EFFECTS OF A COMPUTER AIDED INSTRUCTIONAL METHOD ON PUPILS' PERFORMANCE IN AGRICULTURE- A QUASI EXPERIMENTAL STUDY

MASTER OF SCIENCE

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BY

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UNIVERSITY OF BOTSWANA
BOTSWANA COLLEGE OF AGRICULTURE

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ATTESTATION

I do understand the implications of plagiarism when writing a research project. I am also aware of University of Botswana's policy regarding plagiarism. I therefore certify that this dissertation is composed of my original work and contains no material previously published or written by another person except where due reference has been made in the text.

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DEDICATION

This dissertation is dedicated to my late mother, Gosenyang Dinale, wife, Tselayabotlhe Mbina Sebeso and my daughters, Sokologang and Neelo, who were always my source of inspiration.

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ABSTRACT

The purpose of this study was to experimentally test the effectiveness of computer aided instructional methods (CAI) facilitated through the use of CD-ROM in teaching Agriculture subject contents to Kgafela Primary School standard five pupils. A controlled quasi-experimental designed study was conducted to test the efficiency of CAI in teaching Agriculture subject contents to children. The following data were collected: (a) Performance in an aptitude test administered to both experimental and control groups prior to teaching using CAI and the traditional lecture methods, respectively; (b) Performance in conventional pre and post tests given to standard five pupils; (c) Pupils' responses to likert-type attitude questionnaires. Using hypothesis testing, the researcher compared CAI method with the traditional lecture method of teaching using experimental and control groups studied.

The study tested four hypotheses, which included: (i) If the computer aided instructional method does not significantly influence the pupils' performance in agriculture, (ii) if there is a significant relationship between gender and computer aided instructional method on pupils' performance in Agriculture, (iii) if there is no significant relationship between pupils' attitudes to computer aided instructional method and performance in Agriculture, and (iv) if accessibility or frequency of computer usage by pupils does not significantly affect their performance in Agriculture. Approximately fifty- seven (56.79%) of the children studied were males, ninety eight percent (97.53%) were in the age range between 10 to 13 years old and more than half (55.56%) of the children in the study did not attend pre-school. Fifty three percent (53.09 %) of the children as shown in Table 1 indicated non- availability of their parents' computers at home, two-thirds (66.67 %) indicated availability of video games and eighty two percent (81.48 %) of the children indicated parental or relatives' ownership of cell phones or mobile phones. In testing if computer aided instructional method using interactive CD-ROM had any significant influence

on primary pupils' performance in the subject of Agriculture, the results showed that there was an observed mean difference of

-12.12500; the value of t was -5.008 at $P < 0.005$. The mean difference of -12.12500 between the pre-test and post test scores in the experimental group was statistically significant. Therefore, it can be inferred that computer aided instructional method of teaching had an effect on the performance of primary school kids in Agriculture. With regard to whether gender has significant influence or not on students' performance in Agriculture, using the computer aided instructional method, it is found that gender does not have effect on the performance of pupils in Agriculture.

Therefore, this means that both boys and girls in this study have an equal amount of contribution to the performance mean of pupils in Agriculture. The Pearson correlation was $r = 0.101$, which was a weak positive correlation; it indicates that for a single unit of increase in attitude, there was an equal single unit of increase in children's performance in the test given. The results indicate that there was a weak positive relationship between pupils' attitudes towards computer aided instruction and their performance. Frequency of use of computers has also been found not to have an effect on pupils' performance in Agriculture.

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LIST OF ABBREVIATIONS

AEE	Department of Agricultural Economics, Education and Extension
BIH	Botswana Innovation Hub
BCA	Botswana College of Agriculture
BEC	Botswana Examination Council
BTA	Botswana Telecommunications Authority
CAI	Computer Aided Instruction
GDN	Government Data Network
FST	Food Science and Technology
ICT	Information and Communication Technology
MOE&SD	Ministry of Education and Skills Development
MIST	Ministry of Infrastructure Science and Technology
NDP	National Development Plan
RNPE	Revised National Policy on Education
UB	University of Botswana
RSTI	Research Science Technology and Innovation
BOTEC	Botswana Technology Centre
RIPCO	Rural Industries Innovation Company
RIIC	Rural Industries Innovation Centre
NFTEC	National Food Technology Centre
PSLE	Primary School Leaving Examination
DPRES	Department of Educational Planning Research and Statistics

CHAPTER 1

INTRODUCTION

1.1 Background of study

Effective from the late 1990s, the Botswana's Ministry of Education and Skills Development (MoE&SD) then called the Ministry of Education (MoE) saw a need to introduce computer technology awareness education in all secondary schools. At primary schools level, computers were supplied for administration and management purposes. In junior and senior secondary schools, computer awareness and education was taught to pupils as mindfulness subject that is not tested in the terminal examinations. The government found this as a necessary way of developing the information communication technologies (ICT) awareness skills so as to achieve the goal of an "educated and informed nation" in "a prosperous, productive and innovative nation" by 2016 (Revised National Policy on Education - RNPE, 1994), as envisioned in the national goals and strategies.

Today, several primary schools nationwide have been equipped with computers donated by the government as well as different organisations such as Debswana and the foreign mission organizations found in the country and international organizations. For example, the Kgafela Primary School in Kgatleng District have benefited from the British Council which donated twenty (20) computers as well as the Ghanzi Primary School in Ghanzi District (Maleke, 2012).

Kgafela Primary School in Kgatleng district and Boitumelo Primary School located in Sebele, which hosted this quasi experimental study, had at least twenty computers each. The need for both the government and the private organizations to support schools to have computers was guided by the Revised National Policy on Education (RNPE) which demanded that all school going children be exposed to the use and integration of the technology in their

learning. The Government of Botswana is committed to achieving the 2016 education milestone, on information and communication technology (ICT) through: (i) Preparation of human resources in education to be able to use and integrate computers in education and (ii) development of technology infrastructure for educational purposes.

In an effort to improve the human resource development in line with ICT expectations, the government has started developing teachers to a level of Bachelor's degree and also upgrading those with diploma and lower education in both primary and secondary schools to a bachelor's degree qualification. With regard to infrastructure development, computer technology and other devices have since been made available in institutions for administration purposes, teaching and pupils' learning by the end of the 1990s. Such technology advancement in the education system was a strategy to improve connectivity, networking as well as promoting the adoption of information and communication technology (ICT). The target areas as spelt out in the National Development Plan No 9 (NDP 9) included e-government, e-health and e-education where ICT should be promoted. This kind of development in education could be equated to a journey, which started with the introduction of computer awareness, where all junior secondary schools nationwide were given 50 computers between 1995 and 1999. Currently, all government junior and senior secondary schools, together with government aided senior secondary schools, have computer laboratories with a minimum of fifty (50) computers. In primary schools, as at 2000s, majority have computers for administration and management of tests, management of pupils' data as well as internet usage. These are milestones in the development of ICT in the education system of Botswana as a strategy for improving the education.

Furthermore, in public tertiary institutions such as the University of Botswana and Botswana College of Agriculture (BCA), courses on computer studies, computer education, media studies and information and communication technology are taught as part of the

curriculum. Pupils in these institutions were taking courses as part of their degree programs graduating with awareness on information technology. The goal is mainly to expose teachers with the infusion and integration of technology in teaching and learning.

In yet another development associated with ICT development in Botswana, in 2002 a new ministry was established, called Ministry of Science and Technology (Chisholm, Dhunpath, & Paterson 2004). The purpose of establishing such a ministry was to facilitate the provision of quality infrastructure for technology in the country, promote socio-economic research and enhance economic diversification through technology. Chisholm et al. (2004) further stated that the new Botswana's Ministry of Science and Technology was launched to promote the country's vision of pursuing developmental goals that would enable the country to get connected with the world through technology. Embedded in the Botswana's vision for information and communication technology (ICT) would be a pillar of a quality, relevant and accessible education system which tries to elevate the level of human development capacity and productivity. This goal therefore aimed to intensify basic education through provision of awareness and computer literacy.

According to Kebonang (2012), the Botswana's Minister of Science and Technology, Mr Swartz, when welcoming guests at the launch of the science and technology park, mentioned that it was the responsibility of the directorate of the ministry to ensure the monitoring of the implementation of funded research projects conduced in the country to develop appropriate strategies and mechanisms to promote technology diffusion, uptake and transfer of the technology. The directorate thus becomes responsible for the maintenance of a comprehensive Research, Science, Technology and Innovation (RSTI) data and information management system that contributes to the informed decision making. In addition, the minister indicated that the policy should integrate science and technology into various sectors of the economy and bring cohesion in the currently "fragmented research activities so that technology

development, innovation and knowledge can drive the national socio-economic growth to transform Botswana into a globally competitive country" (Kebonang, 2012).

In line with the country's goal of improving ICT, policies and strategies were put in place such as the Maitlamo policy and the recently launched Research, Science, Technology and Innovation (RSTI) policy. The Maitlamo policy on its own was built on Botswana's national information and communication technology (ICT) for a while to provide a roadmap that has been driving the country's social, economic, cultural and political change (Isaacs, 2007). The newly launched RSTI policy aims to address the knowledge-based competitiveness that forms the basis for economic sustainability and diversification. Among other factors, the goals of this policy included to: (i) Increase national capacity for economic growth through research, (ii) Infuse indigenous knowledge in the national research and development agenda, (iii) Facilitate innovations and sustainable technology development and, (iv) Use and apply technology for the improvement of the quality of life (RSTI Implementation Plan, 2012).

Noted also as a strategy in the development and advancement of the ICT in Botswana, there would be the mention of the country's National Development Plan 9 (NDP 9) 2003-2008/9, during which the University of Botswana became active in developing the academic programmes promoting ICT. The programmes were introduced to prepare pupils in the area of technology (Ministry of Finance and Development Planning, 2003). Courses offered in these programmes included information technology housed in the Department of Library and Information Studies (Balu, Mutula, Sebina & Zulu 2010). The courses include Computer Studies and Computer Science in the Faculty of Education (Isaac, 2007).

Similarly, the Botswana's College of Agriculture, Faculty of Agriculture of the University of Botswana introduced a new department called Food Science and Technology (FST). The goal of this department was to prepare pupils in line with technology usage in Food Science and in

the field of Agriculture while the Basic Science Department continued preparing pupils for Agriculture in the college with basic sciences, as well as computer awareness.

In technical colleges around the country, computer technologies, information systems and other related courses have been part of the curriculum for pupils to access internet and some networks. All these were evident enough to prepare pupils in tertiary education to facilitate their career with the use of technology.

In the corporate world, the local commercial banks such as Barclays bank, First National bank, Standard Chartered bank and Bank Gaborone have also gone an extra mile in adopting technology based facilities such as e-banking, internet banking, electronic money transfer within and between banks as well as the automated teller machines (ATM).

To show commitment on ICT development in Botswana, the revised national policy on education RNPE (1994) recommendation 43-f had placed emphasis on the use of technology in learning and also demanded that teachers use technology in their teaching. The recommendation further acknowledged the importance of pupils' exposure to the application of science and technology needed for problem solving experiences in education (RNPE, 1994). Currently, the Ministry of Education and Skills Development (MoESD) has set up educational television programmes to help in the broadcasting of teaching of subject that tended to be challenging to pupils such as sciences and mathematics (Moeng, 2011).

In yet another milestone, in 2006, the Botswana's telecommunication sector was given the mandate to be responsible for telecommunications services nationwide to work with networking organizations such as Mascom wireless, Orange Botswana and be Mobile on providing network services. These developments enabled the provision of different forms of ICT services over fixed or mobile, wire line or wireless, network links, using any available technology, and international telecommunications, including the operation of international gateways (Barrett, n. d.).

The aforementioned developments expanded the ICT infrastructure in the country supporting the development initiatives in rural and remote areas, setting up of public and private radio stations, television stations, private networks such as Government Data Network (GDN), and public internet cafes in different areas for the purpose of improving knowledge education (International information Management Corporation, 2012). These also provided a forum for different stakeholders who were technology-driven and knowledge intensive industries, researchers, higher education institutions and the ICT industry to develop and promote innovations and new businesses (Dahlman, n.d.). The Thuto Net serves as an expansive project that would deal with the connectivity of the secondary schools around the country. Such developments also enabled schools to link together through internet thus addressing issues of literacy gaps existing between the people living in urban and rural areas (International information Management Corporation, 2012).

Likewise, the private educational institutions including the Limkokwing University of technology, NIIT (Botho) University, Ba isago University and ABM University also provide ICT compliancy curriculum. Other public institutes supported by the government were International University of Science and Technology (BIUST), Botswana technology Centre (BOTEC), Rural Industries Promotion Company (RIPCO), Rural Industries Innovation Centre (RIIC) and the National Food Technology Centre (NFTRC). For example, the media centre in Mochudi was introduced specifically to provide some in-service training guidance and support to educational professionals in ICT for schools to computer teachers in schools (Isaacs, 2007). Thus, the adoption of technology by educationist is in line with the world of work.

Nowadays, computers and related technologies have become popular in education. Where these gargets have been used particularly for teaching and learning science-based subjects, results have been found to improve (Livingstone & Bober, n. d.). Such technologies have been associated with improving pupils' attitudes towards learning and achievement in academics

(Akçay, Durmaz, Tuysuz & Feyzioglu 2006; Basturk, 2005). For example, as indicated by Moosavi (2009) in an experiment that was conducted to compare the use of Think-well CAI and the MyMathLab CAI curriculum, the results revealed that pupils who used the Think-well CAI technology performed better than the group that were taught using MyMathLab CAI.

