UNIVERSITY OF CAPE COAST

EFFECTS OF ICTS ON STUDENTS' KNOWLEDGE OF ENVIRONMENT AND ENVIRONMENTAL PROBLEMS IN JUNIOR HIGH SCHOOLS STUDENTS OF TWIFO HEMANG LOWER DENKYIRA DISTRICT, CENTRAL REGION

BY

JOSEPH KWESI MENSAH

Dissertation submitted to the College of Distance Education, University of Cape Coast, in partial fulfillment of the requirements for award of Master of Education degree in Information Technology

MAY 2017

DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature:..... Date: .....

Name:…….

Supervisor's Declaration

I hereby declare that the preparation and presentation of the dissertation were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Supervisor's Signature:..... Date: .....

Name:…….

ABSTRACT

This study investigated the effects of ICTs on JHS students' knowledge of environment and environmental problems in Twifo Hemang Lower Denkyira District, Central Region. Quasi-experimental research, the pretest-post-test control group design was used for the study. The sample for the study was 120 students from four selected schools which composed of 60 students each in the control and experimental group. The data was analysed using both descriptive and inferential statistics. The study found that ICTs was effective in increasing students' knowledge and understanding of environment and environmental problems in. It also found that the majority of the students had positive attitude towards environment and environmental problems. The study recommended that the District Directorate of Education through school administrators need to encourage the adoption and use of ICT in teaching Social Studies in school levels and Social Studies curriculum should be enriched to incorporate more environmental issues.

ACKNOWLEDGEMENTS

I wish to express my sincere gratitude and appreciation to all whom in diverse ways contributed to the success of this study. My deepest gratitude goes particularly to my supervisor, Dr. Kenneth Asamoah-Gyimah of the Department of Education and Psychology, who offered an immeasurable guidance and support through the research and my entire M.Ed programme. It was a great pleasure working with him on this research.

I am also grateful to Mr. Edmond Kwesi Agormedah of the Department of Business and Social Sciences Education, for his immeasurable support, constructive criticism as well as intellectual and personal interaction that led to the successful completion of the work.

DEDICATION

To my family

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER ONE

INTRODUCTION

Background to the Study

Environmental degradation has emerged as a serious issue in the world today. Human factor is the largest contributor to the environmental degradation which might pose serious threats to sustain life on earth (Makki, Abd-El-Khalick, & Boujaoude, 2003). In Ghana, human activities show a negative effect to environment as other countries in the world. Every region and district in Ghana is suffering from one or more problems of environmental degradation.

In Ghana and other developing countries, environmental waste happens at three stages. These are forest degradation, problems occurs as a result of contamination of water or flooding in many areas as a result of the lack of good drainage system and solid waste management. Industries in Ghana also affect the environment by polluting the air and water bodies through industrial production activities. Consumer's attitude is another factor that effects the environment. The thoughtful disregard for environmental rules by most Ghanaians is a good example which leads to the act of dumping of household solid waste in to open sewers or drainages (Rahardyan, Matstuto, Kakuta, & Tanaka, 2004).

Environmental problems and issues are complex and there are not simple answers. Often there are many possible solutions or no obvious solution at all. It is through the processes of quality environmental education (EE) that students can sort through the frequently biased, emotional, and propagandized elements of environmental issues, weighing various sides of an issue in order to make informed, balanced, and responsible decisions. In Ghana, the above

environmental problems can be solved through environmental education (EE) both in schools and through other media like the radio, TVs and printing/newspapers. Education plays some roles in the formation of students' views on the environment (Tuncer, Ertepinar, Tekkaya & Sungur, 2009).

