhang (2011) stated that student' attitudes towards the computer assisted language learning (CALL) can be considered as a key predictor in terms of successful application of computer to language learning. Moreover, Zhang stated that ''attitudes toward targets will predict multiple-act criteria, provided that the attitudinal and behavioral entities involve the same target elements''. It would seem that awareness of students' attitudes toward computers can be ''a critical criterion in the evaluation of computer courses and in the development of computer-based curricula''. Therefore, computer attitudes should be considered as key constructs in predicting technology acceptance for future use.

Ogembo (2013) study was informed by the need to contribute in mitigating the persistent poor achievement by a majority of students in chemistry, organic chemistry topic being a major contributor. With evidence indicating insignificant effect of interventions previously implemented, a change in pedagogical approach through use of Computer Assisted Learning (CAL) was proposed. A Solomon's four quasi-experimental study was

therefore designed in which 182 form four students and 37 chemistry teachers purposively selected from schools with ICT infrastructure took part. The students in whole class groups were categorized either as control or experimental groups. Two groups (control and experimental each) were pre-tested, intervention (CAL for experimental and conventional for control) administered for three weeks and all the four groups post-tested. Data was obtained using students' questionnaire, pre-test and post-test students' chemistry achievement test, teachers' questionnaire, interview schedule and observation checklist. Post-test results indicated significant mean achievement for students exposed to CAL and significant effect for low ability students in experimental group. Similarly, significant effect was reported for change in students' attitude, the effect being more for students with negative attitude in experimental groups. However, insignificant mean difference was observed for students based on their age and gender. The study established that integration of CAL positively impacts learners' achievement in organic chemistry, the impact being greater for low ability students. Additionally, it showed that the strategy positively impacts students' attitude, the change being more prominent for students with negative attitude.

Students' attitudes towards computer have an influential role on their acceptance to use the computer as a learning tool and their future behaviors towards the computer. In addition, the study examined differences of selected computer activities both in teaching and learning of science concepts across different grades.

2.6Theoretical Frame work

The study will be hinged on B.F.Skinner's 'black box' theory and programmed instruction. Skinner's viewpoint is based on a definition of learning as an observable

change in behaviour (Skinner, 1950).The potential of the computer as a teaching aid promises increasing design sophistication. Computers can be programmed to judge student input and to tailor lessons to each individual's level of mastery. The sensitivity of the instructional designer to alternative patterns of student learning is the necessary key to full use of a computer capacity. Simulation – using the computer to model a real situation enables even greater sophistication, allowing realistic reactions to student input. Well-designed intellectual games can provide pertinent environments in which to practice important problem-solving skills. The relevance of this theory is that the learning process is based on the principle of reinforcement and that the stimulus-response schema is based on the operant conditioning whereby an entirely new behaviour is learnt to a familiar stimulus that is, computer instruction is equated to the conditioning of a desired behaviour. The classroom is equated to the 'black box', with the computer as the device to be clicked by the student to give desired behaviour of positive results from the learning process. This means that computer-based pedagogy (CBP), has to present a stimulus, give feedback to the student's response (to the stimulus) and reinforces desired responses. The behaviour to be learnt has to be split up in small components (computer tasks) which are presented to the student. The desired behaviour is reinforced through repetitions by the computer since it can go over and over a given concept several times based on the student's responses.

2.7 Conceptual Frame work

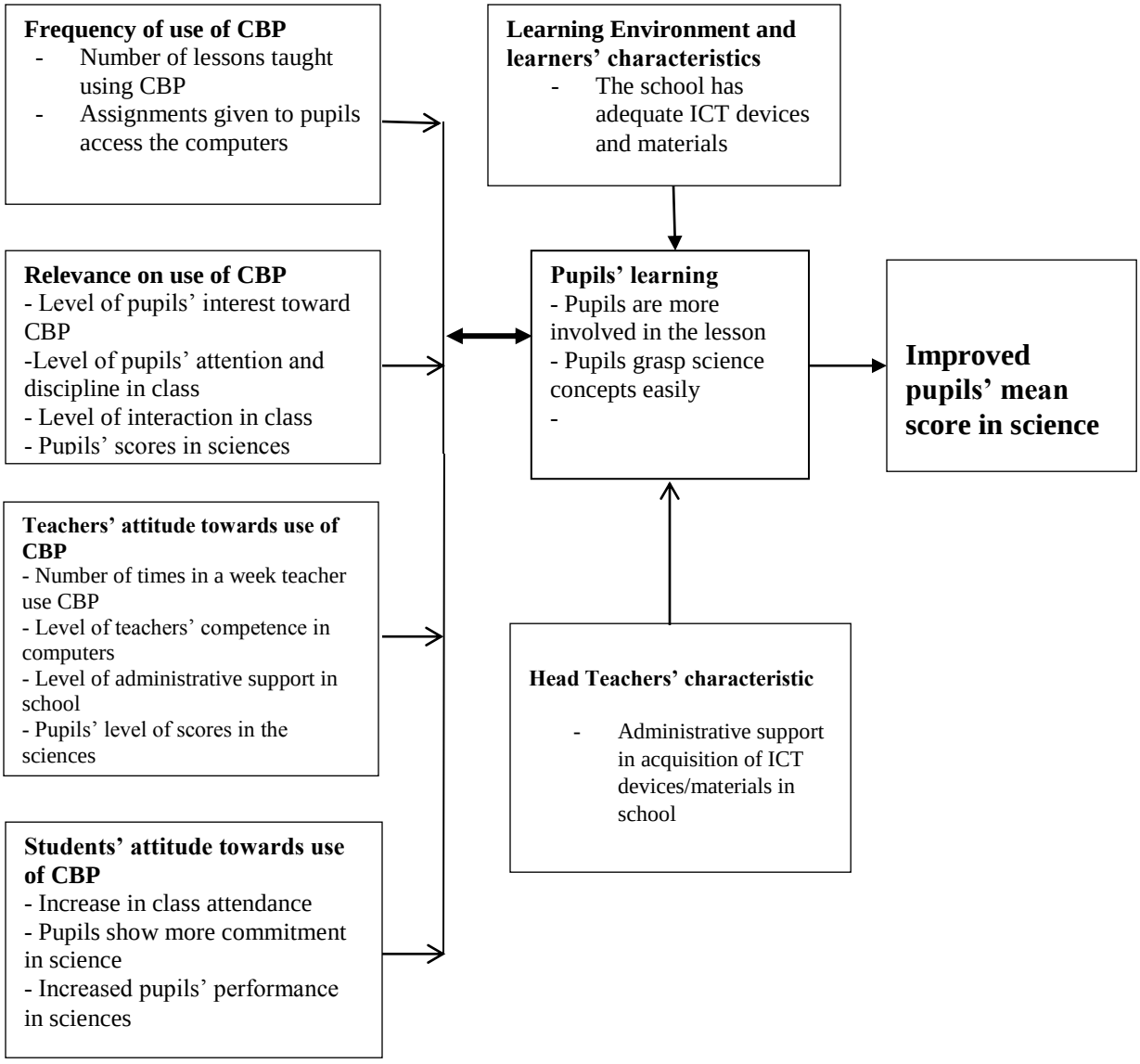

Figure 2. 1: Relationship between Computer Based Pedagogy and pupils' performance in science

Figure 1 shows the diagrammatic impression shows how the pupils' performance in science (dependent variable) will be influenced by the frequency of use of CBP, the pupils and teachers attitude towards the use of CBP (independent variables) in the learning environment that has aspects that are not controlled by the research such as the

head teachers characteristics, the existing learning environment and learners characteristics.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section considered the research design to be used, the target population, sample and sampling procedures, research instruments for data collection and the procedures in data analysis

3.2Research Design

Research design is defined by Mugenda and Mugenda (2003) as a process of creating an empirical data to support or refute a knowledge claim. Kothari (2004) defines it as a blue print to data collection measurement and analysis of data. To achieve the objectives of the study, a descriptive survey research design will be used. According to Mugenda and Mugenda, a descriptive survey is used to describe characteristics of a population or phenomenon. It describes what exists at the moment. Descriptive research design is a study that seeks to depict the participants in an accurate way mainly through observational, case study and survey methods of a specific Topic.This design is suitable because through it, the research was able to collect data and analyze it as it exists in the field without manipulating any variable as stated by (Mugenda & Mugenda, 2003). Descriptive design enabled the researcher to learn about and describe the characteristics of head teachers, science teachers, pupils and other key stakeholders on the frequency of use, relevance and attitudes towards computer-based technology in the teaching and learning of sciences in public primary schools.

3.3Target Population

Kothari 2004 avers that the target population or the universe of a research study as referring to all members or objects involved in the study. This study involved all the3630standard eight pupils in the 52 public primary schools in Mumias West Sub County established and registered as day, or boarding, mixed gender or single gender. Eight schools were incorporated in the study. Four schools were selected purposively based on their use of computer based technology. The other four schools were selected randomly from the remaining 48 public primary schools in the sub county. Head teachers, Sub-County Quality Assurance and Standards Officer (SCQASO) and science teachers in all the public primary schools that were selected formed part of the target sample.

3.4 Sample Size and Sampling Procedure

According to Arodho (2009) a sample is a sub set of the population to which the researcher intends to generalize the results. Mugenda and Mugenda (2003) say a sample of 10-30 percent will be suitable for descriptive survey. Schools were categorized into two groups – those using computer-based pedagogy and those that are using traditional approaches of teaching science. Three schools using computer-based pedagogy and five using traditional approaches of teaching science were identified. To sample the respondents, the researcher used all the Head teachers in the sampled schools and the SCQASO in the sub countybecause it helped enrich the research by identifying schools that have the necessary infrastructure and equipment for the use of computer-based teaching in Mumias west Sub County. These key respondents were selected purposively due to their instrumental role in the implementation of the technology in their respective area of work. Science teachers were also be selected purposively. Pupils in class eight

within the sampled schools were selected using simple random sampling. The researcher sampled 50% of the teachers teaching sciences from the eight public primary schools sampled and 10% of pupils in class eight in all the public primary schools selected for the study. The use of 50% and 20% percent enabled a good representation because the bigger the sample is, the more representative of population it becomes as proposed by Mugenda and Mugenda (2003).The target sample comprised of the eight head teachers of schools sampled, a SCQASO, 12 teachers teaching science in class eight (50% of 24 teachers from the schools sampled), 363 standard eight pupils enrolled in the 8 public sampled schools (10% of 3630 pupils in class eight in the sub county) of Mumias West Sub County. This gave a total of 363 pupils (46 from each school sampled) in the sub county.

Table 3. 1: Sampling Frame

Group	Target	%	Sampling size
Head teachers	8	100%	8
Science Teachers	24	50%	12
SCQASO	1	100%	1
Class 8 pupils (363/8 - 46 from each school)	3630	10%	363
Total	**178**		**115**

3.5 Instruments for Data Collection

To collect data from study respondents, questionnaires and interview schedule guides was used. Two sets of questionnaires were designed; one for science teachers and the second one for pupils to collect data from the respondents. Interview guides will be used for the Head teachers and SCQASO. The researcher used interview schedule guide to seek information on the research objectives from key informants. This consisted of administering oral open-ended questions to the head teacher and SCQASO. The interview

schedule guide provided in-depth data which was not be possible to get using a questionnaire that is needed to meet specific objectives of the study.

3.5.1 Science Teacher's Questionnaire

The teachers' questionnaire was used to investigate the teacher's knowledge and experience, their preference in method of teaching, their frequency of use, relevance of CBP, their attitudes toward CBP and performance in KCPE.

3.5.2 Pupils' Questionnaire

Pupils' questionnaire was administered to establish the learners' preference, knowledge, frequency of use and their attitude towards the use of CBP in determination of their performance in science.