In line with the aforementioned developments, it is worth noting that the primary school education of any country is perceived as the foundation of any education system, upon which appropriate learning should take place. The use of technology, particularly computers, was found imperative in laying the education of any child today. According to Okorie, Agabi and Uche (2005), technologies enhance teaching and pupils' learning in the classroom. Thus, teachers in schools were encouraged to adopt and use technology in their delivery processes to enhance pupils' performance. With regard to Botswana's education, the question is, if computer assisted technology is adopted, will it improve the results? To what extent will the pupils' results improve if technology is used? Currently, there is limited research in Botswana which addressed how technology could improve the results in schools. Studies in other countries, particularly developed countries, have shown that the use of technology in the classroom influences positive results. Can the results improve when using technology?

1.2 Statement of the problem

The emphasis currently in many countries is on science and technology education and the integration of technology in work places. This need is also emphasized in educational institutions, particularly in classrooms where computer technologies have been put in place to serve as a tool for pupils' learning and communication. According to Okorie et al. (2005), technologies enhance teaching and pupils' learning in the classroom. Thus, teachers in schools were encouraged to adopt the technology in their delivery processes to enhance their pupils' performance. If this holds true, it would suggest that the Botswana's primary school

Agriculture Science results should improve when using technology to deliver classroom instructions. Agriculture as a subject on its own in the Botswana's Primary School leaving Examination (P.S.L.E) was first examined in 2006, and the first results were released in 2007. These national Agriculture results were equally comparable with other subjects.

In the results that followed, the primary school pupils' performance in Agriculture has been consistently poor as compared to other subjects in the same primary school leaving examination program. The scenario can be illustrated as follows: in the first results of 2007, where the examination items comprised the multiple choice type of questions, the national performance was 75.6%. This was followed by national performance of 71% in 2008, a drastic drop to 40.2% in 2009; then 39.4% in 2010 and 24.2% in 2011 (Botswana Examinations Council, 2011), when the examination items were changed to a structured format where children were required to write answers instead of choosing the key from alternatives provided. Unpublished information sources have it that the pupils in P.S.L.E Agriculture failed because of several factors associated with the curriculum offered, children's characteristics, teacher education, classroom instructions and lack of use of appropriate technology.

Based on this background, the problem statement addresses the following questions: Does using computer technology in teaching Agriculture Science improve pupils' performance in primary schools? Does computer assisted instructions (CAI) matter for children in primary schools? Furthermore, can children who are taught using computer based instruction improve their performance in comparison to the group that is taught using the traditional classroom lecture methods? This research study investigated the extent to which pupils' performance in Agriculture Science improved or changed when taught using computer aided technology. In addition, the study investigated primary school children's attitudes towards the use of technology in learning Agriculture Science at primary school level.

1.3 Purpose of the study

The purpose of this study is to experimentally test the effectiveness of CAI in teaching the primary Agriculture syllabus to pupils. The specific objectives for this investigation included:

1. To describe the demographic characteristics of the pupils involved in the study.
2. To determine the effect of the computer aided instruction on the performance of pupils in primary Agriculture.
3. To determine if gender has an effect on the performance of pupils in Agriculture when using the computer aided instructional method.
4. To establish if there is a relationship between the pupils' attitudes to computer aided instructional method and performance in Agriculture.
5. To determine if accessibility or frequency of computer usage at home/school affects performance of pupils in Agriculture.

1.4 Significance of the study

The study on the effect of computer technology in teaching Agriculture to pupils in primary schools is deemed important in social sciences. Such a scientific investigation as noted by Ary et al. (2002) made a difference in understanding the role played by different kinds of classroom instructions in teaching and learning. The results of this study had two-fold implications; (i) the outcomes of the study had implications on classroom instructions. The outcomes of such a study would increase knowledge of stakeholders on the theory of using ICT in education. The outcome of the study increased pupils' knowledge on problem solving skills, thus making educators and policy makers realize the importance of learning thorough technology, thus demanding the possibility of modifying the teaching methods strategies to improve the results or performance in schools.

Experiments were minimal in social sciences; therefore, the outcomes of this study where results tended to be positive would motivate scholars to duplicate the study in the same or with other subjects, encouraging teachers as classroom practitioners to accept and adopt the use of technology in teaching. The study was the first of its kind in the teaching of Agriculture in Botswana schools since the country has had an outcry with the poor standard seven results for agriculture. Therefore, the experiment was expected to place the researcher and Botswana College of Agriculture at a favourable position to use the approach in teaching pupils to solve problems in classrooms. With regard to application, the results of the study can be applied in education. The recommendation for adoption of ICT in schools was one of the important aspects to have created awareness to teachers of agriculture, school guidance and counsellors, school heads, educators in formulation of teaching policies, appropriate assessment procedures and action research studies.

The use of CAI to support teaching and learning is an emerging concept in the educational settings and was widely adopted by educational institutions around the world from pre-schools to tertiary institutions. This research was therefore imperative in that it might yield some evidence for Botswana that the stakeholders in the education sector could use to improve the performance of pupils in schools. The study should be helpful to teachers to improve the pedagogy of teaching since there is a huge presence of computer systems together with other complementary gadgets as teaching aids within the classrooms that are not effectively utilized. The outcome of this research study could further open avenues for the future research in the area of computer and related technologies in the teaching and learning of Agriculture.

1.5 Research Questions and Null Hypothesis

1.5.1 The purpose of this study is to determine the effectiveness of the computer assisted computer technology method on the performance of pupils in primary Agriculture. Specifically, the research questions that guided the study included the following:

1.5.1.1 What were the characteristics of pupils used in the study?

1.5.1.2 What were the effects of a computer aided instructional methods on students' performance in primary Agriculture as measured by a traditional standardized test?

1.5.1.3 What were the attitudes of pupils involved in this study towards the computer aided teaching method?

The following null hypotheses guided the study's statistical analyses:

Hypothesis 1

Computer aided instructional method does not significantly influence students' performance in Agriculture.

Hypothesis 2

Gender has no significant influence on the effect of computer aided instructional method on students' performance in Agriculture.

Hypothesis 3

There is no significant relationship between students' attitudes to computer aided instructional method and performance in Agriculture.

Hypothesis 4

Accessibility or frequency of computer usage by pupils at home/school does not significantly affect their performance in Agriculture.

1.6 Limitations of the study

Several methodological limitations which could have impaired the outcomes of this experimental study include the size of the samples used, data collected from the samples, inadequate previous examples of experimental research conducted in the same field of Agriculture Science, particularly in Botswana, lack of exposure to technology usage by the group studied, and the culture found in classroom in primary schools where children do not have access to computer gadget.

The size of the samples: The number of schools and size of the samples used in the study were dictated by the resources available, finances and time available for the study and the nature of the research study. The samples were small and therefore could have made it difficult to find statistical significant relationships from the data collected. Statistical tests usually require sample sizes which are large enough to confirm a representative distribution of the population and to be considered representative of that particular primary school student to whom results were generalized.

Data collected from the samples: data collected from the two groups limited the researcher from making inferential analysis on relationships existing between scores obtained and their demographic characteristics as well as their perceptions of the technology used in teaching the classes. The schools which participated in the study were handpicked and therefore their results could not be generalized to areas where they are located or any other school in the country as they may be some biasness.

Other limitation which could have contributed to the results of this study included pupils' culture of using traditional lecture methods instead of the technology which they were not familiar with. The fluency of teachers who were used to teach the class for this particular research study may have also impacted the results of the study. Demographic characteristics of

teachers used in the study to teach their classes such as level of education, experience in teaching, gender, and technology background could have impacted the results.

1.7 Delimitations of the study

This study was confined to the teaching of Agriculture in upper primary school pupils. These were mainly primary schools in greater Gaborone and Kgatleng regions. The schools were used because they had adequate computers which were used to carry out the study.

1.8 Operational definition of terms

Several terms found throughout the text have meanings which were unique to this investigation. The following definitions were presented as used and applied in this study.

1. Compact Read Only Memory (CD ROM): This is a pre-pressed compact disc which contains data in the form of agriculture topics selected to be packaged for the purpose of teaching a class.

2. Computer Aided Instructional method: This is CD-ROM used as a teaching method loaded in a computer to teach.

3. Performance: This is defined in terms of pupils' marks like percentage (%).

4. Primary School: This is an elementary school with children between the ages of 6 to 14 in the school years 1 to 7.

5. Primary School Leaving Examination (PSLE): This is a terminal examination to mark the end of the 7 years of primary school education in the Botswana's education system.

6. Pupils: These are children under the age of 15 years only going to primary schools.

7. Traditional teaching method: this is a lecture method where the teacher teaches a class on face to face situation writing on the chalk board.

8. Technology: The application of scientific knowledge for practical purposes to improve the results or outcomes of an organization like schools; it includes "computer technology"; it can be a machinery and equipment developed from such scientific knowledge to be used to improve the outcomes of an organization.

CHAPTER 2

LITERATURE REVIEW

2.1 Chapter overview

This chapter presents the theoretical frame work used in the study, literature reviewed on the definition of ICT, classical background of ICT in classroom teaching, classification of technologies in education, benefits of using ICT in education, challenges of using ICT in education, computer aided instruction and performance, gender and performance, attitude and performance, accessibility or frequency of computer use at home or school. The chapter concludes by summarizing the findings of the literature reviewed.

2.2 Theoretical Framework

This study is aligned to the constructivist learning theory. This theory, as described by Norton and Wiburg, (2003) is a process of constructing one's own understanding. In other words, the constructivist emphasizes that learners should construct their own knowledge. It is through this construction of knowledge that people are able to own and understand what they have acquired. Constructivist learning theory emphasizes that there are unique individual experiences. This means that each child is able to interpret notions according to his or her understanding or perceptions. This explains that for learning to take place there should be a defined change in behaviour or the way in which the learning environment is approached (Newby, Steppich, Lehman & Russel, 2006).

The use of technology in education, for example computer aided instructional method (CAI) promotes individualized learning, hence individualized learning systems (ILS). The ILS includes computer devices (ipads, CD- ROMs, podcasts). Through these devices, each learner is able to get his/her own information. In this process, the teacher's role is to provide

instructions for learners to solicit information. This is in line with the constructivists who believe that learners should be able to interpret knowledge and become skilful in directing their own learning (Self-directed learners).

2.3 Information and communication technology (ICT)

The information and communication technology frequently abbreviated as ICT is a "diverse set of technological tools and resources used for communication in different fields to create and disseminate information as well as its storage and management". As indicated by UNESCO (2002), ICTs cover a wide range of features such as "internet service provision, telecommunications equipment and services, information technology equipment and services, media and broadcasting, libraries and documentation centres, commercial information providers, network-based information services, and other related information and communication activities (Noor-UI- Amins, n.d). Noor-UI- Amins (n.d.) further states that ICTs have become common place entities in all human aspects of life and many circumstances changing the practices and procedures of almost every day to day human life including governance of the education systems. In many countries, the use of ICT in the education systems, as indicated by UNESCO (2002), has widely increased, pressurizing the adoption of ICT by many countries. Noor-UI- Amins (n.d.) further reported that the use of ICT provides itself to a more student centered classroom environments promoting the required meaningful learning. ICTs are now found in different fields as a way to expedite and improve human endeavors to perform several functions including that of education in the classroom.

Generally, the argument for the increase in the use of ICTs has become important to bring about the changes to classroom teaching and learning as well as other activities. These changes brought about by ICTs may include improved teaching strategies, improved communication through the adoption of emails, virtual meetings or conference as well as

discussions through chat rooms or platforms (Law, Pelgrum & Plomp, 2008). The regular use of ICT across different curriculum subjects and school administrative platforms is deemed a valuable motivational strategy on pupils' learning and skill development. For example, in the classroom context, ICTs offer students the ability to become lifelong learners within a perspective of collaboration and the ability to work and learn from experts and peers in a connected global community (Law et al., 2008).

Kgwefane and Motswagosele (2001) defined ICT as a form of electronic and non-electronic resources which could help "to store, handle, manipulate and disseminate information to any given audience". Furthermore, the National Council of Teachers of Mathematics (NCTM, 2008) in Australia has conceptualized technology to mean an essential tool that plays a major role in education and therefore every child should appreciate accessibility to understand its development and usage in his or her education.

Information and communication technologies (ICT) generally relate to those technologies that are used for accessing, gathering, manipulating and presenting or communicating information. Technology is a generic concept which may refer to hardware, software and scientific findings being generated through research. For example, as indicated by Toomey (2001), and Mogotlhwane, Mokwena and Talib, (2011), technologies include among others, the hardware like computers, i-pad and mobile devices, software applications and connectivity, accessibility to internet, local networking infrastructure and videoconferencing. The authors asserted that ICTs include all communication devices including mobile telephones, internet, software systems, hardware, computing information services, multimedia, telephone, fax and electronic news.

2.4 Classical background of ICTs in teaching:

In education, as far back as the late 1987s, the concept like that of instructional technology was defined by Gagne (1987) as applied in education in two folds. Firstly, it was defined as the media intuitiveness of the communications uprising used for instructional purposes together with the classic classroom technology such as textbooks. Secondly, the instructional technology was also perceived as a systematic way of designing and evaluating the processes of learning and teaching to bring about effectiveness in the classroom instructions (Gagne 1987). According to Seels and Richey (1994, p.1), instructional technology is referred to "the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning" (p. 1). These definitions imply the adoption of both the device and theories in education to improve learning.

In line with the aforementioned context, Saettler (1990), defined educational technology as any form of devices that can be available for classroom teachers to use in instructing students in a more efficient and stimulating manner than using only the teacher's voice to lecture to students. Januszewski and Molenda (2008, p.2) also defined educational technology as "the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources." Based on these definitions, technology was seen as a device that supports the education of a student to solve a problem in class.

2.5 Classification of Technologies in Education

Lemke and Coughlin (2009), have grouped technology types into several groups which are engagement devices and these include interactive white boards (IWB) and classroom response systems (clickers). The second group includes gaming type of technology whereby videogames, simulations, modeling, augmented reality (AR) and virtual worlds are involved.

The third category of technology is the handheld technologies which cover mobile devices and calculators. The fourth category, according to Lemke and Coughlin (2009), includes those technologies involving instructional technologies like the computers for students, virtual learning platforms, data visualization, analysis tools, computer assisted instruction (CAI) and educational television. On the other hand, Ruhela (2003), asserted that technology has been divided into software technology which is of interest to teachers and teacher trainers. The hardware technology which is known in educational institutions has not yet been introduced in schools. The systems analysis technology is used in education and in the analysis of the work of highly sophisticated educational institutions.

Isman and Dabaj (2003), stated that technology is divided into three categories namely, audio visual technologies which include televisions, videos, compact discs, film reels, video cameras, radios, tapes, overhead and slide projectors. Computer technologies as another category include windows, DOS, PowerPoint, word, excel, scanners, digital cameras, CD-ROM, data show and multimedia equipment. Last was the category of internet based technologies which include the use of internet, webpage construction, internet cameras, teleconferences and search engines (Isman & Dabaj, 2003).

In another study by Isman, Caner and Yarata (2007), educational technology tools are divided into four categories: the classical technology, modern technology, computer technology and laboratory technology. The classical technologies in education involve the use of things such as the blackboards and textbooks. Modern technology involves using the devices such as PowerPoint. The computer technology involves the use of technologies such as blogging, podcasting and social networking devices. Laboratory technology mostly puts emphasis on the use of laboratories that involves carrying out experiments.

2.6 Benefits of using ICTs in education

Despite quite a number of classes of technology, it is clear that technology has a major impact in our daily lives. These various classes benefit people of all ages. As it can be observed today, people are always alert and abreast with current issues due to ICT. The use of ICT in education has proven to be very beneficial. Tella and Oyedeko (2010), concur with this by explaining that the use of ICT contributes to the positive performance of learners. According to Tella and Oyedeko (2010), teachers that used ICT to teach a particular course have a strong perception that ICT contributes a lot to the performances of pupils. These teachers also have a perception that ICT contributes a lot to performance irrespective of gender. Conoley, Croom, Moore and Flowers (2007), alleged that developing technologies such as audience response systems show a promise to improve students' achievement and having positive impact on the classroom environment. On the other hand, Koch, Townsend and Dooley (2005), affirm that certain courses can be taught effectively as web based courses. The benefits of ICT cannot be overemphasized. Quite a number of studies concurred with Tella and Oyedeko (2010), Conoley et al. (2007), and Koch et al. (2005). Based on their arguments, the following benefits have been drawn:

- The use of PowerPoint in teaching helps the students to organise the information, enhances students' attention and note taking behaviour.
- Using ICTs give the weaker students a chance to communicate without depending on text.
- ICT increases access to learning materials and stimulates learners' motivation.
- Using ICT gadgets like iPods and MP3s can be utilized in academics to motivate learning, thus making lessons more enjoyable as such enhancing specific classroom content areas.

In Nigerian schools, it was found that ICT was highly beneficial as it makes teaching-learning processes interesting, enabling distance learning programmes and improving quality of education (Haastrup & Ajayi, 2009).

In Botswana, it has been revealed that "ICT improves innovation, service delivery, efficiency, education quality, productivity and overall development efforts and initiatives." This has also been affirmed by The Botswana's former Vice President, Mompati Merafhe when officially opening the 6th annual forum on E-government and extraordinary council meeting. He stated that "better ICT could also improve people's access to government, increasing participation in decision making process and improving public service." In Botswana, ICT is even used outside the education sector. It is used in the field of medicine in programs like Tele – medicine whereby practitioners communicate with their cooperating partners from as far as India whilst still in Botswana (Voice Newspaper, 2012).

2.7 Challenges of using ICTs in education

Even if we have experienced/observed positive benefits of ICT, there are challenges that can be noted when it comes to the use of ICT. For developing countries like Botswana, ICT facilities are still not easily accessible. Some places are far from developments and the teachers in these areas are found to be lagging behind or reluctant to use ICT in teaching. This is verified by Miller, Murphrey and Roberts (2009), by stating that while teachers have access to technology tools they are also late adopters or laggards while students are innovators or early adopters. The fact that teachers take time to adopt technology while students are fast enough is a challenge in the education system. In addition, ICT adoption is faced with challenges such as irregular power supply, shortage of computer trained teachers, high cost of purchasing computers in schools, limited facilities to support full application of ICT and lack

of funding (Haastrup and Ajayi, 2009). Limited pedagogic and ICT skills of teachers in school can be barrier to the use of ICT in teaching (McGrath & Zhiwen, 2011).

According to Kotrlik and Redmann (2009), teachers in Louisiana have in the past five years increased adoption and use of technology in teaching but have a problem of accessing the technology they need to use. According to Alston, Miller and Williams (2003), teachers in North Carolina and Virginia have identified cost of equipment and software as the greatest barriers to integrate technology in the teaching of Agriculture.

Mumtaz (2000) indicated that the challenge in the integration of ICT in teaching and learning process was also dependent on the teacher's beliefs, perceptions and attitudes. Factors such as time, access, knowledge and support acquired contributed to teachers' use of ICT in their professional development (Hutchison, 2012). Kotrlik and Redmann (2009), asserted that authority of education should develop models that would assist in the integration of technology in the teaching/learning in a faster and better way. Such models should take into consideration accessibility to resources, quality of software and hardware, incentives to change, support in the schools and national policies, teachers' commitment and background in formal computer training (Mumtaz, 2000).

In an attempt to overcome the barriers and improve the use of ICT, Williams, Sieborger and Terzoli (2007), identified that the use of ICT in education in developing countries can be enabled by providing sufficient hardware, appropriate software, technical training and continuous professional development of teachers and willingness of teachers to change. Czerniewicz and Brown (2005), asserts that in South Africa, those that are working in higher education should not only play a role of influencing the adoption of ICT, but they should recognize that integrating it in teaching and learning requires access to resources. This will then make plan differently and design sound educational interventions.

Bose (2004) stated that improving the integration of ICT in education needs one to address issues of standardization of curriculum and syllabus, computer awareness, strengthening of public network infrastructure and teachers' competency. Ololube, Ubogu and Egbezor (2007), emphasized that effective usage, integration and diffusion of ICT in distance learning placed policies in a balanced investment of education programmes. Lumande, Ojedoku and Fidzani (2006), thus recommended the use of opportunities for students to adequately access computers.

Another point to note on challenges of using ICTs in education sector in Botswana is gender stereotype. Schools in Botswana, including those at the junior secondary level operate in a social cultural context that is inherently gendered. A case in point is the stereotypical pattern in enrollment in subject areas such as Design and Technology, Computer Studies and Home Management and Home Economics, where boys are encouraged historically to do Design and Technology and Computer Studies, while girls do Home Economics/Management (Chipeta, Mazile & Shumba 2000). Researchers have also identified gender stereotyping in other subjects such as Science, Social Studies, English and Setswana (Motlotle, 1989; Mannathoko, 1999). Often, in the gender stereotypes, these curricular offerings reveal themselves in the pictures and languages used in teaching materials and daily interactions. Mannathoko (1999), has shown for instance that pictures in Science based textbooks reinforce the image that natural science careers such as medicines, engineering and geology are for males. Whenever a generic term is needed, Sugino (1998) found that use is often made in textbooks, including those used in information technology, of the masculine as the proper form.

In addition to the above presented arguments, Alha and Gibson (2003), stated that gender stereotypes are established in schools. Career fields such as engineering and ICT are described as male oriented fields; Alha and Gibson (2003), further explained that career

advisors and visits from universities have been found to have influenced career choices of students. As a result of these influences, there have been a small number of female students pursuing engineering and ICT related courses compared to males.

2.8 Computer aided instruction (CAI) and performance

Computer aided instructions in this context denotes the use of computer devices to enhance learners understanding in the teaching and learning environment. The use of such devices has been found to improve learners' performance as compared to the conventional method. A study by Mahmood and Mirza (2012), on the effectiveness of CAI in Urdu language for secondary students' achievement in science, revealed that students who received CAI instructions showed significantly better achievement than those using the traditional methods. The thesis therefore is that the use of CAI instructions affects all science based subjects, including Agriculture. However, various studies looked at computer aided instructions and performance according to gender, attitude and frequency of computer use.

2.9 Gender and Performance

Gender differentiates between what is male and female. It has been found that there is no effect on the achievement by students based on gender (Sharaideh, 2011). In agreement, Iravani and Delfechresh (2011), explained that there was no significant difference between the boys and girls in terms of achievement in science after treatment, thereby indicating that the boys and girls were equally affected by CAI.

In a study on gender and social facilitation effects on computer competencies and attitudes towards computers by Corston and Colman (1996), it revealed that male students performed better than female students on a computer based task by 50% of the average amount of time on target. Also, according to Leder and Vale (2004), girls were found to view the computer based

lessons less favorable than boys. On the other hand, boys believed that computers contributed to their experiencing pleasure in lessons, thereby making Mathematics relevant to them.

Velazquez, Joyce and Derby (2009), explained that young European females are held back from venturing into ICT studies by stereotyped thinking. This stereotyped thinking is attributed to a number of reasons; lack of support by role models - it is explained that girls do not have support from role models, stereotyped views that ICT field is mainly suitable for men. Velazquez et al. (2009) further explained that girls dropped out of ICT studies because they do not have a clear understanding of what ICT jobs entail.

In their views, Velazquez et al. (2009), explained that there is under representation of women in ICT. This is attributed to the fact that teachers and parents are poorly educated about what ICT entails (Velazquez et al., 2009). In Britain, girls were found to enjoy using ICT. They were found to have a lot of interest and had similar skills and knowledge when compared to the boys. As they grow older or venture into job world, the number of girls drops. According to Velazquez et al. (2009), this goes back to the issue of stereotype. The girls' role models see the field of ICT as more appropriate for men. Female teachers have less confidence of girl's ability to take jobs such as system engineers and software developers. What Velazquez et al. (2009), appreciated was that even if girls do not take jobs along ICT field, they enjoy the subject and have solid academic prowess. In their views, nurturing this enjoyment of the subject may bring positive change which can eventually lead to change of attitude towards taking jobs on ICT fields.

2.10 Attitude and performance

Attitude and performance have been found to influence an individual behavior in one way or another. In a study that compared the attitudes of men and women about volume of technology in making users more productive for university business communication courses, it was

indicated that women had a more positive attitude and were comfortable in using computers than men (Ray, Somunen & Harris 1999). Baser (2013), explained that there was a positive relationship between students' attitudes and their achievement in programming. Larbi-Apau and Moseley (2012), further revealed that the teaching/academic staff in some universities has a high and positive attitude towards computer technology and ICT. This positive attitude has also been linked to improving job performance.

In addition, Aydin (2013), found that although teachers lacked technical support and had little knowledge about software, they had positive perceptions of computer integration and attitudes towards computer use. There was also an appreciation by the students on the use of internet for homework when using online work sites (OHS) (Altun, 2008). Learners had positive attitude towards this process of doing homework. Achievement rate was observed to have improved as a result of computer instruction. Kenar, Balci and Gokalp (2013), explained that students had positive attitudes when they used technology even though there was no positive effect on their performance. Chen and Chen (2012), also indicated that students had positive attitude towards learning science with computer aided instruction.

Computer aided instruction using visual basic computer software has also been found to have an effect on students' attitudes towards the learning of Biology. This method has also been found to increase the performance of students in Biology (Sharma and Kaur, 2013).

2.11 Frequency of computer use and performance

Senkbeil and Witter (2008), did a study to find out if students' use of computers at home is related to their performance for 15 year old German students; the results revealed that the time the students spent using computer did not have any effect on their academic performance in Mathematics. However, there was an effect only on a small group who used computers for problem solving activities. Frequent use of computers has been found to have an

effect on performance. According to Padma and Vidyhageetha (2012), students who owned computers performed better than student without computers. This was shown on the study carried on students who owned computers and performed better than students without computers. O'Dwyer, Russel, Bebell and Tucker-Seeley (2005), further confirmed this by stating that students with greater frequency of technology use at school had higher total English/arts test scores and higher counting scores.

2.12 ICT in education

According to Okorie et al. (2005), technology enhances teaching and students' learning in the classroom. Thus, teachers in schools are encouraged to use the technology in their delivery processes to enhance students' performance. Computers and related technologies have become popular in education. Where these gadgets have been used particularly for teaching to teach science-based subjects, results have been found to improve. It has been associated with improving students' attitudes towards learning and achievement in academics (Akçay et al., 2006; Moosavi, 2009; Basturk, 2005).

In Florida for example, access to computers was found to be fairly good, with computers located in the classrooms or in mobile carts, serving the classrooms. When it comes to high school, computers were located more in career technical or general education laboratories than in regular classrooms.

According to Santipaporn (2010), in the year 2008 in Thailand, the ratio of students per computer was 14:1 in primary schools, 8: 1 in vocational institutions, 11:1 in higher education and 100:1 in non-formal education. The author further stated that the proportion of educators in higher education was 3: 1, 5: 1 in vocational institutions, 10:1 in primary schools and 12:1 for non-formal education. Furthermore, computer courses are taught in secondary and higher secondary level as optional subjects. The government has initiated a project through which it

will provide computers, printers and other accessories to ten thousand (10,000) selected rural secondary and government aided higher secondary institutions in Bangladesh. In Bihair, all the government and government aided secondary and higher secondary schools are provided with basic computer literacy courses through a computer lab with broadband internet connectivity. Intensive computer training of higher school teachers will be done; school and college curriculum will focus on soft skills like communication skills and personality development. Government will identify knowledge parties to develop the content for the new curriculum.