3.5.3 Key Informant Interview Guides

The researcher used interview schedule guide to seek information on the research objectives from key informants. Frequency of use of ICT resources, resource allocations, effects of the resources in teaching and learning, teachers' and pupils' perceptions towards the use of ICT resources and the technology, challenges on the CBP use and ways of improving CBP were sought.

Documentary Analysis Schedules (DAS)

DAS (appendix I) focused on available test score results in learner's performance in science in sampled schools to find out the relationship between CBP and pupils' academic performance.

3.6 Validity

According to Mutai (2000), validity refers to the degree to which the results obtained from the data collected actually represent the phenomena under study. Validity establishes the relationship between the data and the variable or construct of interest. Its estimates how accurately the data obtained in a study represents a given variable or construct in the study Mugenda, (2004). To ensure validity of the data the research instruments were approved by the supervisor, piloted, analysed and corrections made to ensure the results were representative of the phenomena under study.

3.6 Reliability

Reliability is the proportion of variance attributable to the time measurement of a variable and estimates the consistency of such measurement over time from a research instrument. It is a measure of the degree to which a research instrument would yield the same results or data after repeated trials (Devellis (1991), as cited by Mugenda, (2004) Cooper (2006) define reliability as the level of internal consistency or stability of the measuring instruments to produce consistent results over a period of time. According to Mutai (2000) the reliability of a research is influenced by the random error, an increase in the random error decreases reliability.

A pilot study was carried out to enhance instrument reliability. Test-Retest technique will be used to test the reliability of the instrument. This involved administering the same instrument test twice to the same group of subjects at two separate times with a time lapse between the first and second test. The second administration was done after a time lapse of one week (Orodho, 2009). Scores from both testing period were correlated to determine the reliability using Pearson's product moment correlation coefficient. If the

researcher obtains a coefficient close to +1 or -1, the instrument would be said to be reliable for data collection. According to Mugenda, (2003) a coefficient of 0.8 or more showed there was high reliability of data and may be used to determine the reliability of the instrument.

3.7 Procedure of Data Collection

Upon being cleared by the School of Education, University of Nairobi, the researcher sought for a research permit from the National Commission for Science Technology and Innovation (NARCOSTI) and the Ministry of Education through the Sub County Director of Education to allow teachers to respond to the administered teachers' questionnaire and the pupils' questionnaire. Introductory letters were sent to head teachers of sampled schools and appointment sought to create rapport, confidence and removing any suspicions by assurances of confidentiality on the data they shall generate. Questionnaires were given out and picked at appropriate and convenient time agreed upon. The researcher visited the sampled schools personally and administered the instruments to the respondents.

3.8 Data Analysis

According to Bryman & Cramer (1997) data analysis seeks to fulfil the research objectives and provide an answer to the research questions. LeCompte and Schensul (1999) define data analysis as the process of reducing large amounts of collected data to make sense of them. Patton (1987) indicates three things that occur during analysis as being data are organised, data are reduced through summarization and categorization and patterns and themes in the data are identified and liked. The researcher carried out treatment of qualitative and quantitative data by computing it thematically (Matula,

Kyalo, Mulwa & Gichuhi, 2018). Qualitative data was analyzed using descriptive statistics. Descriptive statistics are indices that describe a given sample, example measures of central tendency and measures of dispersion. In this study data quantitative data was represented in form of frequency distribution tables, pie charts, bar graphs and percentages to analyze data collected. Tables were used to represent responses for each item used in the study.

3.9 Ethical Considerations

The researcher assured the respondents that giving of information for this study was voluntary. The findings of the research were purely for academic purposes. Permission was sought from all areas of administration before the researcher gets to contact with the respondents. The researcher acknowledged all sources of information. The researcher conducted proper references of outsources citations to avoid plagiarism of the work. Collected data was treated with utmost confidentiality and respondents assured that provided information was only used for the purpose of this study. The researcher sought consent from the respondents for participating in the study and no incentives were offered to participate in the study.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSIONS

4.1 Introduction

This chapter deals with analysis, presentation and presentation of the influence of computer-based pedagogy (CBP) on pupil's academic performance in science in public primary schools in Mumias West Sub County, Kakamega County. The data was analyzed with the help of a computer program, SPSS version 23 and Microsoft Excel. This enabled the researcher to present the data in frequencies, percentages, charts and tables.

4.2Instruments Return Rate

The sample consisted of eight science teachers, 8 head teachers, one SCQASO and 312 class eight pupils from the 8 primary schools sampled for the study. This summary is stated in Table 4.1

Table 4. 1: Participants Rate

Respondents	Sample Size	Participants	Questionnaire Return Rate
Head Teachers	8	8	100%
Science Teachers	12	8	67%
Pupils	363	312	86%
SCQASO	1	1	100%
Total	**384**	**329**	**86%**

From the table 4.1, a total of 329 participants from the anticipated 384 respondents participated in the study representing a return rate of 86%. Two sets of questionnaires for science teachers and pupils were used to collect data for the study. Head teachers and SCQASO were interviewed. According to Kumar (2010), a questionnaire response and return rate of 50 percent is sufficient to conduct the study efficiently and, therefore it is a

good response rate. The implication of this healthy response and return rate was that the respondents were cooperative and willing to participate.

4.3 Demographic Characteristics of the Participants

The demographic characteristics covered by the study were gender, age, educational level, refresher courses attended, teaching experience and length of service for science teachers.

4.3.1 Gender of the Participants

The study sought cognize disparities in gender among the respondents. This was overly essential in understanding the respondents in regard to the influence of computer-based pedagogy (CBP) on pupil's academic performance in science in public primary schools in Mumias West Sub County , Kakamega County. In order to determine the gender of the participants, a question was posed to the pupils, science teachers, Head teachers and SCQASO to indicate their gender. The table illustrated the responses gathered as per the gender as seen in Table 4.2

Table 4. 2: Gender of the Participants

Gender	Science Teachers		Pupils		Head teachers		SCQASO	
	f	%	f	%	f	%	f	%
Male	5	62	170	54	4	50	1	100
Female	3	38	142	46	4	50	-	-
Total	**8**	**100**	**312**	**100**	**8**	**100**	**1**	**100**

Data depicted in Table 4.2 show that majority of the Science teachers (62%) in public primary schools from Mumias West Sub County, Kakamega County were males compared to 38% who were female. Majority of the pupils (54%) were males compared to 46% who were females. There was an even gender distribution in the headship of

public primary schools in Mumias West Sub County in Kakamega County. These results clearly suggest a male dominance among science teachers and pupils' enrolment in public primary schools in Mumias West Sub County, Kakamega County.

4.3.2 Age of the Participants

The age of the participants was particularly important in determining the duration they have been in a station and their working experience. Science teachers and pupils were requested to indicate their age bracket. The data collected was summarized as seen in Table 4.3

Table 4. 3: Age Brackets of the Participants

Age brackets	**Science Teachers**		**Pupils**	
	f	**%**	**f**	**%**
Below 12 years	-	-	40	12.8
13 - 15 years	-	-	222	71.1
Above 16	-	-	50	16
31 - 40 years	6	75	-	-
41 - 50 years	2	25	-	-
Above 51-		-	-	-
Total	**8**	**100**	**312**	**100**

Data depicted in Table 4.3 show that majority of the science teachers (75%) were between 31 – 40 years; while a mere 25% were above 41 years representing a vibrant age group that could easily embrace the use of technology in teaching of science. In addition, majority of the pupils (71.1%) were between 13 – 15 years, 16% were above 16 years while 12.8% were below 12 years.

4.3.3 Educational Level

In order to determine whether the participants were well qualified and prepared for their respective duties it was imperative to establish their educational qualification. The study

sought to establish the educational level of science teachers in the study. A question was posed and the following responses realized as shown in figure 4.1.

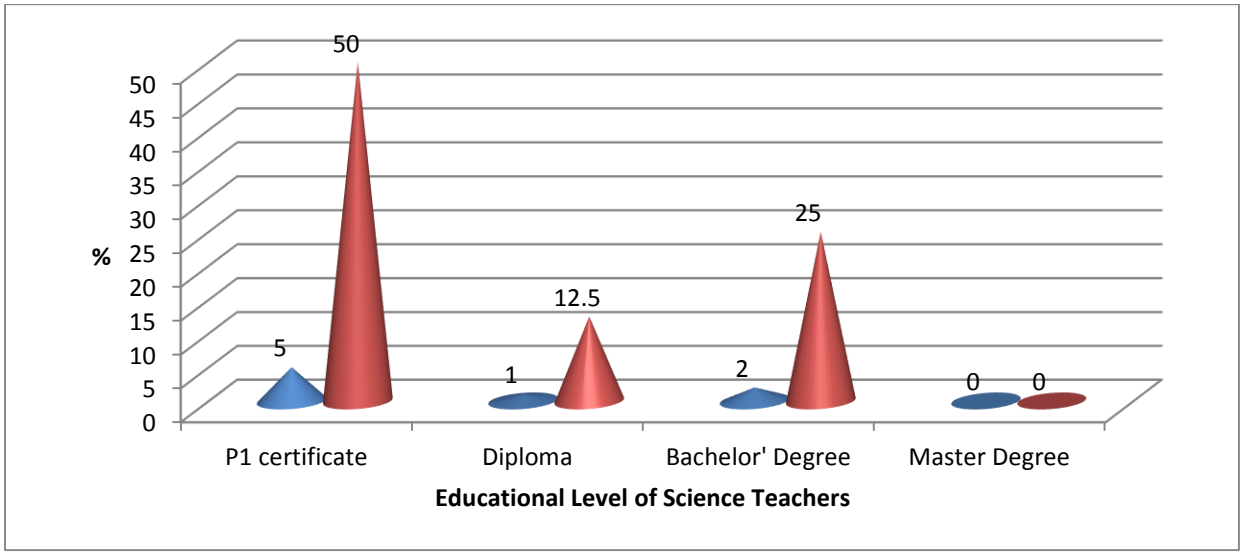

Figure 4. 1: Educational Level of Participants

As seen in Figure 4.1 majority of science teachers' educational level was a P1 certificate (50%), followed by bachelor degree (25%) and diploma (12.5%) respectively. These results suggest the need for science teachers to undergo further courses for effective utilization of technology into the teaching of science and technology.

4.3.4 Refresher Courses Attended

In order to equip science teachers adequately in integration of computer-based pedagogy into teaching and learning they do require proper preparations, through pre-service, regular in-service training and induction on ICT skills. Science teachers were further requested to indicate whether they had attended any refresher courses and they gave the following feedback as seen in Figure 4.2.

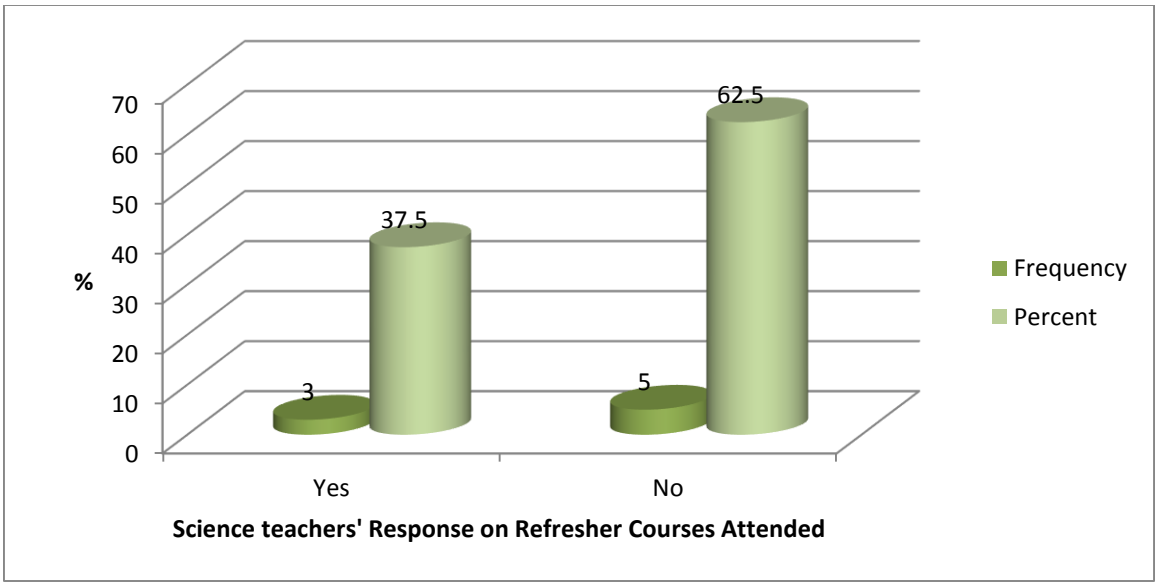

Figure 4. 2: Science Teachers Response on Refresher Courses Attended

Data postulated in Figure 3 show that majority of the science teachers (62.5%) had not attended any refresher courses compared to a mere 37.5% who had attended refresher courses of any kind which could pose a challenge to the use of ICT in learning and teaching of science a finding opined in Odhiambo (2013) that the use of ICT was lower over the years. This created the need for institutions such as MoEST, TSC and KEMI to organize in-service courses, workshops and seminars in order to equip science teachers with the requisite skills for effective integration of computer base technology into teaching and learning .Further the researcher was interested in establishing specifications of refresher courses science teachers were interested in order to integrate computer-based pedagogy into their teaching and the question elicited the following responses.

Table 4. 4: Relevant Courses Suggested by Science Teachers

Areas suggested for further training	Frequency	Percent
ICT	7	87.5
Modern teaching methods	1	12.5
Total	**8**	**100**

As seen in Table 4.4 an over whelming number of science teachers suggested ICT course (87.5%) as a key area that required further training compared to a mere (12.5%) who indicated modern teaching methods. From these results it was apparent that science teachers were aware for them to be effective in integrating computer-based pedagogy into their classroom teaching they required training in ICT.

4.3.5 Teaching Experience

The teaching experience attained in schools help to equip science teachers with the requisite skills and experience to teach science in schools and experiment with different teaching methodologies in order to yield improved educational outcomes. Science teachers were further requested to indicate the number of years they had served as teachers and the question elicited the following responses as captured in Figure 4.3.

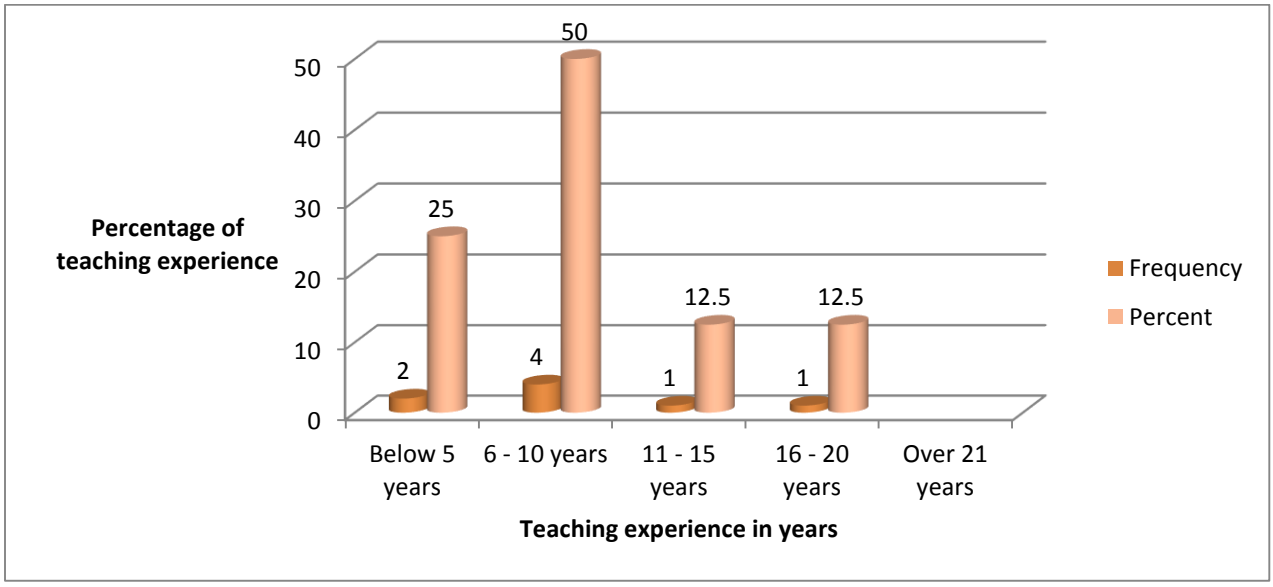

Figure 4. 3: Teaching Experience for Science Teachers

From Figure 4.3, majority of the science teachers 4 (50%) had been in teaching for between 6 – 10 years, 2 (25%) for below 5 years and a mere 1 (12.5%) who had served

for between 11 – 15 years and 16 – 20 years respectively. It was apparent that majority of the science teachers (50%) had served as teachers for less than 10 years. The lesser the number of working experiences the lesser the teachers' resistance to new innovations hence appropriate for science teachers to embrace current trends in teaching and integration of computer-based pedagogy in the teaching of science in primary schools.

4.3.6 Length of Stay in Current Station

Science teachers' length of stay in a working station will enable them state clearly the use of computer-based technology and the availability of these resources and materials that made the technology applicable in schools. Science teachers were required to indicate the length of service they had been in the current station and the following feedback was obtained as seen in Figure 4.4:

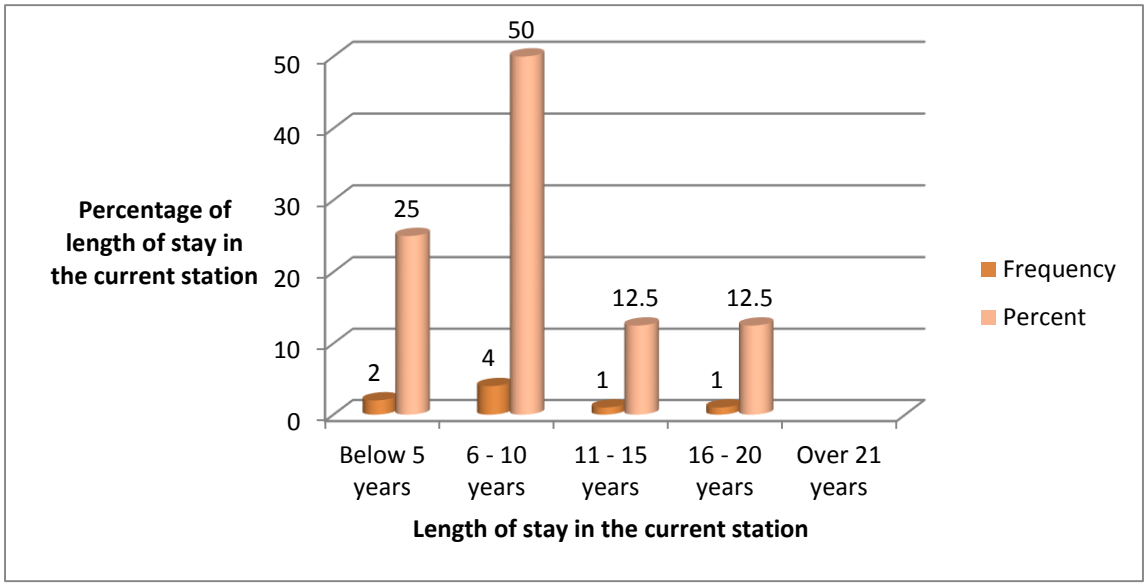

Figure 4. 4: Length of stay in current station

Data depicted in Figure 5 show that an overwhelming majority of the science teachers (87.5%) had been in the current station for a period of between 6 - 10 years compared to 12.5% who had been in their current station for below 5 years. These results suggested

that a majority of science teachers (87.5%) were serving in their current stations for a period of between 6 - 10 years which presented an opportunity for teachers to be well versed with the modern trends of teaching science and the resources available in the school that could help in the use of computer based pedagogy in the station.

4.4 Frequency of use of Computer Based Pedagogy in schools on Pupils' Science Performance

In order to establish the frequency of use of computer-based technology in schools it was important to establish the availability of ICT materials and devices in schools and how it influenced pupils' scores in weekly continuous assessment tests. A questionnaire for Science teachers and pupils and an interview for head teachers were conducted in order to indicate computer-based pedagogy materials available for use for teaching science in schools.

4.4.1 CBP materials available for use for teaching science in schools

Availability of ICT materials and devices in schools influenced the usage of CBP as a teaching approach in sciences. The following ICT materials were available in schools as indicated by science teachers

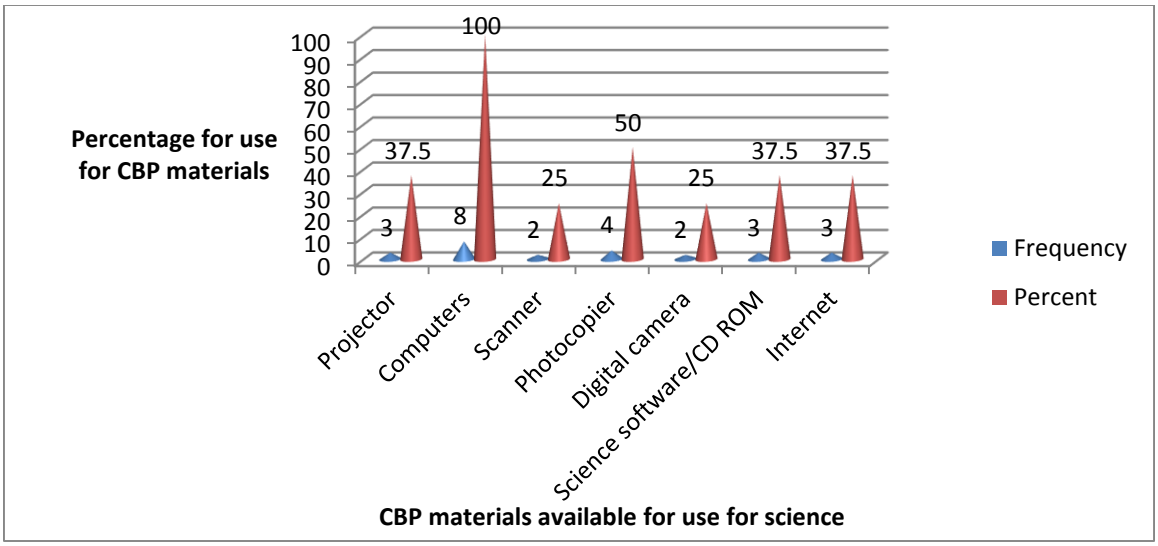

Figure 4. 5: CBP materials available for use for sciences

Data postulated in Figure 4.5 show that schools had projectors, computers, printers, science software and the internet as key resources in teaching of science. Other resources present in these schools included scanners and digital cameras. From these results unavailability of ICT resources in public primary schools was a major hindrance towards the use of computer based program in the teaching of science in public primary schools; a finding that resonated with Odhiambo (2013)that most teachers reported that the use of ICT in learning and teaching was slow in the past years due to lack of computer labs and internet connectivity in the schools. This finding confirmed the assumption the study had that schools using CBP had adequate ICT resources.