In African countries, there seems to be low level of provision of ICT equipment and facilities to schools. As indicated by Olaleye and Adeyemi (2010), in Nigeria for example, the states were still not fully ready to integrate ICT in schools. Although the strategies were developed to achieve the objectives of the Nigerian National Policy for information communication and technology, some of those strategies included among others making ICT compulsory at all educational institutions, and the development of curricular for all levels of education including using ICT in distance education and by that promoting training in the line of ICT (Agbetuyi & Oluwatayo, 2012).

In Ghana, the government came up with an ICT, in education policy whereby they aimed at providing ICT infrastructure within the education sector, facilitating equitable access to all students and community, integrating ICT into the curriculum and among other things developing the content for open distance and electronic learning (e-learning) (Acquah, 2012).

In Botswana, ICT in schools, Thutonet project was aimed at connecting the secondary schools through internet, and each school computer laboratory, which houses 15 to 20 computers in secondary schools, was set up in some primary schools (International Information Management Corporation, 2012). Under this project, schools seem to implement principles of Maitlamo National policy. The policy allows the participation of all the stakeholders including government and private sector to be engaged in the development of ICT in the country. The

country also developed telecommunication infrastructure like the Sesigo project 2011, with a fixed line and fibre optic infrastructure which provides a real telephone lines, mobile telephone, radio, television and internet to communities. In the education sector, the University of Botswana has some several ICT initiatives such as the development of an e-learning environment that promotes conducting research, development of UB ICT policy (International Information Management Corporation, 2012).

The East African countries have also made some strides in including ICT in the national curricular. In Uganda, the primary school level has acquired the technology to use to produce teaching materials and there is also the introduction of computer awareness programme at primary teacher training level so that newly qualified teachers are equipped with ICT curriculum for both primary and secondary schools. In Uganda, Computer Science is taught as a separate subject in secondary schools and it is examined in the country's national examining body at the end of 4 years of lower body secondary. In Rwanda, the government has made an investment by increasing the availability of ICT in primary and secondary schools (Wamakote, 2010). In Kenya, it is offered as an optional subject in secondary schools.

In Tanzania, the country adopted NICT policy in 2003 that recognized new avenues in applying ICT to enhance education, including curriculum development and teaching methods among others. This policy also called for the development of a nationwide education system, teaching of ICT at all levels of education and training, including the use of ICT to improve the quality of delivery of education (Tanzania ICT policy for basic education, 2007). This policy further states that the general status of ICT in basic education is that few schools have computers or internet access. Most schools lack electricity; most schools have radios but very few televisions. The ministry has also implemented various radio programmes for primary and secondary education. There is also limited distribution of telecommunication landlines more especially in the rural areas, but on the other hand, there is rapid and more use of mobile

phones. The ministry has also established an ICT curriculum in primary and pre-primary education known as Teknolojia ya Habarina Mawasiliano (TEHAMA). The limitation of this curriculum is that it is taught only in schools that have computers or internet access and electricity.

2.13 Summary

Information and communication technology plays a very vital role in enhancing learners' performance. Quite a number of studies have shown that the use of ICT in education is very useful (Tella and Oyedeko, 2010; Conoley et al., 2007). Studies show that the use of ICT gives teaching-learning process a new face. Improved quality of education and distance learning programmes are some of the things identified as beneficial as a result of using ICT gadgets.

It has been observed that there are also challenges in using ICT in education. The first one is lack of developments, whereby facilities are not easily accessible; far places from developments are outlined as contributory factors to poor ICT facilities utilization by teachers. Socialization is also identified as another factor whereby parents, teachers and learners themselves associate the use of ICT with males than females. The use of ICT improves/enhances performance through computer aided instruction. Gender showed a slight difference with boys doing better than girls. Corston and Colman (1996) and Leder and Vale (2004) found girls to be less interested in computers than boys.

According to Atuahene (in Mokgosi and Jotia, 2013), there are no computers in primary schools in Botswana; where they are available, the learner- computer ratio is very high. Most of the teachers have not received adequate training on computers and electricity remains a critical challenge. There are some possibilities that some teachers and learners are lagging behind when it comes to using ICT. Computer aided instruction is not utilized in some of the

schools. Therefore, it is very vital for computer usage to be encouraged or infused into the curriculum. Currently, there is a gap in literature regarding research in Botswana, in relation to computer aided instruction. This study aims to fill in this gap.

CHAPTER 3

METHODOLOGY

3.1 Chapter Overview

The purpose of this quasi-experimental investigation is to determine the influence of a computer aided instructional (CAI) method on the performance of primary school pupils in Agricultural Science. This chapter presents the experimental procedures used in conducting the investigations; the design of the study, development and packaging of the instructional materials (CD-ROM technology), selection of the target population, sampling, development of survey instrumentation for data collection, development of the test instruments, validity and reliability procedures, data collection, ethical considerations and data analysis.

3.2 The Design of the Study

This study was a quasi-experimental research. The design of the quasi experiment was the pre-test - post-test with the treatment and control group. A quasi experimental design is the type of research that is used when the researcher wants to find out if a particular intervention has an effect on the participants (Silver-Paucilla, Brown, Overton & Steward, 2011). This design is used when the research has got no control over the participants in either treatment or control groups (Ary, Jacobs & Asghar, 2002). According to Gay and Airasian (2003), the classes involved in the study were randomly assigned to the two groups; the control and experimental groups, followed by a pre-test to the two groups in the study. A treatment in the form of Computer aided instructional method using a CD-ROM technology was given to the experimental group. The control group was taught using the traditional lecture method. Both groups, which received the treatment and one which received no treatment, were given a pen

and paper test in the same room and the same environment. The pen and paper test written by the groups was graded by the researcher. Figure 1 presents the lay out for the research design as used in the study.

Figure 1: Non- randomised control group pre-test -post-test control group

GROUP	PRE TEST	INDEPENDENT VARIABLE	POST TEST
E	Y_1	X	Y_2
C	Y_1		Y_2

Adapted from Ary, D., Jacobs, L. C., & Asghar, R. (2002)

Key:

E =Experimental group given computer based instruction;

C = Control group taught using the traditional lecture method;

Y1 = Pre-test given to all the classes at the same time

X = Independent variable/treatment used in the study

Y2 = Post-test given to all classes at the same time

3.3 The target population

The study targeted Kgafela Primary School in Mochudi, Kgatleng District. In particular, standard five classes were utilized for the purpose of data collection. The targeted groups were standard five classes purposively selected since Agriculture is only done in the upper classes at primary level. This group of pupils did not do Agriculture at lower levels, as such prior knowledge in Agriculture could not have an effect on their performance. The standard six and seven pupils could not be used in the study as they are already prior knowledge on Agriculture. The total population of all the pupils used in the study from all the schools was 81. Two classes were used in the study. This was because the school had twenty computers enough to be used by a whole class with active internet facility. In addition, the

facility was installed with various software and interactive smart board to facilitate teaching and learning through the use of a CD-ROM package.

3.4 Sampling

Looking at the nature of the study, all the targeted population of the study was used and therefore purposive sampling was employed. Purposive sampling is whereby the researchers intentionally choose the cases to be included in the sample on the basis of their judgment of possession of a particular characteristic that is of interest to the researcher. That is, the researcher builds up a sample that is satisfactory to their specific needs (Cohen, Manion and Morrison 2007). According to Cohen et al. (2007), although this type of sampling might be representing the researchers' needs, it does not represent the wider population. On the other hand, Gay and Airasian (2003) have described purposive sampling as the type of sampling whereby the researcher selects a sample based on experience and knowledge of the group to be sampled; they further stated that the weakness of this type of sampling is inaccuracy in the researcher's criteria, which result in sample selections. The participants in this study were chosen on the basis of being members of the classes in the targeted schools. This type of sampling then leads to the target population being equal to the study sample. The intact classrooms at Kgafela Primary School were randomly assigned either to a treatment or control group. The random assignment of pupils was carried out in the following manner. Since there were two classes at Kgafela Primary School, the teachers who taught the classes were used to select the classes to either treatment or control group.

3.4.1 Sampling procedures

In order to have a control and treatment groups, the researcher randomly selected the subjects using the following process; two small paper pieces of equal sizes were cut. On one

paper, the letter C was written to represent control group class and on the other paper, the letter T was written to represent treatment group class. All the small pieces of paper were then folded in the same pattern and placed in a small box. The box was then shaken to mix the folded papers. The teachers were then allowed one by one to pick one folded piece of paper without looking into the box. After picking the papers from the box, the teachers were allowed to unfold the papers. The teacher that picked the paper with letter C indicates that teacher's class was used as a control group class and the teacher that picked the paper with letter T indicates that teacher's class was used as the treatment group class. The treatment group received the computer aided instruction through the use of the CD-ROM (compact disc read only memory). The control group class was taught using the traditional teaching method. The sample sizes were determined by the number of pupils enrolled in each of the classes that participated in the study. The groups at Kgafela Primary School were 40 and 41 pupils in the control and experimental, respectively. The total number of the pupils who participated was 81.

3.5 Data collection

A researcher test instrument was prepared to assess pupils' achievement on the topics taught using different methods in the classroom. The test items were constructed specifically for this study from Agriculture topics taught to pupils. The test was written by the two groups and marked by the researcher using a marking key provided. Marks obtained from this test were used in the study as data set. At the end of the experiment, pupils were asked to complete an attitude test based questionnaire to gather their views and opinions regarding the use of technology in classroom teachings. The mean test scores for individual pupils were recorded in a Statistical Package for Social Science, Version 21 (SPSS 21) file for analysis.

The researcher obtained the permission from the Ministry of Education and Skills Development (Appendix F) to be able to gather data from primary schools. The permission was

referred to district or regional education offices which were in charge of schools involved in the study to be aware of the importance of the research. The second letter was written to parents of pupils who were involved in the study since the study involved human subjects who were below the age of 21. The parents were also made aware that the children's involvement was voluntary and if they felt like withdrawing from the study they should feel free to do so. The letter also assured the parents of the children that respect for privacy is at the heart of the researcher (Ary et al., 2002).

3.5.1 Instrumentation

Data were gathered through the use of two measuring instruments: knowledge testing instrument (achievement test) and a questionnaire.

3.5.2 Development and packaging of the CD-ROM

The Compact Disk – Read Only Memory [CD-ROM] classroom instructional technology was designed by the researcher with the help of the fourth year student from Botho University. To compile the instructional materials and packaged into the CD-ROM, the researcher obtained the text materials from the Botswana upper primary school syllabus available online which was then re-typed. The re-typed text materials were organized into units with objectives, pictures and practice questions to be studied by pupils. The modules were; introduction to Agriculture, farm tools, biotechnology, soils, crop husbandry and animal husbandry. The researcher was guided by the supervisor. Each topic was created into a reading text illustrated with the help of pictures to capture the interest of pupils reading the text. The text was divided into: (i) description of the concept, (ii) examples of each phenomenon described and (iii) practice questions to make pupils involved. The CD-ROM structure comprised hyperlinks to be interactive.

3.5.3 Attainment tests

Two tests were designed by the researcher comprising test items based on the objectives of the syllabus pertaining to the topic taught during the experiments. The aptitude test was designed to gather data prior to the treatment on the knowledge level of pupils. The second test items were designed by the researcher to gather data based on the subject matter taught in the classroom.

3.5.4 Questionnaire

The researcher designed a survey instrument to check the attitudes of pupils after being exposed to teaching using the computer aided instructional method. This was to obtain information about all the pupils used in the study and solicit their views regarding the use of the computers in teaching and learning of Agriculture.

Another tool that was used to collect data was a questionnaire. It was administered after the post-test to both the control and the experimental group at the end of the experiment. According to Cohen et al. (2007), a questionnaire is used for collecting survey information so that it can provide data and can be administered without the presence of the researcher. The questionnaire was directly administered to the learners. Ary et al. (2002) suggests that it is advantageous to directly administer questionnaires because one gets a high response rate; costs are also low because the researcher is available to provide assistance. Even though a questionnaire can be administered in the absence of the researcher, as stated by Cohen et al. (2007), in this case, the researcher was available to provide assistance, as suggested by Ary et al. (2002).

The questionnaire covered the introductory remarks about the research, the objective of the study and the information on the rights of the participants to withdraw or not complete the particular items in the questionnaire (informed consent). The second part of the questionnaire

covered the demographic information of the participants, the third part was on the opinions of the participants on the use of computers, the other part was on how the participants view the use of computers in teaching and lastly it covered the information on ownership of various ICT tools and gadgets by parents at home. The sections on the opinions and views of the participants were responded to by either positive or negative (Agree or Disagree) statements.

3.6 Instrument Validity

Students' achievement tests were assessment by examination and testing professionals in the department of Agricultural Economics, Education and Extension (AEE). The professionals assessed the instrument's coverage of the objectives in the syllabus, the understandability of test items formulated, and objectivity of the items. The specialists were also asked to assess the modified likert-type survey instrument to establish the adequacy of the instrument in gathering data from learners about the technology used. Suggestions gathered from the agricultural education specialists were used to modify the items for gathering data.

3.7 Instrument reliability

The test was administered to a standard five pupil at Boitumelo Primary School in Sebele as pilot test. The results obtained from the pilot study were used to modify the tests and the materials prepared for teaching. Some pictures were added as a result of the pilot study. The outcomes of the pilot study made the researcher to change the type of questions which were initially formulated in the questionnaire. A Cronbalch's alpha was computed and its value was 0.89 on an attitude scale and mean for the test score administered was 75%. Based on these results, the instruments were found to be suitable for data collection in line with Gay and Airasian (2002).