4.4.2 Weekly frequency of use of CBP materials in learning of science

Frequency of use of CBP materials will determine the effect of the methodology in instilling positive educational outcomes among learners. Science teachers were requested to indicate the frequency with which they use the following ICT materials in learning of science as seen in Table 4.5.

Table 4. 5: Weekly use of CBP materials in learning of science

CBP materials in use	Science teachers using CBP		Science teachers using traditional approaches		
	Twice	Total	Rarely	Once	Total
	f (%)	f (%)	f (%)	f (%)	f (%)
Projector	3 (100)	**3 (100)**	0	0	**0**
Laptop	3 (100)	**3 (100)**	0	0	**0**
Desktop	3 (100)	**3 (100)**	5 (100)	0	**5 (100)**
Printer	3 (100)	**3 (100)**	5 (100)	0	**5 (100)**
Digital camera	3 (100)	**3 (100)**	0	0	**0**
Science software	3 (100)	**3 (100)**	2 (40)	0	**2 (40)**
Internet	3 (100)	**3 (100)**	0	0	**0**

From the cross-tabulation in Table 4.5, science teachers used CBP materials like a projector, laptop, desktop, photocopier, digital camera, science software and internet twice in a week. These results implied that computer-based pedagogy was embraced in the teaching of science in public primary schools where the CBP materials were available. In schools where science teachers used traditional approaches; desktops, photocopier and science software were rarely used on a weekly basis implying that these teachers had not embraced computer-based technology in the teaching of sciences in their respective schools. This low use of various CBP materials and devices could be attributed to unavailability of a wide array of CBP materials in their schools as well or lack of awareness of how to integrate CBP materials into the teaching of sciences in schools.

Head teachers interviewed on frequency of use of computer-based technology in school noted that science teachers occasionally used Wifi-connectivity installed in school to

teach a number of science concepts. They also added, school projector was rarely in use. Pupils also indicated the frequency of use of computer-based pedagogy in classroom activities and they noted the following.

Table 4. 6: Pupils' response on the frequency of use of computer-based pedagogy in classroom activities

CBP programs/practices	Frequency of use of CBP in classroom activities			
	Yes f (%)	**No f (%)**	**No response f (%)**	**Total f (%)**
Teachers frequently use computer-based technology in the teaching of science.	60 (19.2)	250 (80.1)	2 (0.6)	**312 (100)**
There is access to computer-based technology resources for sciences.	40 (12.8)	265 (85)	7 (2.2)	**312 (100)**
There is internet access in the school.	36 (11.5)	270 (86.5)	6 (1.9)	**312 (100)**
There is an adequately equipped computer laboratory in the school.	20 (6.4)	290 (92.9)	2 (0.6)	**312 (100)**
There are computers for pupils and teachers in the school.	10 (3.2)	290 (92.9)	12 (3.8)	**312 (100)**
Classrooms are well lit for computer aided instruction in sciences.	60 (19.2)	210 (67.3)	42 (13.5)	**312 (100)**
Assignments encourage pupils to use computer-based technology such as the internet.	40 (12.8)	260 (83.3)	12 (3.9)	**312 (100)**
There are computer software programs for teaching sciences in school.	65 (20.8)	240 (76.9)	7 (2.2)	**312 (100)**

From the Table 4.6, majority of the pupils indicated that there were no adequately equipped computer laboratories in public primary schools (92.9%);there were no computers for pupils and teachers in the school (92.9%); there was no internet access in the school (86.5%); there was no access to computer based technology resources for sciences (85%); assignments do not encourage pupils to use computer based technology such as the internet (83.3%); teachers frequently use computer based technology in the teaching of science (80.1%); and there were no computer software programs for teaching sciences in schools (76.9%). These results further compounded the sorry state of affairs

in public primary schools implying that the usage of CBP was rare a finding supported by Wabuyela (2003) that ICT use in education was still minimal with teachers avoiding to use these technologies in public primary schools and this was attributed to lack of necessary CBP resources and devices in most public primary schools further confirming the assertion stated by science teachers that CBP was only applicable in few public primary schools where the CBP materials and devices were available.

4.4.3 Frequency of use of CBP and pupils' performance in weekly science tests

In order to establish pupils' performance in science teachers were requested to indicate mean scores in weekly continuous assessment tests in science in primary schools that frequently and rarely used CBP materials and devices in teaching of science. The results obtained were summarized in Figure 4.6.

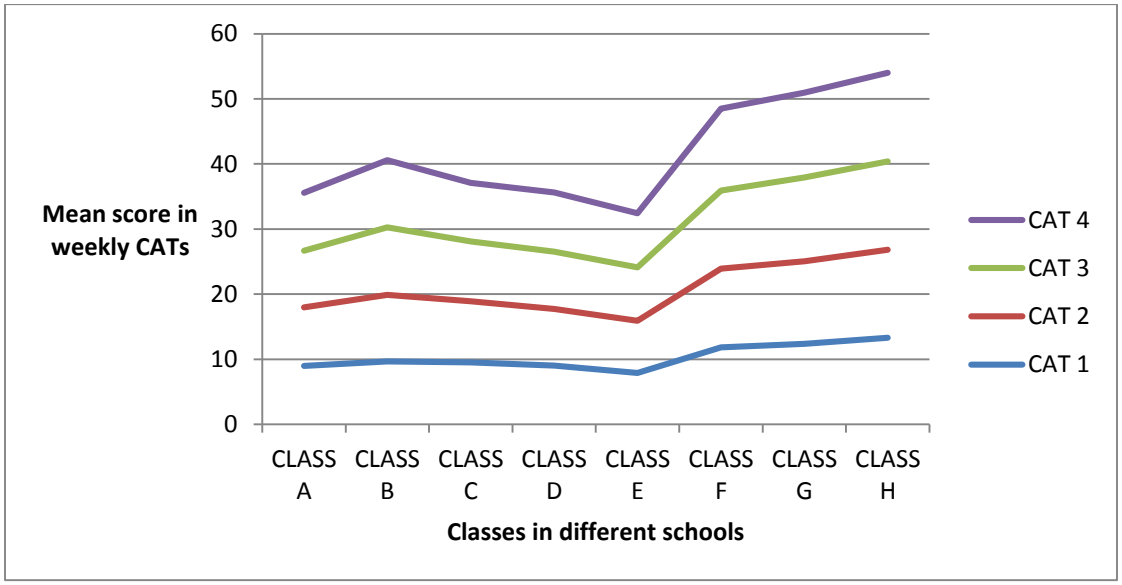

Figure 4. 6: Use of CBP and pupil' mean score performance in different weekly CATs

Data postulated in Figure 4.6 show that schools that frequently used CBP in teaching of science (school F, G and H) mean scores increased steadily in successive weekly CATs

compared to schools that rarely used CBP materials and devices (school A, B, C, D, and F) whose mean scores kept on oscillating upwards and downwards. Teachers in the three schools (school F, G and H) that used CBP materials and devices twice in a week registered superior means scores compared to the five schools that rarely used CBP in their weekly teaching. This finding confirmed the assumption that classes using CBP performed better than traditional methods of teaching.

4.4.5 CBP programs/practices science teachers involve pupils to support learning of sciences

In order to establish the effectiveness of science teachers in integrating CBP in teaching and learning of sciences in schools it was necessary to determine the CBP programs/practices teachers involved pupils. A question to this effect was directed to participants and the question yielded the following results as seen in Table 4.7.

Table 4. 7: CBP programs/practices involving pupils in support of learning sciences

	Schools where CBP was in use		**Schools where traditional approaches were in use**		
CBP Programs/Practices	**Yes** **f (%)**	**No** **f (%)**	**Yes** **f (%)**	**No** **f (%)**	**Total** **f (%)**
Storing and sharing information	3 (37.5)	0	0	5 (62.5)	**8 (100)**
Typing	3 (37.5)	0	0	5 (62.5)	**8 (100)**
Emailing	1 (12.5)	2 (25)	0	5 (62.5)	**8 (100)**
Surfing the internet	3 (37.5)	0	0	5 (62.5)	**8 (100)**
Playing video games	0	3 (37.5)	0	5 (62.5)	**8 (100)**
Photocopying	0	3 (37.5)	0	5 (62.5)	**8 (100)**
Taking pictures	1 (12.5)	0	0	5 (62.5)	**8 (100)**
Doing assignments	2 (25)	1 (12.5)	0	5 (62.5)	**8 (100)**
Data generation from CD	0	3 (37.5)	0	5 (62.5)	**8 (100)**

Downloading vital info from internet	1 (12.5)	2 (25)	0	5 (62.5)	**8 (100)**
Drawing, painting or graphics	0	3 (37.5)	0	5 (62.5)	**8 (100)**
Internet research to update subject knowledge	3 (37.5)	0	0	5 (62.5)	**8 (100)**
Online discussions	0	3 (37.5)	0	5 (62.5)	**8 (100)**
Prepare question banks	1 (12.5)	2 (25)	0	5 (62.5)	**8 (100)**

As seen in Table 4.7, schools where CBP was in use, all science teachers 3 (37.5%) indicated that pupils used CBP programs/practices to store and share information, typing, surfing the internet and conducting internet search to update subject knowledge and teaching a finding that correlated with the findings of Hadley and Sheingold (2011), Harris (2000), Wallace (2001), Omur (2008), Bhalla (2013) and Mathevula and Uwizeyimana (2014) while 25% for doing assignments. Further, pupils in schools in which science teachers were using traditional approaches pupils were not co-opted in the use of CBP programs/practices for any activity. These results further confirmed that schools that had embraced computer based pedagogy in teaching science had incorporated pupils in learning activities that were more likely to usher in positive learning outcomes such as arousing learners' interest and improving their mean scores in science as compared to schools that had adopted traditional learning approaches.

Head teachers interviewed on the conditions under which pupils learn sciences noted that majority of the science teachers in public primary schools in the sub county rely on the traditional methods of teaching science. The few who underwent INSETS organized by Ministry of education tried to use computer technology to enhance teaching in the sciences but stopped when they realized it was very involving and required administrative

support from the school. Science teachers were also incapacitated in the sense schools lack facilities to enhance computer-based pedagogy in the teaching of science. Finally, schools lack internet connectivity, laptops, desk top computers, white boards, projectors and the few ICT devices present such as desk top computers and projectors are inadequate to be used effectively by all science teachers in the school on a regularly basis.

4.5 Relevance of computer-based pedagogy on effective teaching and learning of science

Science teachers were requested to indicate the relevance of computer-based pedagogy on teaching and learning of science in public primary schools. From the questionnaire, thirteen structured statements were incorporated with a scale ranging from Strongly Agree to Strongly Disagree. For ease of analysis, Strongly Agree and Agree were combined as Agree while Disagree and Strongly Disagree became Disagree. The respondents' percentages of Agreement and Disagreement with the various effects of computer-based pedagogy were worked out as shown in table 4.8.

Table 4. 8: Relevance of computer-based pedagogy on teaching and learning of science

Relevance of CBP in schools	Agree f (%)	Disagree f (%)	No response f (%)	Total f (%)
Pupils become more interested to learn if materials from the internet are used in teaching.	8 (100)	0	0	8 (100)
Excellent pupils become more interested to learn if teachers use a computer/laptop in teaching	6 (75)	2 (25)	0	8 (100)
Weak pupils become more interested to learn if teachers use a computer in teaching.	8 (100)	0	0	8 (100)
Computer assisted learning discourages rote learning in class.	5 (62.5)	3 (37.5)	0	8 (100)
Computer based teaching motivates pupils to learn and participate in classroom activities.	7 (87.5	1(12.5)	0	8 (100)
Computer technology offers students much more confidence in the learning of science concepts.	6 (75)	2 (25)	0	8 (100)
Computer based technology allows more autonomy in the pupils' work in the classroom than the traditional way of teaching.	6 (75)	1 (12.5)	1 (12.5)	8 (100)
Computer based teaching provides greater attention and discipline of pupils in the learning process than the traditional way of teaching.	7 (87.5)	1 (12.5)	0	8 (100)
Computer based teaching application inhibits teachers' creativity.	0	8 (100)	0	8 (100)
Computer based teaching gives pupils' higher cognitive activity in the classroom than the traditional way of teaching.	6 (75)	2 (25)	0	8 (100)
Use of computers in education increases the amount of human interaction	7 (87.5)	1 (12.5)	0	8 (100)
Use of computer technology in classroom activities helps to improve pupils' scores.	7 (87.5)	0	1 (12.5)	8 (100)
Computer programs help in saving time in classroom activities.	8 (100)	0	0	8 (100)

Data depicted in Table 4.8 show that pupils became more interested to learn if materials from the internet were used in teaching 8 (100%);computer programs help in saving time in classroom activities 8 (100%); weak pupils become more interested to learn if teachers use a computer in teaching 8 (100%)as confirmed in Owusu, Appiah, Monney and Wilmot (2010)improved performance of low achievers; computer based teaching motivated pupils to learn and participate in classroom activities 7 (87.5%);computer based teaching provided greater attention and discipline of pupils in the learning process than the traditional way of teaching 8 (100%);computer based teaching application did not inhibit teachers' creativity 8 (100%); use of computers in education increased the amount of human interaction 7 (87.5%);use of computer technology in classroom activities helped to improved pupils' scores 7 (87.5%)a finding supported by Kayri et al., (2012) who established that use of a visual training CD had a similar academic success with CBP, as major learning outcomes created when science teachers use computer based approaches in teaching science. Other minor learning outcomes included: excellent pupils becoming more interested to learn if teachers used a computer/laptop in teaching 6 (75%); computer technology offered pupils much more confidence in the learning of science concepts 6 (75%);computer based technology allowed more autonomy in pupils' work in the classroom than the traditional way of teaching 6 (75%);computer based teaching provided greater attention and discipline of pupils in the learning process than the traditional way of teaching 6 (75%);and computer based teaching gave pupils' higher cognitive activity in the classroom than the traditional way of teaching 6 (75%) a finding echoed in Tareef (2014) who noted computer-assisted learning methods increased learners' problem solving level.

4.6 Teachers' attitude towards the use of computer-based pedagogy (CBP) in teaching of science in schools

Teachers' perception towards a teaching methodology or technology was more likely to influence the way they would implement it or use the technology to inculcate learning outcomes in the classroom. Teacher's adequacy, skills, and attitudes influence successful implementation of computer-based approaches in school. Science teachers were required to indicate their attitude towards CBP by filling a questionnaire in order to determine their skill level in IT and on usage of CBP materials and devices influenced their attitude towards CBP. Head teachers' views were also sought from the interviews on the same.

4.6.1 Information technology training

Teacher's adequacy and IT skills influenced successful implementation of computer-based approaches in school. The researcher was interested in determining whether science teachers had any formal training in Information technology and the question yielded the following:

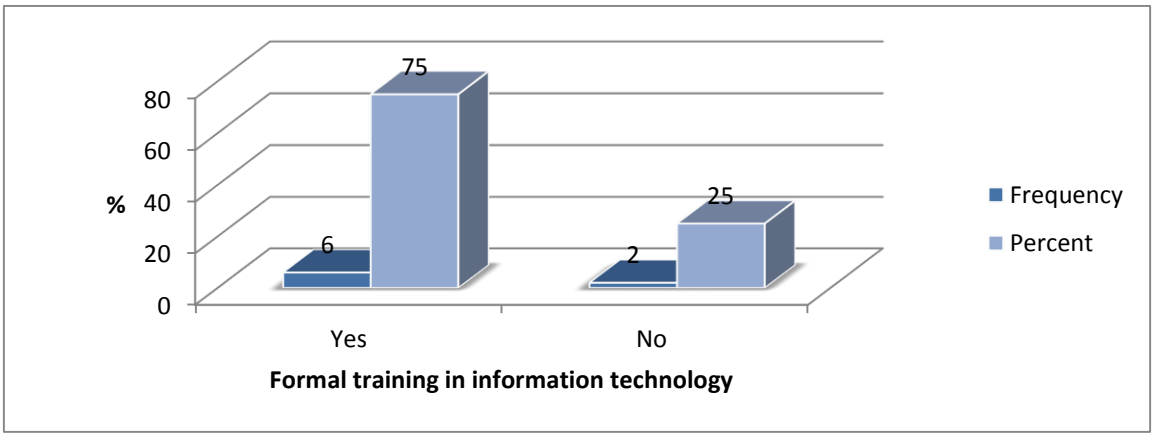

Figure 4. 7: Formal training in information technology among science teachers

Data obtained in Figure 4.7 indicated that majority of the science teachers 6 (75%) had received formal training in information technology and hence were comfortable to use

teaching aids and devices in teaching of sciences in primary schools. The researcher established that teachers' formal training positively influenced the use of CBP in teaching of science as opined by Mustafina (2016) that knowledge in ICT had the potential to influence and change teachers' attitudes toward technology.

Further the researcher cross tabulated the training and the skill level of science teachers and the following results were obtained as shown in Table 4.9.

Table 4. 9: Formal training in IT and skill level

		Formal training in IT		
		Yes f (%)	**No f (%)**	**Total f (%)**
Skill level	Basics	2 (25)	2 (25)	4 (50)
	Certificate	4 (50)	0	4 (50)
Total		**6 (75)**	**2 (25)**	**8 (100)**

Data obtained indicated that majority of the science teachers (50%) had received certificate training in information technology as compared to 25% who had received basic training. Fairly, half the numbers of science teachers sampled had certificate training in ICT, further pointing out the need to train more science teachers for them to be effective and minimize anxiety when dealing with computer-based technologies in the classrooms.

From the interviews conducted, Head teachers noted that very few teachers were comfortable teaching their lessons using CBP and this was attributed to limited skills teachers had to integrate technology in the teaching of science and young teachers recruited in the school have been using computer based technology to teach science and seemed very much at peace with the technology.

The researcher was also interested in establishing who sponsored science teachers for formal IT training and the results were summarized in Table 4.10.

Table 4. 10: Skill level and sponsor

		Skill level		
		Basic f (%)	**Certificate f (%)**	**Total f (%)**
Sponsor	Self	1 (12.5)	4 (50)	5 (62.5)
	School	1 (12.5)	0	1 (12.5)
Total		**2 (25)**	**4 (50)**	**6 (75)**

As seen in Table 4.10, majority of the science teachers who had attained certificate level in information technology training (50%) were self-sponsored compared to 12.5% who had basic skills while a mere 12.5% had been sponsored by the school. A small number of science teachers had been sponsored by public primary schools for formal training in IT and this was likely to deter the use of teaching aids and devices that were CBP related and could instill a negative attitude towards the technology in teaching of science lessons.

4.6.2 Attitude of science teachers towards teaching of sciences using CBP materials/devices

Science teachers were further required to indicate their attitude towards computer-based pedagogy in the teaching of sciences in primary schools and the following results obtained.

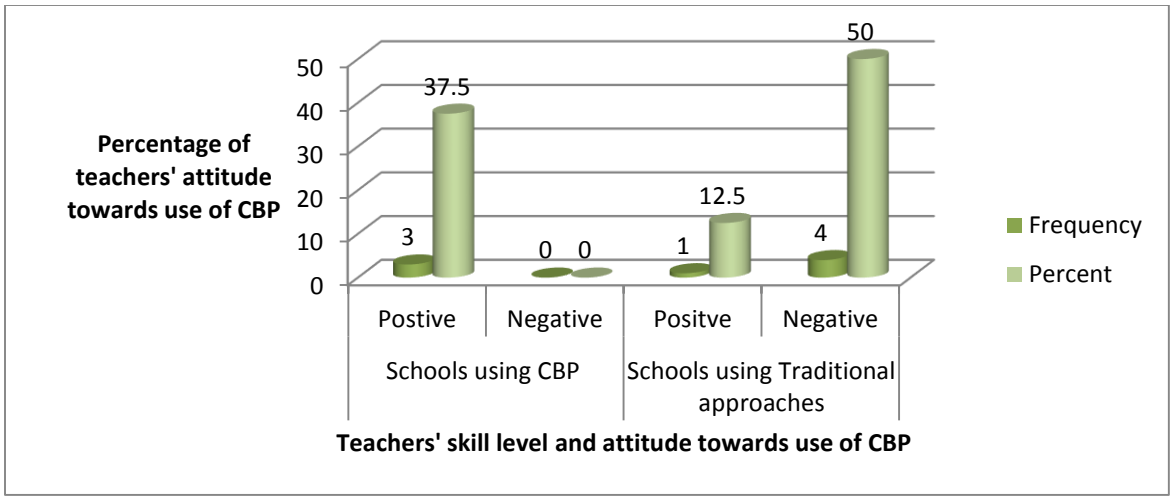

Figure 4. 8: Teachers' skill level and attitude towards use of CBP

Data obtained indicated that science teachers who had certificate training in IT (50%) had a positive attitude towards CBP in teaching of sciences compared to 12.5% who had basic training a number that could easily provide useful insight about implementation of CBP in public primary schools as postulated by Keengwe and Onchwari (2011). The results further postulated that skill level in IT influenced the attitude of science teachers on the use of computer-based approaches in teaching of sciences in public primary schools in the sub-county. Teachers' positive attitudes toward CBP could be attributed to their vision of technology itself, their experiences with it and cultural conditions surrounding its introduction in schools and its subsequent diffusion into their educational practice as opined by Abdulkafi (2006).

Further the researcher was interested in establishing whether the attitude of teachers influenced the use of CBP in teaching of sciences in primary schools.

Table 4. 11: Attitude towards CBP and its use in teaching sciences

		Attitude towards CBP		
		Positive f (%)	**Negative f (%)**	**Total f (%)**
Use of CBP	Yes	5 (62.5)	0	5 (62.5)
	No	0	1 (12.5)	1 (12.5)
	Total	**5 (62.5)**	**1 (12.5)**	**6 (75)**

Data captured in the Table 13 show that majority of the science teachers who had a positive attitude towards CBP (62.5%) used CBP in the teaching of sciences compared to a 12.5% who had a negative attitude that curtailed them to use CBP in their respective schools. A teachers' attitude towards a computer-based approach of teaching influenced his/her use of the approach in the teaching of sciences in primary schools a finding supported byAlmusalam (2001).

Science teachers were further requested to indicate their attitude towards various statements in line with computer-based pedagogy on teaching and learning of science in public primary schools. Eleven structured statements were incorporated with a scale ranging from Strongly Agree to Strongly Disagree. For ease of analysis, Strongly Agree and Agree were combined as Agree while Disagree and Strongly Disagree became Disagree. The respondents' percentages of Agreement and Disagreement with the various effects of computer-based pedagogy were worked out as shown in table 4.11.