3.8 Data analysis

The researcher's personal computer was used to analyse statistical data. Statistical procedures employed were selected from the latest version of the Statistical Package for Social Sciences, Version 21 (SPSS, Version 21). Statistical analysis plan is as follows.

Objective 1

To describe the demographic characteristics of the pupils involved in the study. This objective was analysed using the descriptive statistics such as frequencies, percentages, mean and standard deviation. The SPSS version 21 was used for analyses.

Objective 2

To determine the effect of the computer aided instruction on the performance of pupils in primary Agriculture.

This objective was analysed using paired t-test to separate the means based on the test pre-test and post test scores.

Objective 3

To determine if gender has an effect on the performance of pupils in agriculture when using the computer aided instructional method. In analysing this objective, the mean separation technique using the independent T-test was used to compare the means of the post test scores in Agriculture and gender of the primary pupils who were in the experimental group in this study.

Objective 4

To establish if there is a relationship between the pupils' attitudes to computer aided instructional method and performance in Agriculture. This objective was analysed using the Pearson correlations to find if there is a relationship between the pupils' attitudes towards computer aided instructional method and performance in Agriculture.

Objective 5

To determine if accessibility and frequency of use of computers at home/school affects performance of pupils in Agriculture. In analysing this objective, the mean separation technique of using one way analysis of variance was used.

3.9 Ethical Considerations

The researcher obtained permission from the Ministry of Education and Skills Development to conduct the study in the selected primary schools. The permission in the form of a letter was issued by the Gaborone regional education office which was the custodian of the schools involved in the study. A letter was also written to schools involved in the study and parents of children were involved to get their consent for their children to be part of the study. Both parents and children were informed about the importance of the study, likely outcomes of the study as well as the psychological risks in the procedures. The parents were also made aware that the children's involvement in such a study was voluntary and should they feel like withdrawing from the study, they were free. Stakeholders were assured of the confidentiality of the data gathered from schools participating in the study and its usefulness in the education system of Botswana (Ary et al., 2002).

CHAPTER 4

RESULTS

4.1 Chapter Overview

The main aim of this study is to determine the effect of computer aided instructional (CAI) method on the performance of standard five pupils at Kgafela Primary School in Agriculture. This chapter presented the analysis of results and interpretations. Simple descriptive statistics in the form of frequencies and percentages were used. Other statistics used were Analysis of Variance (ANOVA) to compare means, and Pearson correlation values to establish relationships. The frequencies and percentages were used to describe the demographic information for pupils who participated in the study responding to objective # 1. To test the null hypotheses formulated in chapter one at 0.05 alpha levels, the paired T-test, independent T-test, and Pearson correlations were calculated. In addition, a one way ANOVA was used to respond to the second objective to compare means on the experimental post-test scores and frequency of use of computers at school. Means and standard deviations were used to compute the attitudes of pupils towards the use of CAI in learning Agriculture in schools. The purpose of this experimental investigation was to determine the influence of a computer aided instructional method on the performance of primary school children in Agriculture. The specific objectives include:

1. To describe the demographic characteristics of the pupils involved in the study.
2. To determine the effect of the computer aided instruction on the performance of pupils in primary Agriculture.
3. To determine if gender has an effect on the performance of pupils in Agriculture when using the computer aided instructional method.

4. To establish if there is a relationship between the pupils' attitudes to computer aided instructional method and performance in Agriculture.

5. To determine if accessibility or frequency of computer usage at home/school affects performance of pupils in Agriculture.

The null hypotheses tested in the study are as follows:

Hypothesis 1

Computer aided instructional method does not significantly influence students' performance in Agriculture.

Hypothesis 2

Gender has no significant influence on the effect of computer aided instructional method on students' performance in Agriculture.

Hypothesis 3

There is no significant relationship between students' attitudes to computer aided instructional method and performance in Agriculture.

Hypothesis 4

Accessibility or frequency of computer usage by pupils at home/school does not significantly affect their performance in Agriculture.

The results of a pilot test conducted at Boitumelo were also presented in this chapter. These results were used to compare the performance in the two schools so as to inform stakeholders on the role and importance of computer aided instructions. Perceptions of the teachers toward the CAI for the two schools were also compared.

4.2 Results Presentation

4.2.1 Objective 1: Analysis of Students' Demographic Information

Tables 1 and 2 presented the demographic information for pupils from two primary schools which participated in the study to answer objective number 1 on personal characteristics. The results showed that in total, there were 22 from Boitumelo Primary School which participated in the piloting and 81 pupils from Kgafela Primary School which were used in the final study. The tables also showed that in total, there were 59 boys and 44 girls involved in this quasi- experimental research study. Boitumelo was used in the experiment for trial and testing the technology, while Kgafela Primary School was used in the final study.

Table 1 showed the personal demographic characteristics of children from Boitumelo Primary School, identified as school (pilot school). The results showed that close to 55% of the children who participated in the pilot study were in the treatment group while 45% were in the control group. At least 59% of the children in the piloting were boys and 41% were girls. 95.45% of the children were in the age range of 10 to 13 years old and 59% of the children did not attend pre-school. The children studied in this school were also asked to indicate whether or not their parents or guardians had computers, video games or cell phones at home. 55% of the children indicated either parents or relatives with computers at home, 63.64% of the children indicated the non-availability of video games. 86.36% of the children indicated ownership of cell phones by parents and/or relatives. The results showed that parents of children in the pilot school (Boitumelo Primary School) were technology compliant and therefore implying that children studied should be assumed to be aware of technology usage.

Table 1: Demographic Characteristics of Pilot School

Characteristics	Variables	Frequency	Percentage (%)
Pupils	Control group	10	45.45
	Treatment group	12	54.55
Gender	Boys	13	59.09
	Girls	9	40.91
Age in years	≤10 Years old	1	4.55
	10-13 Years old	21	95.45
	≥13 years old	0	0
Attended pre-school	Yes	9	40.91
	No	13	59.09
With computers at home	Yes	12	54.55
	No	10	45.45
Availability of video games at home	Yes	8	36.36
	No	14	63.64
Parents or relatives with cell phones	Yes	19	86.36
	No	3	13.64

Table 2 presents the demographic information for pupils at Kgafela Primary Schools which participated in the final quasi-experimental study. The results in Table 3 answered objective # 1 of the study to describe the personal characteristics of pupils who participated in the actual study in terms of their gender, age, parental computer ownership, videos, phones and usage. The results showed that in total, there were 81 primary school pupils involved in the actual experimental research study; 46 boys and 35 girls. Table 2 also showed that 51% of the children at Kgafela Primary School participated in the control group while 49% children were in the treatment group. Approximately, fifty- seven (56.79%) of the children were males and forty-three percent (43.21%) were females; ninety eight percent (97.53%) were in the age range between 10 to 13 years old and more than half (55.56 %) of the children in the study did

not attend pre-school prior to enrolling at Kgafela Primary School. The children studied were also asked to indicate whether or not parents or guardians had computers, video games or cell phones at home. Fifty three percent (53.09%) of the children as shown in Table 2 indicated non- availability of computers at home by their parents, two-thirds (66.67%) indicated availability of video games and approximately eighty two percent (81.48 %) of the children indicated parental or relatives' ownership of cell phones or mobile phones. The fact that the proportion of parents as indicated by children who owned computers at home (46.91%) was smaller than the percentage of children who indicated that their parents had no computers (53.09%) may not be implying that children would be positive nor negative about computer usage in school.

The conclusions drawn from the demographic characteristics of the pupils in this experiment are therefore that generally, parents and guardians of these children are technology compliant. The majority of the parents had mobile phones; this showed that they were positive about technology in their homes. The second conclusion drawn from this, regarding children, would be that majority of the children were likely to be enthusiastic and early adopters of the different technologies owned by parents, including the internet for communication, video games for their entertainment and learning of some sort. Thus, parents of this nature would always hope that access to technology may help to improve their children's educational prospects, although many may be unsure of how to guide their children towards valuable technologies, and may be concerned about some online technologies. In schools, pupils increasingly rely on online educational resources and the internet for the existence of the different technologies (Livingstone and Bober, n.d.). Both the piloting and the final study showed that parents and guardians were technology compliant, thus positive about the use of technology.

Table 2: Demographic Characteristics of Experimental School (N=81)

Characteristics	Variable	Frequency	Percentage (%)
Pupils	Control	41	50.62
	Treatment	40	49.38
Gender	Boys	46	56.79
	Girls	35	43.2
Age in years	≤10 Years old	1	1.23
	10-13 Years old	79	97.53
	≥13 years old	1	1.23
Attended pre-school	Yes	36	44.44
	No	45	55.56
With computers at home	Yes	38	46.91
	No	43	53.09
Availability of video games at home	Yes	54	66.67
	No	27	33.33
Parents or relatives with cell phones	Yes	66	81.48
	No	15	18.52

4.2.2 Objective 2: Effect of computer aided instruction on performance

In an effort to address objective 2 of the study, four hypotheses were formulated which guided the researcher on the effects that the computer aided instruction (CAI) has on performance of pupils in Agriculture. The results on each of the hypotheses tested are presented as follows;

Hypothesis 1: Computer aided instructional method does not significantly influence students' performance in Agriculture

In testing this hypothesis, the mean separation technique using the paired T-test was used to compare the means for the pre-test and post-test scores in an attainment test for agriculture administered to the primary school standard five pupils who were in the

experimental group in the study. Table 3 presents the means for the pre-test and post-test scores for the Agriculture test given to standard five pupils at Kgafela Primary School who were in the experimental group of the study. The mean separation technique used the paired sample T- test to compare the means of scores obtained from two tests given to the group. The results showed that the observed mean difference was -12.12500 and since the value of t is -5.008 at P<0.005, the mean difference (-12.12500) between the pre-test sores obtained from the pre- test and the post-test scores from an attainment test given to the experimental group was therefore statistically significant. As shown in Table 3, statistical significance of 0.000, which is less than 0.05 as set out in the experiment, means that hypothesis # 1 was therefore rejected. Therefore, it can be inferred that the CAI method of teaching had an effect on the performance of pupils in Agriculture.

Table 3: Paired sample T-test for the experimental pre-test and post test scores

Parameter	Mean	SD	Std. Error mean	95% confidence interval		t	df	Sig.(2-tailed)
				Lower	Upper			
Pre-test-post-test	-12.12500	15.31245	2.42111	-17.02216	-7.22784	-5.008	39	0.000

Hypothesis 2: Gender has no significant influence on the effect of computer aided instructional method on students' performance in Agriculture.

In testing this hypothesis the mean separation technique using the independent T-test was used to compare the means of boys and girls on the post-test scores of the primary pupils who were in the experimental group in this study. Table 4 shows the outcome of the mean separation technique using independent T-test to compare participants' gender and performance to find out if gender affects performance. The results showed that the observed mean difference in performance between the boys and girls was 1.54731. Based on these

results, the value of t, which is 0.233, was not statistically significant (which is greater than 0.05) as set, and implied that the hypothesis was therefore not rejected. Based on the results, it can therefore be inferred that gender did not have any effect on the performance of pupils in Agriculture. This means that both boys and girls had an equal amount of contribution to the performance mean of pupils in Agriculture.

Table 4: Independent sample T-test for the experimental post test scores and gender

Parameter	Levene' test for equality of variances		t-test for equality of means						
	F	Sig	t	df	Sig	Mean difference	SD error diff	95% confidence interval of the difference	
								lower	upper
Post-test equal variances not assumed	1.507	0.227	0.233	38	0.817	1.54731	6.62862	-11.87162	14.96625

Hypothesis 3. There is no significant relationship between students' attitudes to computer aided instructional method and performance in Agriculture.

In testing the hypothesis 3, the Pearson correlations were used to establish the relationship between the pupils' attitudes towards CAI method and performance in Agriculture. Table 5 presents the results of the relationship between pupils' attitudes towards CAI and their performance. The Pearson correlations were used to relate pupils' attitudes towards computer aided instruction and performance. The Pearson correlation gave an $r = 0.101$ which was a weak positive correlation, indicating that for a single unit of increase in attitude there was an equal single unit of increase in students' performance in Agriculture. The results can be interpreted to indicate that there was a weak, positive relationship between pupils' attitudes towards CAI and performance in the subject.

Table 5: Relationship between the pupils' attitudes towards computer aided instruction and performance

Parameter	Pearson correlation	Post-test	Attitudes
		1	0.101
Post-test	Significance		0.535
	N	40	40

Hypothesis 4: Accessibility or frequency of computer usage by pupils at home/school does not significantly affect their performance in Agriculture.

In testing hypothesis 4 the separation technique, using one way analysis of variance (ANOVA) was used to find out if frequency of use of computers either at home or school had an effect on the performance of pupils in Agriculture. Table 6 shows the outcome of a mean separation technique where a one way ANOVA was computed to compare participants' frequency of use of computers at home and performance in Agriculture. The analysis was conducted to find out if frequency of use of computers at home affects performance of pupils in Agriculture at school. The results in Table 6 showed that the observed mean difference in performance for frequency of use of computers at home was not significantly different. The value of F, which is 0.12, was not statistically significant since the computed statistical significance was found to be greater than 0.05, thus implying that the hypothesis was not rejected. One can therefore conclude that the frequency of use of computers by the pupils at home does not necessarily affect the performance of pupils in Agriculture through the use of a computer aided instruction at school. This means that the pupils may have been frequently using computers like playing computer games, using face book and twitter at home, not necessarily for academic purposes but for other purposes, and this does not help to improve pupils' performance. The use of computers at home does not necessarily guarantee one that he/she will use the knowledge and skills to pass at school.