Table 4. 12: Teachers' attitude towards CBP on teaching of sciences in primary schools

Attitude of teachers towards CBP	Agree f (%)	Disagree f (%)	No response f (%)	Total f (%)
Use of computer-based approach to teaching science is complex.	6 (75)	2 (25)	0	**8 (100)**
Use of computer-based technology is intimidating.	3 (37.5)	5 (62.5)	0	**8 (100)**
Use of computer-based technology makes teaching more systematic.	5 (62.5)	2 (25)	1 (12.5)	**8 (100)**
Use of computer-based technology makes teaching more creative.	5 (62.5)	2 (25)	1 (12.5)	**8 (100)**
Use of computer-based technology requires high administrative support.	8 (100)	0	0	**8 (100)**
Use of computer-based technology is less time consuming in preparation	2 (25)	6 (75)	0	**8 (100)**
Use of computer-based technology leads to greater pupils' involvement.	6 (75)	2 (25)	0	**8 (100)**
Use of computer-based technology in teaching ensures greater teacher availability round the clock.	8 (100)	0	0	**8 (100)**
Use of computer based instructional technology leads to easier pupils' assessment.	5 (62.5)	1 (12.5)	1 (12.5)	**8 (100)**
Use of computer-based technology gives pupils an orientation to the usage of ICT in learning.	4 (50)	4 (50)	0	**8 (100)**
Use of computer-based approaches leads to intellectual enhancement of the teachers.	7 (87.5)	1 (12.5)	0	**8 (100)**

Data depicted in Table 4.12 show that use of computer based technology required high administrative support (100%) in terms of acquisition of necessary devices and materials such as the projector, laptops, internet and others that complement the approach; use of computer based technology in teaching ensured greater teacher availability round the clock (100%);use of computer based approaches led to intellectual enhancement of teachers (87.5%) which can encourage science teachers to adopt the approach in teaching of sciences; use of computer based technology was more time consuming in preparation (75%) which was more likely to deter teachers from frequently using computer based

approach in the lessons; use of computer based approach to teaching science was complex (75%);use of computer based technology led to greater pupils' involvement (75%) which made learning more interesting and involving; use of computer based technology made teaching more creative (62.5%);use of computer based technology made teaching more systematic (62.5%); and use of computer based instructional technology led to easier pupils' assessment (62.5%) hence improving pupils' performance. The findings suggested that these teachers had a positive attitude towards use of CBP in instruction as a result of their vision of technology itself, their experiences with it and cultural conditions surrounding its introduction in schools and its subsequent diffusion into their educational practice as opined by Abdulkafi (2006).

4.7 Pupils' attitude towards computer-based pedagogy on their performance in science

Using new technologies in learning contributed to positive attitudes among learners toward a discipline such as science. Pupils were required to fill a questionnaire in order to establish their attitude towards use of CBP in teaching sciences and in response to statements that were in connection to their attitude towards use of CBP.

4.7.1 Attitude of pupils toward science

Science teachers were required to indicate pupils' attitude toward CBP and the following responses were yielded from the questionnaires.

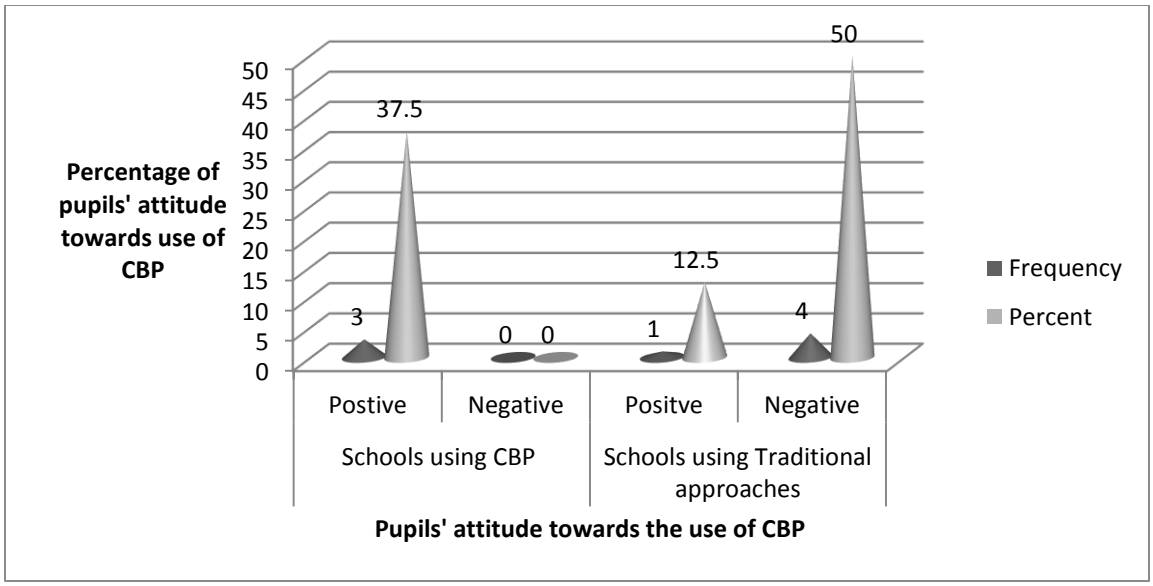

Figure 4. 9: Pupils' attitude toward use of CBP in teaching of science

As seen in Figure 4.9, all pupils in schools using CBP (37.5%) had a positive attitude towards the teaching approach compared to 12.5% which were using traditional approaches. In addition, half the number of pupils in schools using traditional approaches (50%) had a negative attitude toward science. From the analysis, pupils in schools using CBP had a positive attitude toward science as opposed to schools using traditional approaches a finding that was observed by Ogembo (2013) who established that integration of CAL positively impacted on students' attitude.CBP as a teaching approach aroused pupils' interest in learning science, made learning more enjoyable, led to greater pupils' involvement,encouraged commitment in the subject and enable pupils to grasp science concepts easily which further translated to pupils registering improved scores in sciences as established by Kayri et al., (2012).

Pupils were further requested to indicate their attitude towards statements in relation to computer based pedagogy on teaching and learning of science in public primary schools. Eight structured statements were incorporated with a scale ranging from Strongly Agree

to Strongly Disagree. For ease of analysis, Strongly Agree and Agree were combined as Agree while Disagree and Strongly Disagree became Disagree. The respondents' percentages of Agreement and Disagreement with the various effects of computer-based pedagogy were worked out as shown in table 4.9.

Table 4. 13: Pupils attitude toward CBP in teaching of science

Attitude of pupils towards CBP	Agree f (%)	Disagree f (%)	No response f (%)	Total f (%)
Computer based teaching approaches encourage class attendance.	252 (80.7)	60 (19.2)	0	**312 (100)**
Pupils' attitude towards science lessons using computer technology is positive compared to normal lessons.	265 (84.9)	40 (12.8)	7 (2.2)	**312 (100)**
Pupils involved in computer-based program outperform those who learn passively.	260 (83.3)	46 (14.7)	6 (1.9)	**312 (100)**
Pupils who learn using CBP show more commitment in the subject.	210 (67.3)	56 (17.9)	46 (14.7)	**312 (100)**
Teaching sciences using computer programs and materials make learning more interesting and enjoyable than traditional lessons.	196 (62.8)	70 (22.4)	46 (14.7)	**312 (100)**
Computer based program encourages students to grasp science concepts easily.	200 (64.1)	100 (32.1)	12 (3.8)	**312 (100)**
Pupils taught using computer-based approaches develop a positive attitude towards sciences.	198 (63.5)	34 (10.9)	70 (22.4)	**312 (100)**
Computer based approaches encourages students to opt for career choices that are related to science related fields.	215 (68.9)	66 (21.2)	31 (9.9)	**312 (100)**

Data depicted in Table 4.13 show that pupils' attitude towards science lessons where there was use of computer technology was positive compared to normal lessons (84.9%) concurring with the findings of Hüsamettin et al., (2006) who noted that using new technologies contributed to positive attitudes of pupils toward ICT; pupils involved in computer based program outperform those who learn passively (83.3%) confirming

Ogembo (2013) findings that post-test results indicated significant mean achievement for students exposed to CAL and significant effect for low ability students in experimental group; computer based teaching approaches encouraged class attendance (80.7%);computer based approaches encouraged pupils to opt for career choices that are related to science related fields (68.9%);computer based learning encouraged students to grasp science concepts easily (67.5%); pupils who learn using CBP showed more commitment in the subject (67.3%);Computer based learning encourages students to grasp science concepts easily (64.1%); pupils taught using computer based approaches developed a positive attitude towards sciences (63.5%) a finding reiterated by Haunsel and Hill (2002) who found that pupils using computers had more positive attitude towards biology and natural sciences than pupils who were educated by traditional styles; and teaching sciences using computer based pedagogy and materials make learning more interesting and enjoyable than traditional lessons (62.8%).

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary, conclusions and recommendations based on the findings. The summary presents each part of the study in brief, conclusions are made for each research question and recommendations are based on the general findings of the study.

5.2 Summary of the Study

The purpose of this study was to establish the influence of the computer-based pedagogy (CBP) on pupil's academic performance in science in public primary schools of Mumias West Sub County, Kakamega County. The study sought to examine the following: use of computer-based pedagogy (CBP) on pupils' performance in science; relevance of computer based pedagogy on effective teaching and learning of science; influence of teachers' attitude towards computer based pedagogy (CBP) on pupils' performance; and in public primary schools in Mumias West Sub County, Kakamega County.

The study employed a descriptive research design. The data was analyzed with the help of a computer program, SPSS version 23 and Microsoft Excel. The sample consisted of eight science teachers, 8 head teachers, one SCQASO and 312 class eight pupils from the 8 primary schools sampled for the study. A total of 329 participants from the anticipated 384 respondents participated in the study representing a return rate of 86%. Two sets of questionnaires for science teachers and pupils were used to collect data for the study. Head teachers and SCQASO were interviewed. From the analysis, there was a male dominance among science teachers and pupils' enrolled in public primary schools in Mumias West Sub County, Kakamega County.Majority of

the science teachers (75%) were between 31 – 40 years – a vibrant age group that could easily embrace the use of technology in teaching of science. In addition, majority of the pupils (71.1%) were between 13 – 15 years. Majority of science teachers' educational level was a P1 certificate who had not attended any refresher courses of any kind which posed a challenge to the use of ICT in learning and teaching of science a finding echoed in Odhiambo (2013) that the use of ICT was lower over the years. This created the need for institutions such as MoEST, TSC and KEMI to organize in-service courses, workshops and seminars in order to equip science teachers with the requisite skills for effective. An over whelming number of science teachers suggested ICT course (87.5%) as a key area that required further training. Majority of the science teachers (50%) had served as teachers for less than 10 years as teachers and in their current stations which implied they were less resistance to new innovations and could easily embrace current trends in teaching and integration of computer based pedagogy in the teaching of science in primary schools.

5.2.1 Use of computer-based pedagogy in schools on pupils' science performance

On the use of computer based pedagogy in schools on pupils' performance the study established that in schools where science teachers used CBP had projectors, laptops, desktops, printers, science software and the internet as key resources in the teaching of science while in schools where traditional approaches of teaching science were in use had desktop computers. This confirmed the assumption that schools using CBP had adequate supply of computers and other ICT resources. Unavailability of ICT resources in public primary schools was a major hindrance toward computer based pedagogy in the teaching of science in public primary schools a finding that resonated with Odhiambo (2013) that most teachers reported that the use of ICT in learning and

teaching was slow in the past years due to lack of computer labs and internet connectivity in the schools.

Science teachers used CBP materials like a projector, computers, photocopier, digital camera, science software/CD ROM and internet twice in a week in schools where CBP was in use. In schools where science teachers used traditional approaches; computers, photocopier and science software/CD ROM were rarely used on a weekly basis implying that these teachers had not embraced computer based technology in the teaching of sciences in their respective schools. This low usage of various CBP materials and devices could be attributed to unavailability of a wide array of CBP materials in various public primary schools and lack of awareness on how to integrate CBP materials into the teaching of sciences in schools a position affirmed by head teachers.