Table 6: One way analysis of variance (ANOVA) for the experimental post test scores and frequency of use computers at home

Parameter	Sum of squares	df	Mean square	F	significance
Between groups	10.744	2	5.372	0.12	0.988
Within groups	16333.631	37	441.449		
Total	16344.375	39			

Table 7 shows the mean separation technique by using one way ANOVA to compare participants' frequency of use of computers at school and performance. The analysis was conducted to find out if frequency of use of technology at school affects performance. The results showed that the observed mean difference in pupils' performance for frequency of use at school was not significantly different. The computed value of F, which is -0.814, was not statistically significant and found to be greater than 0.05; thus, the hypothesis was therefore not rejected. Based on these results, it can be inferred that the frequency of use of computers by the primary school pupils at school does not in any way affect the performance of pupils in Agriculture through the use of a computer aided instruction. The result therefore informed the study that the fact that the pupils may have been frequently using computers at school and not necessarily for academic purposes has not helped them to improve performance in school in Agriculture lesson.

Table 7: One way analysis of variance (ANOVA) for the experimental post-test scores and frequency of use of computers at school

Parameter	Sum of squares	df	Mean square	F	Significance
Between groups	688.868	2	344.434	0.814	0.451
Within groups	15655.507	37	423.122		
Total	16344.375	39			

4.3 Summary of the Findings

The purpose of this study was to determine the effect of computer aided instructional method on the performance of primary pupils in Agriculture. This study was motivated by the fact that students were not performing well in Agriculture in the overall primary school leaving examinations compared to other examinable subjects in Botswana. Based on this background, the problem statement addresses the following questions: Does using technology in teaching Agriculture Science improve pupils' performance in primary schools? Does classroom instructional method matter in primary schools? Furthermore, will the primary school pupils in Botswana improve when taught using technology than those taught using the traditional classroom instructional methods? It was the nature of these questions that prompted this study. The following hypotheses were tested:

Hypothesis 1. Computer aided instructional method does not significantly influence students' performance in Agriculture.

Hypothesis 2. Gender has no significant influence on the effect of computer aided instructional method on students' performance in Agriculture.

Hypothesis 3. There is no significant relationship between students' attitudes to computer aided instructional method and performance in Agriculture.

Hypothesis 4. Accessibility or frequency of computer usage by pupils at home/school does not significantly affect their performance in Agriculture.

Data were collected through the use of a researcher prepared test instrument to assess pupils' achievement on the topics taught using different methods in the classroom. The test items were constructed specifically for this study from agriculture topics taught to pupils. The tests were written by the two groups and marked by the researcher using a marking key provided. Marks obtained from this test were used in the study as data set. At the end of the experiment, pupils were asked to complete an aptitude test based questionnaire to gather their views and opinions

regarding technology in classroom teachings. The data collected were then coded and entered into the social science statistical package (SPSS version 21) for analysis. The data were analysed using paired T-test, independent T-test, Pearson correlation and one way analysis of variance. The results revealed that the mean difference for the pre-test and post-test scores was highly significant for the computer aided instructional method as compared to the traditional instructional method. However there was no significant difference on gender and performance. There was also a weak positive relationship between the pupils' attitudes and performance in Agriculture.

CHAPTER 5

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Chapter overview

The main aim of this study is to determine the effect of computer aided instructional method on the performance of primary school pupils at Kgafela in Agriculture. This chapter focuses on the discussions of the results, summary, conclusion and recommendations. The discussions were based on the following hypotheses:

H_0 1: Computer aided instructional method does not significantly influence students' performance in Agriculture.

H_0 2: Gender has no significant influence on the effect of computer aided instructional method on students' performance in Agriculture.

H_0 3: There is no significant relationship between students' attitudes to computer aided instructional method and performance in Agriculture.

H_0 4: Accessibility or frequency of computer usage by pupils at home/school does not significantly affect their performance in Agriculture.

5.2 Discussion of Results

Generally, the study has revealed that the computer aided instructional method had an effect on the performance of pupils in primary Agriculture in Botswana. The findings revealed that the mean difference for the pre-test and post-test scores for the pupils in the experimental group is significant, showing that the computer aided instructional method had an effect on the performance of the pupils. This is consistent with the findings of Sharaideh (2011), Iravani and Delfechresh (2011) and Mahmood and Mirza (2012) that computer aided instruction improved students' achievement in national education in Jordanian schools, and had an effect on science

achievement of higher primary students of Ahwaz City in Iran and also that computer aided instruction had an effect in Urdu language for secondary school students in science, respectively. On the other hand, Schoemaker (2013) asserted that computer aided instructional method did not have any significant effect on students' achievement but low achieving students developed a positive attitude.

5.2.1 Gender and performance

The gender factor does not have an effect on the performance of pupils in Agriculture when using the computer aided instructional method. The results revealed that both boys and girls performed equally on the post-test scores in primary Agriculture. In this study, it was observed that there was no significant mean difference between boys and girls in terms of performance in Agriculture when using the computer aided instructional method. This is in line with the findings of Iravani and Delfechresh (2011) and Sharaideh (2011) that both boys and girls were equally affected by the computer aided instruction. Hence, gender factor does not have an effect on the performance of pupils. However, these findings differ with what Wintz (2009) found, that female students recorded significant results than the male students. In addition, in a study by Leder and Vale (2004), girls were found to view the computer based lessons less favourable than boys. On the other hand, boys believed that computers contributed to their experiencing pleasure in lessons, thereby making Mathematics relevant to them.

5.2.2 Pupils' Attitudes and Performance

There is a weak positive correlation between the pupils' attitudes towards the computer aided instruction and performance. The Pearson correlation was $r = 0.101$, indicating that for a single unit of increase in attitude, there was an equal single unit of increase in performance. This relationship although positive, is so weak, so much that it cannot be stated that

performance can be much attributed to the pupils' attitudes towards the computer aided instructional method. The findings are in line with Ray et al. (1999) and Baser (2013) who reported that when students were taught some courses using the computer aided instructional method, there were positive attitudes which were also associated with improved performance. These results therefore showed that when pupils are exposed to learning using ICT gadgets like computer, performance improves along with a change of attitude towards the instructional method.

5.2.3 Accessibility or frequency of use of computers at home and performance

The study has also revealed that accessibility to computers or frequent use of computers by pupils at home and school did not have any significant mean difference with performance. This therefore shows that when pupils use computers at home or school it does not necessarily mean that they are engaged in academic pursuits that will help them improve their performance. The same results have also been reported by other authors such as Padma and Vidyhageetha (2012) who asserted that pupils who owned computers at home performed better than those pupils without computers. This shows that when pupils use computers at home they may not be using them for entertainment purposes but for academic purpose which help them to improve their performance.

5.3 Conclusions drawn from the study

This study's intention was to determine the effect of the computer aided instruction on the performance of pupils in Agriculture. The findings have revealed that computer aided instructional method had an effect on the performance of primary pupils in Agriculture. It has also shown that when used to teach pupils in Agriculture, the computer aided instructional method enhances academic performance. Gender factor has also been seen not to affect

performance of pupils in Agriculture through the use of the computer aided instructional method. Both boys and girls were equally affected by the computer aided instructional method when used to teach Agriculture. A weak positive relationship between the pupils' attitudes and performance was also noticed, emphasizing that those attitudes did not strongly affect the performance of pupils in Agriculture. Accessibility to computers or frequent use of computers by pupils at home and school was also found not to have an effect on the performance of pupils in Agriculture. This shows that when pupils interact with computers either at home or school they were not necessarily using it for academic purposes, which might have improved their performance in agriculture but other activities like watching videos, playing games and chatting with others.

5.4 Recommendations

The following recommendations have been made based on the findings of this study.

i. That, a comprehensive experiment be conducted to cover more than two schools in different regions of Botswana. In addition to this recommendation, students should be encouraged to spend more time, use and practice test items prior to testing through the computer aided instructional method.

ii. The results of this study revealed that training and encouragement of teachers to use different computer aided instructional methods was crucial for the improvement of performance of pupils. Teachers' education becomes crucial to put them at an advanced level of their students in the classroom who are using technology daily through internet cafes.

iii. Other studies should be conducted to investigate the effect of different computer aided instructional methods on agriculture at junior and senior secondary school education levels.

iv. Technology infrastructure development in schools needs to be improved to give children an opportunity to learn how to use it at an early age.

v. Learning with computers should start at an early age so as to increase attitudes of young learners to the different computer aided instructional methods.

References

Acquah, B. Y. S. (2012). Status of implementation of the ICT curriculum in Ghanaian basic Schools. *Journal of Arts and Humanities (JAH), 1* (3), 27-37.

Agbetuyi, P. A., & Oluwatayo, J. A. (2012). Information and communication technology (ICT) in Nigerian Educational System. *Mediterranean Journal of Social Sciences, 3* (3), 41-45.

Akçay, H., Durmaz, A., Tuysuz, C., & Feyzioglu, B. (2006). Effects of computer based learning on students' attitudes and achievements towards analytical chemistry. *Turkish Online Journal of Educational Technology, 5* (1), 44-48.

Alha, K., & Gibson, I. (2003). Using ICT to improve the gender balance in engineering Education. *European Journal of Education, 28*(2), 15.

Alston, A. J., Miller, W. W., & Williams, D. L. (2003). The future role of instructional technology in Agricultural education in North Carolina and Virginia. *Journal of agricultural education, 44* (2), 38-49.

Altun, E. (2008). 6th, 7th and 8th Graders attitudes towards online homework assignment sites. *The Turkish Online Journal of Educational Technology, 7* (4), 5-18.

Ary, D., Jacobs, L. C., & Asghar, R. (2002). *Introduction to Research in Education* (6th ed.). Belmont, Wadsworth/Thomson learning.

Atuahene, F. (2013). Enhancing teaching, learning research through technology: Challenges of ICT in curriculum transformation in Africa's Educational Institutions (AEIS). In L.Z. Mokgosi and A.L. Jotia (Eds.) *Transforming curriculum for quality education and globalisation challenges* (pp 139-180) Windhoek, Zebra Publishing (Pty) Ltd.

Aydin, S. (2013). Teachers' perceptions about the use of computers in EFL teaching and learning: The case of Turkey. *Computer Assisted Language Learning, 26* (3), 214-233.

Balu, G., Mutula, S., Sebina, P., & Zulu, S. (2010). *Towards an information society in Botswana: ICT4D country Report.* Theta: The Sangonet regional ICT discussion forum project.

Barrett, M. (n.d.). *Making ICT infrastructure, appliances and services more accessible and affordable in rural areas* (University of Cambridge) and MIRA SLAVOVA (International Food Policy Research Institute).

Baser, M. (2013). Attitude, gender and achievement in computer programming. *Journal of Scientific research, 14* (2), 248-255.

Basturk, R. (2005). The effectiveness of computer-assisted instruction in teaching introductory statistics. *Educational Technology and Society, 8*(2), 170-178.

Bose, K. (2004). Computer training programme for primary school teachers in teacher training institutions of the Southern Region of Botswana. *Post compulsory education, 9* (3), 401-415.

Botswana Examinations Council. (2011). 2007-2011 Primary School Leaving Examination Results Summary Report. Retrieved from: http://www.bec.co.bw/downloads/2011/psle2007/2011_psle_summary.pdf

Chen, C. H., & Chen, C. Y. (2012). Instructional approaches on science performance, attitude and inquiry ability in a computer supported collaborative learning environment. *The Turkish journal of educational technology, 11* (1), 113-124.

Chipeta, D. P., Mazile, B. M., & Shumba, A., (2000). *Curriculum development: Contemporary issues and instructional materials development techniques*. Gaborone: Printing and Publishing Company.

Chisholm, L., Dhunpath, R., & Paterson, A. (2004): The use of ICTs in the curriculum in Botswana, Namibia and Seychelles. A country case study for Southern African Comparative and Historical Education Society (SACHES): Commissioned by Southern African Development Community Education Policy Support Initiative (SADC EPSI).

Cohen, L., Manion, L., & Morrison, K. (2007). *Research Methods in Education* (6th ed.). Oxon, Routledge Publishers.

Conoley, J. W., Croom, D. B., Moore, G. E., & Flowers, J. L. (2007). Using electronic audience: Response systems in high school agri-science courses. *Journal of Agricultural Education, 48* (3), 67-77.

Corston, R., & Colman, A. M. (1996). Gender and social facilitation effects on computer competence and attitudes towards computers. *Journal of Educational Computing Research, 14*(2), 171-183.

Czerniewicz, L., & Brown, C. (2005). Access to ICTs for teaching and Learning: From single artefact to inter-related resources. *International journal of education and development using ICT, 1*, 34.

Dahlman, C. (n.d.). Technology, globalisation international competitiveness: Challenges for developing Countries. *Worldbank.org/information-communications.*

Gagne, R. M. (1987). *Instructional technology: Foundations*. New Jersey: Lawrence Erlbaum Associates Inc.

Gay, L. R., & Airasian, P. (2003). *Educational Research: Competencies for analysis and applications* (7th ed). New Jersey: Pearson Education, Inc.

Haastrup, T., & Ajayi, I. A. (2009). The application of information and communication technology in Nigerian secondary schools. *International NGO Journal, 4*(5), 281-286.

Hutchison, M. (2012). Literacy teachers' perceptions of professional development that increases integration of technology into literacy instruction. *Technology, Pedagogy and Education, 21* (1), 37-56.

International information Management Corporation Ltd (IIMC) (2012). *Guide to ICT policy in IST-Africa partner countries* 2010-2012 IST Africa consortium, 2, 1.

Iravani, M. R., & Delfechresh, H. (2011). Effect of CAI on Science Achievement of Higher Primary Students. *International Journal of Business and Social Science, 2* (19), 170-172.