Teachers in schools that used CBP materials and devices twice in a week registered superior means scores compared to the schools that rarely used CBP in their weekly teaching confirming the earlier assertion the study had that schools that used CBP performed better than schools that used traditional approaches. Pupils used CBP programs/practices to store and share information, typing, surfing the internet and conducting internet search to update subject knowledge and teaching a finding that correlated with the findings of Hadley and Sheingold (2011), Harris (2000), Wallace (2001), Omur (2008), Bhalla (2013) and Mathevula and Uwizeyimana (2014) while 25% for doing assignments confirming the interaction pupils had with the devices that made learning more interesting, involving and rewarding to the pupils. Further, pupils in schools in which science teachers were using traditional approaches were not co-opted in the use of CBP programs/practices for any activity showing the alienation pupils continue to experience with their teachers hence less interesting, less involving

and less rewarding to the pupils. These results further confirmed that schools that had embraced computer based pedagogy in teaching science had incorporated pupils in learning activities that were more likely to usher in positive learning outcomes such as arousing learners' interest and improving their mean scores in science as compared to schools that had adopted traditional learning approaches a stand observed by head teachers.

5.2.2 Relevance of computer-based pedagogy on effective teaching and learning of science

On the relevance of computer based pedagogy on effective teaching and learning of science the study established that pupils became more interested to learn if materials from the internet were used in teaching; computer programs help in saving time in classroom activities; weak pupils become more interested to learn if teachers use a computer in teaching as confirmed in Owusu, Appiah, Monney and Wilmot (2010) improved performance of low achievers; computer based teaching motivated pupils to learn and participate in classroom activities; computer based teaching provided greater attention and discipline of pupils in the learning process than the traditional way of teaching; computer based teaching application did not inhibit teachers' creativity; use of computers in education increased the amount of human interaction; use of computer technology in classroom activities helped to improved pupils' scores a finding supported by Kayri et al., (2012) who established that use of a visual training CD had a similar academic success with CBP, as major learning outcomes created when science teachers use computer based approaches in teaching science. Other minor learning outcomes included: excellent pupils becoming more interested to learn if teachers used a computer/laptop in teaching; computer technology offered pupils much more confidence in the learning of science concepts; computer based

technology allowed more autonomy in pupils' work in the classroom than the traditional way of teaching; computer based teaching provided greater attention and discipline of pupils in the learning process than the traditional way of teaching; and computer based teaching gave pupils' higher cognitive activity in the classroom than the traditional way of teaching a finding echoed in Tareef (2014) who noted computer-assisted learning methods increased learners' problem solving level.

5.2.3 Teachers' attitude towards the use of computer based pedagogy (CBP) in teaching of science in schools

On teachers' attitude towards the use of computer based pedagogy (CBP) in teaching of science in schools, the study established that teachers' formal training positively influenced the use of CBP in teaching of science as opined by Mustafina (2016). Majority of the science teachers had received certificate training in information technology. Fairly, half the numbers of science teachers sampled had certificate training in ICT, further pointing out the need to train more science teachers in order to be effective and minimize anxiety when dealing with computer based technologies in the classrooms. Science teachers who had certificate training in IT (50%) had a positive attitude towards CBP in teaching of sciences compared to 12.5% who had basic training a number that could easily provide useful insight on implementation of CBP in public primary schools as postulated by Keengwe and Onchwari (2011). The results further postulated that skill level in IT had a significant influence in determining the attitude of science teachers in the use of computer based approaches in the teaching of sciences in public primary schools in the sub-county. Teachers' positive attitudes toward CBP could be attributed to their vision of technology itself and its subsequent diffusion into their educational practice as opined by Abdulkafi (2006). In addition, majority of the science teachers who had a positive attitude

toward CBP (62.5%) compared to a 12.5% who had a negative attitude and failed to use CBP in their respective schools. A teachers' attitude towards a computer based approach of teaching influenced his/her use of the approach in the teaching of sciences in primary schools a finding supported byAlmusalam (2001).

For teachers to develop a positive attitude toward CBP;science teachers required high administrative support in terms of acquisition of necessary devices and materials such as the projector, laptops, internet and others that complement the approach; use of computer based technology in teaching ensured greater teacher availability round the clock; use of computer based approaches led to intellectual enhancement of teachers which can encourage science teachers to adopt the approach in teaching of sciences; use of computer based technology was more time consuming in preparation which was more likely to deter teachers from frequently using computer based approach in the lessons; use of computer based approach to teaching science was complex; use of computer based technology led to greater pupils' involvement which made learning more interesting and involving; use of computer based technology made teaching more creative; use of computer based technology made teaching more systematic; and use of computer based instructional technology led to easier pupils' assessment hence improving pupils' performance. The findings suggested that these teachers had a positive attitude towards use of CBP in instruction as a result of their vision of technology itself, their experiences with it and cultural conditions surrounding its introduction in schools and its subsequent diffusion into their educational practice as opined by Abdulkafi (2006).

5.2.4 Pupils' attitude towards computer based pedagogy on their performance in science

On pupils' attitude towards computer based pedagogy on their performance in science the study established that all pupils in schools using CBP (37.5%) had a positive attitude towards the teaching approach compared to 12.5% which were using traditional approaches. In addition, half the number of pupils in schools using traditional approaches (50%) had a negative attitude toward science. Pupils in schools using CBP had a positive attitude toward science as opposed to schools using traditional approaches a finding that was observed by Ogembo (2013) who established that integration of CAL positively impacted on students' attitude. CBP as a teaching approach aroused pupils' interest in learning science, made learning more enjoyable, led to greater pupils' involvement, encouraged commitment in the subject and enable pupils to grasp science concepts easily which further translated to pupils registering improved scores in sciences as established by Kayri et al., (2012).

Further, pupils' attitude towards science lessons using computer based pedagogy was positive compared to normal lessons and this concurred with the findings of Hüsamettin et al., (2006) who noted that using new technologies contributed to positive attitudes of pupils toward ICT; pupils involved in computer based program outperform those who learn passively confirming Ogembo (2013) findings that post-test results indicated significant mean achievement for students exposed to CAL and significant effect for low ability students in experimental group; computer based teaching approaches encouraged class attendance; computer based approaches encouraged pupils to opt for career choices that are related to science related fields; computer based learning encouraged students to grasp science concepts easily; pupils who learn using CBP showed more commitment in the subject; Computer based

learning encourages students to grasp science concepts easily; pupils taught using computer based approaches developed a positive attitude towards sciences a finding reiterated by Haunsel and Hill (2002) who found that pupils using computers had more positive attitude towards biology and natural sciences than pupils who were educated by traditional styles; and teaching sciences using computer based pedagogy and materials make learning more interesting and enjoyable than traditional lessons.

5.3 Conclusions of the Study

The following conclusions were made based on the findings of the study: On the use of computer based pedagogy in schools on pupils' performance the study established that there was a lower usage of CBP in public primary schools of Mumias West Sub-county in Kakamega County. Unavailability of ICT resources in public primary schools was a major hindrance toward computer based pedagogy in the teaching of science in public primary schools. In the few primary schools where CBP was in use; science teachers used materials like a projector, computers, photocopier, digital camera, science software/CD ROM and internet twice in a week.

On the relevance of computer based pedagogy on effective teaching and learning of science the study established that pupils became more interested to learn if materials from the internet were used in teaching; computer programs help in saving time in classroom activities; weak pupils become more interested to learn if teachers use a computer in teaching; computer based teaching motivated pupils to learn and participate in classroom activities; computer based teaching provided greater attention and discipline of pupils in the learning process than the traditional way of teaching; computer based teaching application did not inhibit teachers' creativity; use of computers in education increased the amount of human interaction; use of computer technology in classroom activities helped to improved pupils' scores as major

learning outcomes created when science teachers use computer based approaches in teaching science. Schools that used CBP materials and devices frequently registered superior means scores compared to the schools that rarely used CBP in their weekly teaching.

On teachers' attitude towards the use of computer-based pedagogy (CBP) in teaching of science in schools, the study established thatskill level in IT had a significant influence in predicting the attitude of science teachers in the use of computer based pedagogy in the teaching of sciences in public primary schools in the sub-county. Majority of the science teachers had a positive attitude toward CBP. Teachers' positive attitudes toward CBP could be attributed to their vision of technology itself, their experiences with it and cultural conditions surrounding its introduction in schools and its subsequent diffusion into their educational practice. Use of computer-based technology required high administrative support in terms of acquisition of necessary devices and materials such as the projector, laptops, internet and others that complement the approach.

On pupils' attitude towards computer-based pedagogy and pupils' performance in science the study established that all pupils in schools using CBP had a positive attitude towards the approach compared to traditional approaches. CBP as a teaching approach aroused pupils' interest in learning science, made learning more enjoyable, led to greater pupils' involvement, encouraged commitment in the subject and enable pupils to grasp science concepts easily which further translated to pupils registering improved scores in sciences.

5.4 Recommendations of the study

In order to enhance the use of computer-based pedagogy (CBP) on pupil's academic performance in science in public primary schools of Mumias West Sub County, Kakamega County, there is need to implement the following:

5.4.1Class Level

Classes should be installed with electricity, sockets and appropriate ICT resources in order for teachers to minimize time wasting during the usage of CBP in science lessons.

5.4.2 School Level

The school through its BOM should mobilize funds for the acquisition of CBP materials and devices such as projectors, laptops, desktops, photocopiers, digital cameras, science software/CD ROM and internet connectivity in order to enhance computer-based pedagogy application in the teaching of science in public primary schools. The BOM in conjunction with ICT companies should sponsor teachers for training of the utilization of computer-based technology.

5.4.3 Teacher' and pupils' level

Teachers need to co-opt pupils in the use of CBP programs/practices for any meaningful science activity in order to make science lessons more interesting, more involving and more rewarding to the pupils. Use of the internet in teaching should be encouraged by science teachers so that pupils can continue learning when they have access to the internet even at home. Teachers and pupils should develop a positive attitude toward use of CBP in teaching science due to its relevance and influence in predicting pupils' score in sciences. Teachers should frequently use CBP materials and devices in their weekly teaching of sciences in order to register superior means scores.

5.4.4 The National level

The Government through the Ministry of National Treasury and Ministry of Education should allocate adequate funds for in its national budgetary allocations for acquisition of CBP materials like a projector, laptop, desktop, photocopier, digital camera, science software/CD ROM and internet connectivity in all public primary schools. The government through the Ministry of National Treasury through Kenya Revenue Authority (KRA) should step in and subsidize the purchase of ICT materials and devices for primary schools in order to make them affordable.

The Teachers Service Commission in conjunction with the MoEST and institutions such as Kenya Educational Management Institute to organize in-service courses, workshops and seminars in order to equip science teachers with the requisite ICT skills for effective utilization of CBP in classroom applications. The Government partnership with Non-Governmental Organizations should introduce CBP programs in sciences and train more science teachers for them to be effective and minimize anxiety when dealing with computer-based technologies in the classrooms.

5.5 Suggestions for further research

i. The effect of CBP in teaching early literacy skills in primary schools.

ii. A comparative analysis of perception of teachers and pupils on the use of CBP in teaching sciences in public and private schools in Kenya.

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APPENDICES

Appendix A: Introductory Letter
TO WHOM IT MAY CONCERN

Dear Sir/Madam,

RE: **REQUEST FOR PERMISSION TO CONDUCT A RESEARCH**

I am a student enrolled with the University of Nairobi and presently conducting a study whose purpose is to determine theeffect of Computer Based Pedagogy (CBP) in instruction of sciences in public primary schools in Mumias West Sub County in Kakamega County, Kenya, as part of the requirement for the award of a degree in master of education in Educational Technology. The information obtained will be confidential and the identity of the respondents will not be revealed.

Thanking you in anticipation for a positive response.