Isaacs, S. (2007). *ICT in Education in Botswana: A survey of ICT and Education in Africa. Botswana country report.* Gaborone: Botswana.

Isman, A., & Dabaj, F. (2003). The evaluation of the course. Introduction to school experience I" with respect to information Technologies. *Turkish Online Journal of Educational Technology, 2* (2), 38-45.

Isman, A., Caner, H., & Yaratan, H. (2007). How technology is integrated into Science Education in a Developing Country: North Cyprus Case. *The Turkish Online Journal of Educational Technology, 6* (3).

Januszewski, A., & Molenda, M. (2008). *Educational technology: A definition with commentary.* New York: Lawrence Erlbaum Associates.

Kebonang, S. (2012, November 12*).* Kedikilwe launches Science Park. *Botswana Daily news newspaper* p. 3.

Kenar, I., Balci, M., & Gokalp, M. S. (2013). Effects of Tablet computer assisted Instruction on Students Attitudes towards Science and Technology Course. *International Journal of Educational Science, 5* (3), 163-171.

Kgwefane, T. A., & Motswagosele, D. A. (2001). Towards a Nationwide Utilisation of Information and Technology in Education. *A paper presented at the 5th Biennial Conference on Teacher education,* Tonota: Botswana.

Koch, S., Townsend, C. D., & Dooley, K. E. (2005). A case study comparing between Web-based and traditional graduate level academic leadership instruction. *Journal of Agricultural Education, 46* (4), *72 – 82.*

Kotrlik, J. W., & Redmann, D. H. (2009). Analysis of teachers' adoption of technology for use in Seven career and Technical Education programmes. *Career and Technical Education Research, 34* (1), 47-77.

Larbi-Apau, J. A., & Moseley, J. L. (2012). Computer attitude of teaching faculty: Implications for technology based performance in higher education. *Journal of Information Technology Education and Research, ii,* 221-233

Law, N., Pelgrum, W. J., & Plomp, T. (2008). *Pedagogy of ICT use in schools around the world: Findings from the IEA sites 2006 study*. Hong Kong, China: Comparative Education Research Centre.

Leder, G. C., & Vale, C. M. (2004).Student view s of computer –based Mathematics in the middle years: Does Gender make a difference? *Educational studies in Mathematics, 56* (2), 287-312.

Lemke, C., Coughlin, E., & Reeifsneider, D. (2009).*Technology in schools: What the research says: An update*. Culver City, CA: Commissioned by Cisco.

Livingstone, S., & Bober, M. (n.d.). Regulating the internet at home: Contrasting the perspectives of children and parents. In D. Buckingham and R. Willett. R, *Digital (2006) Generations: Children, young people and new media* (pp. 93 - 113). Mahwah, N. J: Lawrence Erlbaum.

Lumande, E., Ojedokun, A., & Fidzani, B. (2006). Information Literacy Skills Course delivery through WebCT: The University of Botswana Library experience. *International Journal of Education and Development using ICT, 2* (1).

Mahmood, M. K., & Mirza, M. S. (2012). Effectiveness of Computer- Assisted Instruction in Urdu language for Secondary School Students' Achievement in Science, Language in India: *Strength for Today and Bright Hope for Tomorrow, 12* (2), 266-283.

Maleke, L. (2012, November 20). British Council launches Kgatleng IT hub in Kgafela Primary School. *Mmegi Newspaper, 29* (173).

Mannathoko, C. (1999). Theoretical perspective on gender in education: The case of Eastern and Southern Africa. *International Review of Education, 45* (5/6), 445-460.

Mc Grath, I., & Zhiwen, H. (2011). Innovation in higher education in China: Are teachers ready to integrate ICT in English language teaching? *Technology, Pedagogy and Education, 20* (1), 41-59.

Miller, A. K., Murphrey, P. T., & Roberts, G. T. (2009). Examining IPod use by Texas agricultural science and technology teachers: *Journal of agricultural education, 50* (4), 98-109.

Moeng, G. (2011, September 2). Big role for citizens in ICT. *Mmegi Newspaper, 28* (131).

Moeng, G. (2011, Tuesday 14). Botswana educational television launched. *Mmegi Newspaper. 28 (86)*.

Mogotlhwane, T. M., Mokwena, M., & Talib, M. (2011). Reduction of poverty using ICT in SADC Region: A case study. *International journal of computing and ICT research, 5* (1), 54-65.

Moosavi, A. S. (2009). *A comparison of two computer-aided instruction methods with traditional Instruction in freshmen college mathematics classes* (Unpublished doctoral dissertation). University of Alabama, Tuscaloosa.

Motlotle, K. (1989). *Hidden language in educational textbooks: Life chances of male and female students in science in senior schools.* A paper presented at the BOLESWA Educational research symposium on educational research in the SADC Region, Gaborone, Botswana.

Mumtaz, S. (2000). Factors affecting teachers' use of information and communication technology: A review of the literature. *Journal of information technology for teachers, 9* (3), 319-342.

Murphrey, T. P., Miller, K. A., & Roberts, T. G. (2009). Agricultural science and technology teachers' perceptions of IPOD and MP3; Technology integration into curricular and co-curricular activities. *Journal of Agricultural Education, 50* (4), 110-119.

National Council of Teachers of Mathematics (2008). *The role of technology in the teaching and learning of Mathematics*.www.nctm.org.

Newby, T., Stepich, D. A., Lehman, J. D., & Russell, J. D. (2006). *Educational technology and learning* (3rd ed.). New Jersey: Pearson Prentice Hall.

Noor-Ul-Amin, S. (n.d.). *An Effective use of ICT for education and learning by drawing on worldwide knowledge, research, and experience: ICT as a change agent for education* (A literature Review). University of Kashmir, Kashmir.

Norton, P., & Wiburg, K. M. (2003). *Teaching with technology: Designing opportunities to learn.* (2nd ed.). Belmont: Thomson learning Inc.

O'Dwyer, L. M., Russell, M., Bebell, D., & Tucker-Seeley K. R. (2005). Examining the relationship between home and school computer use and students English language arts test scores, *Journal of Technology and Assessment, 3*(3). 1-45.

Okorie, D. N., Agabi, O. G., & Uche, C. M. (2005). Application of information and communication technology (ICT) in the management of public and private Universities. *Nigerian Journal of Educational Administration and Planning, 5*(2), 29-36.

Olaleye, F. O., & Adeyemi, T. O. (2010). Information communication and technology (ICT) for the effective management of secondary schools for sustainable development in Ekiti State, Nigeria, *American-Eurasian Journal of Scientific Research, 5*(2), 106-113.

Ololube, N. P., Ubogu, A. E., & Egbezor, D. E. (2007). ICT and distance education programs in a Sub-Saharan African country: A Theoretical perspective. *Journal of information technology impact, 7*(3), 181-194.

Padma, B., & Vidyhageetha, N. (2012). Higher secondary students' achievement in computer science and their attitude towards computer. *International journal for teacher educational research, 1*(2), 16-24.

Ray, C., Sormunen, C., & Harris, T. M. (1999). Men's and women's attitudes towards computer technology. *A comparison office systems; Research journal, 17*(1), 1- 8.

Republic of Botswana Ministry of Education (1994). *The Revised National Policy on Education*. Gaborone: Government Printers.

Republic of Botswana, Ministry of Finance and Development Planning. *(2003). National Development Plan 9*. Gaborone, Botswana: Government Printers.

Republic of Botswana, Ministry of Infrastructure Science and Technology. (2012). *National policy on research, science, technology and innovation implementation plan.* Department of Research, Science and Technology. Gaborone: Government Printers.

Ruhela, S. P. (2003). Education – Technology. *Turkish online journal of distance education, 4 (1).*

Saettler, P. (1990). *History of instructional technology.* New York: McGraw-Hill.

Santipaporn, S. (2010). *Information and communication technology statistics in Thailand:* International seminar on information and communication technology statistics, Seoul, Republic of Korea.

Seels, B. B., & Richey, R. C. (1994). Instructional technology: The definition and domains of the field. Bloomington, IN *Association for educational communications and technology.*

Senkbeil, M., & Wittwer, J. (2008). Is students' computer use at home related to their mathematical performance at school? *Computers and education, 50* (2008), 1558-1571.

Sharaideh, S. T. S. A. (2011). The impact of using Computer-Assisted programs for teaching national Education in Jordanian Schools, *Interdisciplinary journal of contemporary research in business, 3* (8), 860-876.

Sharma, S., & Kaur, R. J. (2013). Managing students' attitude towards Science through Computer Assisted Instruction, *International indexed and refereed research journal, 4* (40), 79-81.

Shoemaker, T. L. (2013). *Effect of Computer-aided instruction on attitude and achievement of fifth grade math students* (Unpublished Doctoral Dissertation). Liberty University, Lynchburg.

Silver-Paucilla, H., Brown, S., Overton, C., & Steward, A. (2011). *Assistive technology research matters.* Washington, DC: American Institute for Research.

Staff Reporter. (2012, March 9). Botswana makes strides in ICT access. *The Voice Newspaper.* Botswana. Retrieved from http:/www.the voicebw.com/2012/03/09

Sugino, T. (1998). Gender stereotypes and children's literature. University of Botswana. Retrieved from http://langue.hyper:chubu.ac.jp/jalt/tlt/98/jun/sugino.html.

Tella, A., & Oyedeko, G. A. (2010). Teachers' perception of the contribution of ICT to pupils performance in Christian Religious Education. *Journal of Social Science, 22* (1), 7-14.

Toomey, R. (2001). Information and communication technology for teaching and learning. *Schooling issues digest, 2. Retrieved from* http://www.dest.gov.av/schools/publications/2001/technology.htm

UNESCO (2002) 'Open and distance learning trends, policy and strategy considerations', 14 UNESCO.

UNESCO (2002) Information and communication technology in Education - *A curriculum for schools and programme for teacher development.* Paris: UNESCO.

United Republic of Tanzania Ministry of Education and vocational training (2007) *National Information and Communications Technology (ICT) Policy for Basic Education*, Dar-es - Salaam. Tanzania.

Velazquez, A. G., Joyce, A., & Derby, M. (2009).*Why are girls still not attracted to ICT studies and careers?* White Paper: Women and ICT, Brussels, Belgium, European Schooling (EUN partnership AISBL).

Wamakote, L. (2010). National government investment in ICT initiatives in primary and secondary in East Africa. *Developing the use of information and communication Technology to enhance teaching and learning in East African Schools.* Review of literature, Centre for Commonwealth Education & Aga Khan University Institute for Educational Development-Eastern Africa Research Report No1.

Williams, C. H., Sieborger, I., & Terzoli, A. (2007). Enabling and constraining ICT practice in Secondary schools. Case studies in South Africa. *International journal of knowledge and learning, 3* (2), 171-190.

Wintz, P. (2009). Accelerating quality delivery of the Mathematics curriculum by re-tooling Mathematics classrooms with only one Computer, *International journal of education and development using information and communication technology* (IJEDICT), *5* (3), 72-84.

APPENDICES

APPENDIX A

PRIMARY AGRICULTURE PRE-TEST

STANDARD FIVE

TIME: 25 MINUTES

MARKS: 20

NAME OF STUDENT _____ CLASS: _____

INSTRUCTIONS

- Answer all the questions
- Circle the letter for the correct answer of each question
- Use a pencil to write the answers

1. _____ means those things that make up the soil.

A. Formation of the soil
B. constituent of the soil
C. fertility of the soil
D. structure of soil

2. When rocks break down because of force or pressure applied to them is called_____

A. physical weathering
B. biological weathering
C. chemical weathering
D. geographical weathering

3. The ability of the soil to give plant enough food so that they can grow well is called _____?

A. soil fertility
B. soil constituents
C. soil structure
D. soil formation

4. Which is a disadvantage of using modern biotechnology in agriculture?

A. genetically modified seeds are expensive

B. improved crops and livestock yields

C. possible to engineer crops and livestock for specific purposes

D. increased crop and livestock production

5. Which one of the following is an example of artificial fertilizer?

A. urea

B. compost

C. green manure

D. kraal manure

6. Soil is important in agriculture because;

A. it supplies plants with nutrients

B. it is source of water for plants

C. it gives the plants the green colour

D. it destroys microorganisms

7. Which of the following was developed in Botswana?

A. Ripper

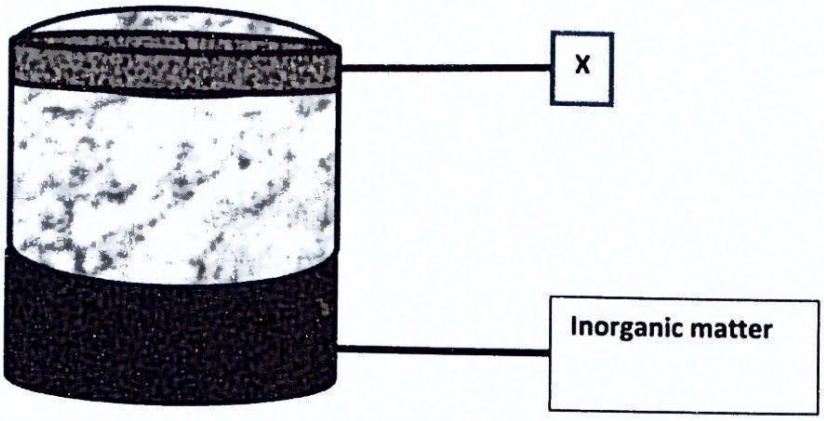
B. Binder

C. Disc harrow

D. Sebele planter

8. Use the illustration to answer the question.

Tshepho collected a dry sample of soil from the school garden and put it in the jar. She then added water to the jar until it is almost full and used a rod to stir for a minute. She allowed the jar to stand for least 20 minutes then made some observation as shown in the drawing.