Yours Faithfully

Malack P.M. Wesa

Appendix B: Research Questionnaire for Science Teachers

Kindly respond honestly to all the questions. The information you are going to provide will be strictly for the purposes of the study and will be treated with utmost confidentiality.

Part I: DEMOGRAPHIC CHARACTERISTICS

(Tick the answer that applies to you and fill in the blank spaces)

1. Gender: Male [ ] Female [ ]
2. Age: Below 30 years [ ] 31- 40 years [ ]

   Over 41 years [ ]
3. Educational level Masters ( ) Bachelor ( )

   Diploma ( ) Certificate ( )
4. Besides academic qualifications, are there any refresher courses you have attended?

   Yes ( ) No ( )
5. If yes, please specify _____
6. Teaching Experience: Below 5 years [ ] 6 – 10 Years [ ] 11 - 15 years [ ] 16 – 20 Years [ ] Over 21 years [ ]
7. Length of service in the current station. (Tick one)

   Below 5 years ( ) 5-10 years ( )

   11-15 years ( ) Over 15yrs ( )

PART 2: Frequency of use of computer based pedagogy or computer assisted learning in schools

8. Which of the following Computer based pedagogy materials are available for your use for teaching of Sciences in your school? (Choose one option in each case).

	CBP materials/devices	**Available**	**Not Available**
a.	Projector		
b.	Laptop		
c.	Desktop computers		
d.	Scanner		
e.	Photocopier		
f.	Digital camera		
g.	Science software/CD-ROM		
h.	Internet		
i.	Video games		
j.	E-library		
	Others …… (Specify)		

9. Indicate the frequency with which you use the following ICT materials in learning of science. (Choose one option in each case)

	CBP materials/devices	**Weekly frequency of use**				
		None	Rarely	Once	Twice	Always
a.	Projector					
b.	Laptop					
c.	Desktop computers					
d.	Scanner					
e.	Photocopier					
f.	Digital camera					
g.	Science software/CD-ROM					
h.	Internet					
i.	Video games					
j.	Computer library					

10. Indicate which of the following CBP programs/practices you involve your pupils in to support learning of Sciences. (Choose one option in each case)

	CBP Programs/Practices	Are pupils involved	
		Yes	No
a.	Storing and sharing information		
b.	Typing		
c.	Emailing		
d.	Surfing the internet		
e.	Playing video games		
f.	Photocopying		
g.	Taking pictures		
h.	Doing assignments		
i.	Data generation from CD		
j.	Downloading vital info from internet		
k.	Using educational material		
h.	Drawing, painting or graphics		
i.	Internet research to update subject knowledge and teaching skills		
j.	Online discussions		
k.	Prepare question banks		
	Others …….. (Specify)		

PART 3: Relevance of computer-based pedagogy/computer assisted learning in schools

11. To what extent do you agree or disagree with each of the following statements? (Tick **(√)** your response)

1. **Strongly disagree (SD)** **2. Disagree (SD)** **3. Neutral (N)**
4. **Agree (A)** **5. Strongly Agree (SA)**

	Relevance ofCBP/Computer Assisted Learning in teaching of science in school	SD 1	D 2	N 3	A 4	SA 5
a.	Pupils become more interested to learn if materials from the internet are used in teaching.					
b.	Excellent pupils become more interested to learn if teachers use a computer/laptop in teaching					
c.	Weak pupils become more interested to learn if teachers use a computer in teaching.					
d.	Computer assisted learning discourages rote learning in class.					
e.	Computer based teaching motivates pupils to learn and participate in classroom activities.					
f.	Computer technology offers students much more					

	confidence in the learning of science concepts.					
g.	Computer based technology allows more autonomy in the pupils' work in the classroom than the traditional way of teaching.					
h.	Computer based teaching provides greater attention and discipline of pupils in the learning process than the traditional way of teaching.					
i.	Computer based teaching application inhibits teachers' creativity.					
j.	Computer based teaching gives pupils' higher cognitive activity in the classroom than the traditional way of teaching.					
k.	Use of computers in education increases the amount of human interaction					
l.	Use of computer technology in classroom activities helps to improve pupils' scores.					
m.	Computer programs help in saving time in classroom activities.					
	Others ……..... (Specify)					

PART 3: Attitude of Teachers Towards Computer Based Pedagogy in Teaching of Sciences

12. Do you have any formal training in IT? Yes ( ) No ( )

13. If yes, please indicate level

Basics in IT ( ) Certificate ( ) Diploma ( )

14. Who sponsored you for the training? Self ( ) School ( ) Others ( )

If others please specify _____

15. Indicate by ticking your attitude towards teaching of sciences using CBP materials/devices

Positive ( ) Negative ( )

16. Does science teacher(s) use Computer Based Pedagogy/Computer Assisted Learning materials/devices in science lessons?

Yes ( ) No ( )

17. To what extent do you agree or disagree with each of the following statements? (Tick **(√)** your response)

1. Strongly disagree (SD) 2. Disagree (SD) 3. Neutral (N)

4. Agree (A) 5. Strongly Agree (SA)

	Attitude of teachers towards CBP/Computer Assisted Learning in teaching of science in school	**SD 1**	**D 2**	**N 3**	**A 4**	**SA 5**
a.	Use of computer based approach to teaching science is complex.					
b.	Use of computer based technology is intimidating.					
c.	Use of computer based technology makes teaching more systematic.					
d.	Use of computer based technology makes teaching more creative.					
e.	Use of computer based technology requires high administrative support.					
f.	Use of computer based technology is less time consuming in preparation.					
g.	Use of computer based technology leads to greater pupil involvement.					
h.	Use of computer based technology in teaching ensures greater teacher availability round the clock.					
i.	Use of computer based instructional technology leads to easier pupils' assessment.					
j.	Use of computer based technology gives pupils anorientation to the usage of ICT in learning.					
k.	Use of computer based approaches leads to intellectual enhancement of the teachers.					
	Others ---------- (Specify)					

THANK YOU

Appendix C: Research Questionnaire for Pupils

PART A: Demographic Characteristics.

1. What is your gender? (Tick one) Male ( ) Female ( )

2. What is your age? Below 12 years ( ) 13 – 15 ( ) Above 16 ( )

Part A: Frequency of Computer based learning in the teaching of science in schools

3. Indicate by ticking on the following statements (Tick **(√)** your response)

	CBP Programs/Practices	**Frequency of use of computer based learning in classroom activities**	
		Yes	**No**
a.	Teachers frequently use computer based technology in the teaching of science.		
b.	There is access to computer based technology resources for sciences.		
c.	There is internet access in the school.		
d.	There is an adequately equipped computer laboratory in the school.		
e.	There are computers for pupils and teachers in the school.		
f.	Classrooms are well lite for computer aided instruction in sciences.		
g.	Assignments encourage pupils to use computer based technology such as the internet.		
h.	There are computer software programs for teaching sciences in school.		

Part B: Relevance of Computer based learning in the teaching of science in schools

4. To what extent do you agree or disagree with each of the following statements? (Tick **(√)** your response)

2. Strongly disagree (SD) **2. Disagree (SD)** **3. Neutral (N)**

4. Agree (A) **5. Strongly Agree (SA)**

	Relevance ofCBP/Computer Assisted Learning in teaching of science in school	**SD 1**	**D 2**	**N 3**	**A 4**	**SA 5**
a.	Pupils become more interested to learn if materials from the internet are used in teaching.					
b.	Excellent pupils become more interested to learn if teachers use a computer/laptop in teaching					
c.	Weak pupils become more interested to learn if teachers use a computer in teaching.					
d.	Computer assisted learning discourages rote learning in class.					
e.	CAL motivates pupils to learn and participate in classroom activities.					
f.	Computer technology offers students much more confidence in the learning of science concepts.					
g.	CAL allows more autonomy in the pupils' work in the classroom than the traditional way of teaching.					
h.	CAL provides greater attention and discipline of pupils in the learning process than the traditional way of teaching.					
i.	CAI application inhibits teachers' creativity.					
j.	CAL gives pupils higher cognitive activity in the classroom than the traditional way of teaching.					
k.	Use of computers in education increases the amount of human interaction					
l.	Use of computer technology in classroom activities helps to improve pupils' scores.					
m.	Computer programs help in saving time in classroom activities.					
	Others ……..... (Specify)					

5. To what extent do you agree or disagree with each of the following statements? (Tick **(√)** your response)

1. Strongly disagree (SD) **2. Disagree (SD)** **3. Neutral (N)**

4. Agree (A) **5. Strongly Agree (SA)**

	Attitude of pupils towards CBP/Computer Assisted Learning in teaching of science in school	**SD 1**	**D 2**	**N 3**	**A 4**	**SA 5**
a.	Computer assisted learning approaches encourage class attendance.					
b.	Pupils' attitude towards science lessons using computer technology is positive compared to normal lessons.					
c.	Pupils involved in computer assisted learning outperform those who learn passively.					
d.	Pupils who learn using ICT show more commitment in the subject.					
e.	Teaching sciences using computer programs and materials make learning more interesting and enjoyable than traditional lessons.					
f.	Computer based learning encourages students to grasp science concepts easily.					
g.	Pupils taught using computer based approaches develop a positive attitude towards sciences.					
h.	Computer based approaches encourages students to opt for career choices that are related to science related fields.					

THANK YOU

Appendix D: Head Teachers/SCQASO Interview Guide

This interview aims at obtaining information on your experiences in the use of CAL in the teaching and learning of chemistry. The information you provide will be highly confidential and will only be used for the purposes of this study. Your cooperation is highly appreciated.

1. In your opinion, how do you rate the performance of sciences in your school? [Probe performance in sciences over the past four years – 2016 - 2019]

2. What is your comment about the conditions under which pupils learn sciences in your school or schools in the sub-county? [Probe: Availability and use of CBP hardware and software – computers, internet, scanners, computer libraries, online learning/discussions, computer software etc]

3. What is the most predominant method that you prefer to use? [Probe for traditions vs CBP in in the teaching of science and its impact on pupils' performance].

4. What are some of the reasons why the method you have stated above is most preferred?

5. What are some of the specific ICT tools that are in use in teaching and learning of science?

6. How often does your science teacher use computer based technology in your teaching sciences?

None ( ) Rarely ( ) Occasionally ( ) Always ( )

7. Is your science teacher comfortable teaching his/her lesson with the help of a computer based technology?

Yes ( ) No ( )

8. How do you rate the pupils' participation when taught using a computer based technology?

Active ( ) Passive ( ) No effect ( )

9. How do you rate the pupils' participation when taught without the use of a computer based technology?

Active ( ) Passive ( ) No effect ( )

10. What is the attitude of teachers towards the use of computer based technology in the teaching of science in schools? (Probe on their competence, readiness and resources availability)

11. What are some of the challenges that schools encounter in teaching sciences using CAL?

12. In your opinion, what do you think should be done to improve the use of CAL in teaching and learning of sciences?

Thank You

Letter of Authority to Conduct Research in School

University of Nairobi,

School Of Education,

PO BOX 30197-00100,

Nairobi.

The head teacher.,

.....Primary School

RE: PERMISSION FOR RESEARCH ACTIVITY IN YOUR SCHOOL

I am a Post Graduate student at the University of Nairobi pursuing a Masters of Education Degree in Educational Technology in the School of Education. As part of the requirement for the award of this degree .I am carrying out a study on the Influence of Computer Based Pedagogy on Pupils' Academic Performance in Science in Public Primary Schools of MumiasWest sub county, Kakamega County .the study is designed as a descriptive survey and will involve the filling of relevant questionnaires .the sole purpose of this study is to gather data for the Masters of Education in Educational Technology research project and will not be used for any other purpose. Thank you

Yours faithfully

Wesa P.M Malack

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