Which soil constituent is labelled at **X**?

A. water

B. organic matter

C. air

D. mineral matter

9. The followings are living things which cause the rocks to break and form soil **except**

A. cattle

B. tree

C. elephant

D. water

10. The followings are ways of increasing soil fertility **except** _____

A. adding artificial fertilizer

B. adding kraal manure

C. adding compost manure

D. adding soil manure

11. The use of farm implements can damage the environment by;

A. causing soil erosion

B. aerating the soil

C. finishing nutrients from the soil

D. finishing the water from the soil

12. What are agricultural implements?

A. small devices which are hand operated

B. equipment that are drawn by tractors and animals

C. equipment that need fuel

D. devices that do not have moving parts

13. Which one of the following is not a soil constituent?

A. air

B. water

C. iron matter

D. inorganic matter

14. Which of the following is not an inorganic fertilizer?

A. Superphosphate

B. Urea

C. Compost

D. Limestone ammonium nitrate

15. Which of the following is an agricultural implement?

A. Spade

B. Planter

C. Tractor

D. Rake

16. Organic matter makes how much percentage in a soil?

A. 5%

B. 10%

C. 25%

D. 45%

17. Which of the following is not a form of physical weathering of rocks?

A. freezing water

B. running water

C. burrowing animals'

D. temperature changes

18. Soil is formed from?

A. Rocks

B. Acid rain

C. Nitrogen

D. Carbon

19. What is biotechnology?

A. application of physical sciences to solving agricultural problems

B. genetically modified food substances

C. manipulating organisms to produce new genetic material

D. Using biological organisms to make or modify products

20. A proper care of farm implement is by_____

A. loosening the tight parts such as bolts and nuts

B. cleaning them after use

C. mounting them to the tractors

D. leaving them in the field after farm operations

APPENDIX B

PRIMARY AGRICULTURE POST-TEST

STANDARD FIVE

TIME: 25 MINUTES

MARKS: 20

NAME OF STUDENT _____ CLASS: _____

INSTRUCTIONS

- Answer all the questions
- Circle the letter for the correct answer of each question
- Use a pencil to write the answers

1. Soil is formed from?

A. Rocks B. Acid rain

C. Nitrogen D. Carbon

2. Which of the following is not an inorganic fertilizer?

A. Superphosphate B. Urea

C. Compost D. Limestone ammonium nitrate

3. Which of the following is an agricultural implement?

A. Spade B. Planter

C. Tractor D. Rake

4. Which of the following was developed in Botswana?

A. Ripper B. Binder

C. Disc harrow D. Sebele planter

5. What are agricultural implements?

A. Small devices which are hand operated

B. Equipment that are drawn by tractors and animals

C. Equipment that need fuel

D. Devices that do not have moving parts

6. What is biotechnology?

A. Application of physical sciences to solving agricultural problems

B. Genetically modified food substances

C. Manipulating organisms to produce new genetic material

D. Using biological organisms to make or modify products

7. Which is a disadvantage of using modern biotechnology in agriculture?

A. Genetically modified seeds are expensive

B. Improved crops and livestock yields

C. Possible to engineer crops and livestock for specific purposes

D. Increased crop and livestock production

8. A proper care of farm implement is by_____

A. Loosening the tight parts such as bolts and nuts

B. Cleaning them after use

C. Mounting them to the tractors

D. Leaving them in the field after farm operations

9. Which of the following is not a form of physical weathering of rocks?

A. Freezing water

B. Running water

C. Burrowing animals

D. Temperature changes

10. Organic matter makes how much percentage in a soil?

A. 5% B.10%

C. 25% D.45%

11. Soil is important in agriculture because;

A. It supplies plants with nutrients B. It is source of water for plants

C. It gives the plants the green colour D. It destroys microorganisms

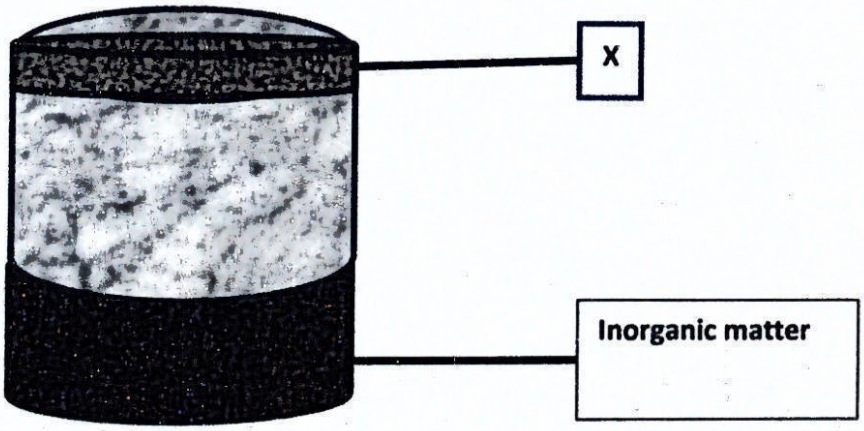
12. The use of farm implements can damage the environment by;

A. Causing soil erosion B. Aerating the soil

C. Finishing nutrients from the soil D. Finishing the water from the soil

13. Use the illustration to answer the question.

Tshepho collected a dry sample of soil from the school garden and put it in the jar. She then added water to the jar until it is almost full and used a rod to stir for a minute. She allowed the jar to stand for least 20 minutes then made some observation as shown in the drawing.



Which soil constituent is labelled at **X**?

A. Water B. Organic matter

C. Air D. Mineral matter

14. The following are living things which cause the rocks to break and form soil **except**

A. Cattle
B. Tree
C. Elephant
D. Water

15. The ability of the soil to give plant enough food so that they can grow well is called _____?

A. Soil fertility
B. Soil constituents
C. Soil structure
D. Soil formation

16. Which one of the following is an example of artificial fertilizer?

A. Urea
B. Compost
C. Green manure
D. Kraal manure

17. _____ means those things that make up the soil.

A. Formation of the soil
B. Constituent of the soil
C. Fertility of the soil
D. Structure of soil

18. The following are ways of increasing soil fertility **except** _____?

A. Adding artificial fertilizer
B. Adding kraal manure
C. Adding compost manure
D. Adding soil manure

19. When rocks break down because of force or pressure applied to them is called_____?

A. Physical weathering
B. Biological weathering
C. Chemical weathering
D. Geographical weathering

20. Which one of the following is **not** a soil constituent?

A. Air
B. Water
C. Iron matter
D. Inorganic matter

APPENDIX C

Questionnaire

Effects of computer assisted instruction on the performance of pupils in Agriculture

You are invited to participate in this survey. The survey is part of the Quasi experimental study on effects of computer assisted teaching method on pupils' performance in Agriculture.

Your participation in this study is completely voluntary. There are no foreseeable risks associated with this project. However, if you feel uncomfortable answering any questions, you can withdraw from the survey at any point. Your opinions are very important to the project.

Your responses will be strictly confidential and data from this research will be reported only in the aggregate. Your information will be coded and will remain confidential. If you have questions at any time about the survey or the procedures you may contact me at the following; cell 71677158/73502640.email:sebesod@yahoo.com.

Thank you very much for your time and support

PART 1.

Tell us about yourself.

1. What is the name of your school? [ ]

2. Are you a boy or girl?

Boy
Girl

3. How old are you? [ ]

4. Did you attend preschool?

Yes
No

Part 2:

Pupils' opinions about using computers

Indicate your level of agreement with statements listed

Scale: 1 = Disagree

2 = Agree

5.	I feel excited when using computers	1	2	
6.	Computers make lessons more fun for me	1	2	
7.	Computers make lessons more interesting for me	1	2	
8.	Computers make me understand more things taught	1	2	
9.	Learning with computers improved my skills	1	2	
10.	Computers make me like agriculture	1	2	
11.	I like learning agriculture using computers	1	2	
12.	Computers are important to me	1	2	
		Every day	1-2 days/ week	Never
13.	I use a computer at home			
14.	I use a computer at School			
15.	I use a computer at some other places			
I often use computers to				
16.	Look up things for sports			
17.	Find music I like			

18.	Find out about other activities of interests			
19.	Chat with friends on line			
20.	Read email			
21.	Send instant message to friends			

Do your parents or relatives have

Computer at home	Yes	No
Video games	Yes	No
Cell phone	Yes	No

Thank You!!

APPENDIX D

INFORMED CONSENT LETTER

Private Bag 24
Francistown

18 February 2013

Dear Parent or Guardian.

I am a student in the Department of Agricultural Economics, Education and Extension at Botswana College of Agriculture. I am conducting a research project on Effects of Computer aided instructional method on the performance of students in Agriculture. I request permission for your child to participate in the project.
The study involves your child learning agriculture concepts through the use of a computer followed by writing an achievement test to establish the influence of computer aided classroom instructions. The test will be standardised by the Botswana Examination Council (BEC) as the highest body of education with an authority on educational testing in the country. The child will also be asked to complete the survey questionnaire that will solicit their views regarding the use of technology in learning.

The project will be explained to the participating child to understand, and your child will participate only if he or she is willing to do so. Please be informed that, I and the research supervisor of this project will have access to information from your child. At the conclusion of the study, children's responses will be reported as group results only.

Participation in this study is voluntary. Your decision whether or not to allow your child to participate will not affect the services normally provided to your child by the school. Your child's participation in this study will not lead to the loss of any benefits to which he or she is otherwise entitled. Even if you give your permission for your child to participate, your child is free to refuse to participate. If your child agrees to participate, he or she is free to end participation at any time. You and your child are not waiving any legal claims, rights, or remedies because of your child's participation in this research study.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of keeping the identity of the students anonymous. The data obtained will also be kept under lock and key where only the researcher and the supervisor will have access to it.

The information that will be released will be the final findings of the study and only relevant stakeholders like the Ministry of Education and Skills Development (MoESD), Botswana College of Agriculture, participating schools and sponsors of the research will be furnished with such information

Should you have any questions or desire further information, please call me or email me at 71677158/73502640 email:sebesod@yahoo.com or my research supervisor at 74062078/71916092 email:khuleta@bca.bw.

Keep this letter after tearing off and completing the bottom portion and the letter signed form may be given to the child to return to school as evidence of participating in the study.

Sincerely,

Graduate student
Dichepi Sebeso (Mr)

Dr. K. Huleka
Senior Lecturer

Graduate Studies
Program Coordinator. BCA

This page to be signed and returned to school

Please indicate below by checking the statement and signing to show participation in the study. Please return the signed letter into the envelope and give your child to hand it to the teacher at school. Keep a copy of the signed letter for your records.

[Child] **I agree /do not agree** to participate in Dichepi Sebeso's study on effects of computer aided instructional method on the performance of students in agriculture.

[Parent/Guardian] **I grant/ do not grant** permission for my child to participate in Dichepi Sebeso's study on effects of computer aided instructional method on the performance of students in agriculture.

Signature of Parent/Guardian

Printed Parent/Guardian Name

Printed Name of Child

Date

APPENDIX E

REQUEST TO CONDUCT RESEARCH

Private Bag 24
Francistown

18 February 2013

The Regional Education Director
P.O. Box 199
Mochudi

Dear Sir/ Madam,

REQUEST FOR PERMISSION TO CONDUCT A RESEARCH STUDY

The purpose of this correspondence is to ask your office to grant me permission to carry out a research study in one of the primary schools in your Region. The study is aimed at investigating the *Effects of Computer Assisted Teaching Method on Students Performance in Agriculture*. This is planned to be a quasi-experimental investigation which will involve students using computers in learning agriculture materials hence our request to use Kgafela Primary School in your region which currently has the computer facility.

I am currently pursuing my Master of Science degree studies in Agricultural Education at Botswana College of Agriculture. I hope to complete the programme in May 2013 and vow to share the results of the study with your office. Enclosed in is a copy of letter from the Ministry of Education and Skills Development (MoESD) which granted me the permission to conduct the study upon obtaining the further approval from your office. The intended duration of the study is seven months

Thanking you in advance

Yours Faithfully

Dichepi Sebeso (Mr)
Graduate Students

Dr K. Hulela
Senior Lecturer (Graduate studies program coordinator .BCA)

APPENDIX F

PERMISSION TO CONDUCT RESEARCH

TELEPHONE: 3656869
TELEX: 2944 THUTO BD
FAX: 3283167

REPUBLIC OF BOTSWANA

MINISTRY OF BASIC EDUCATION
AND SKILLS DEVELOPMENT
PRIVATE BAG 005
GABORONE

REFERENCE : E1/20/2 XXXII (8)

22nd February 2013

Sebeso Dichepi
Botswana College of Agriculture
P Bag 0027
Gaborone

Dear Madam/Sir

RE: REQUEST FOR A PERMIT TO CONDUCT A RESEARCH STUDY

This serves to grant you permission to conduct your study in the sampled areas in Botswana to address the following research objectives/questions /topic:

Effects Of A Computer Assisted Institutional Method On Students' Performance In Agriculture: A Quasi Experimental Study.

It is of paramount importance to seek Assent and Consent from the Department of Basic Education, School Heads, Teachers, Students and Parents of Kgafela and Notwane Primary School that you are going to collect data from. Interview/administration of questionnaires to students should be done in the afternoon to avoid students missing lessons. We hope that you will conduct your study as stated in your proposal and that you will adhere to research ethics. Failure to comply with the above stated, will result in immediate termination of the research permit. The validity of the permit is from 1st February 2013 to 31st January 2014.

You are requested to submit a copy of your final report of the study to the Ministry of Education and Skills Development, in the Department of Educational Planning and Research Services, Botswana.

Thank you

E Ranganai
For/Permanent Secretary