Environmental Education (EE)

Environmental education (EE) is a process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment (Gruenewald, 2004). Environmental education (EE) refers to organized efforts to teach how natural environments function, and particularly, how human beings can manage behaviour and ecosystems to live sustainably. It sometimes includes all efforts to educate the public and other audiences, including print materials, websites, media campaigns, etc (UNESCO, 2014a). The components of environmental education are:

a) Awareness and sensitivity to the environment and environmental challenges
b) Knowledge and understanding of the environment and environmental challenges
c) Attitudes of concern for the environment and motivation to improve or maintain environmental quality
d) Skills to identify and help resolve environmental challenges
e) Participation in activities that lead to the resolution of environmental challenges (UNESCO, 2014b).

The main goal of environmental education (EE) is to gain awareness of individuals and establish a conscious interaction with the environment which influences the development of a critical perspective and let the future

generations enjoy a healthy and clean environment (Lieberman2013). According to the United Nations Educational, Scientific and Cultural Organisation (UNESCO), EE is vital in imparting an inherent respect for nature amongst society and in enhancing public environmental awareness. UNESCO emphasises the role of EE in safeguarding future global developments of societal quality of life (QOL), through the protection of the environment, eradication of poverty, minimization of inequalities and insurance of sustainable development (UNESCO, 2014a). Environmental education teaches individuals how to weigh various sides of an issue through critical thinking and it enhances their own problem-solving and decision-making skills. As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions (Wals, 2014)

Environmental education which has been introduce in all schools which will encourage and promote the creation of environmental awareness and protection among the students and at the same time develop useful activities for the students and society (Incekara, Tuna, & Dogan, 2011). According to the North American Association of Environmental Educators (NAAEE) (2015) the level of awareness is an important goal of environmental education from kindergarten to third grade, the level of knowledge is an important goal in the third through ninth grade and the degree of relationship is important throughout the entire educational career. Therefore, there is a dire need to pay serious attention towards protecting life on earth. As teacher and teacher educator, it is our prime responsibility to take measures to overcome this problem.

Pupils' behaviour is generally supported by the knowledge and attitude, but the direct connection from knowledge to attitude and on to the behaviour

does not always exist (Monroe, Day, & Grieser, 2000). It is necessary to start developing positive attitudes and values towards the environment in early childhood, because the patterns of behaviour in later years only strengthen and develop further. A few studies have been made, where they studied the link between science, environmental education and the promotion of positive attitudes towards the environment (Gurevitz 2002). It is well known that individuals, who are well educated and develop concerned environment view, also behave responsibly regarding the environment (Mobley, Vagias, & DeWard, 2010).

Many researchers agree that knowledge in itself will not motivate individuals to adopt a new behaviour (Schultz, 2002) and it is clear that the lack of knowledge may present a barrier for behavioural changes (DeYoung, 2000). Azizan (2008) says that pupils have a good awareness of environmental issues, but in practice their attitude and behaviour has not changed yet. Dunlap, Gallup and Gallup (2003) conducted an international survey on environmental values and found that citizens of many developing nations were highly concerned about the state of the environment. Larijani (2010) examined students' environmental attitudes across gender and found overall positive attitude towards environment across gender.

In a comparative study by Huang and Yore (2003), they reported that both Canadian and Taiwanese 5th grade students held positive behaviour and attitudes towards the environment. Moreover, they expressed a high emotional disposition toward the environment and high concern about environmental problems and issues as well as a moderate level of environmental knowledge. Makki et al. (2003) study showed that Lebanese high school students held

positive environmental attitudes but had inadequate environment knowledge. In Turkish, Cavas, Cavas, Tekkaya, Cakiroglu and Kesercioglu, (2009) found that Turkish students generally have favourable attitudes and interest toward environmental issues. They seemed to be eager to find solutions to environmental problems and show optimistic trends about the future.

Technology and Education

Technology use in education has become more popular in recent years and educational institutions try to rearrange and restructure their educational programs and classroom facilities in order to maximise the teaching and learning technology. The important role that information and communication technologies (ICTs) play in many educational institutions of the 21st century cannot be overemphasized. The potential that these ICTs have in supporting the school curriculum and education through the provision of effective communication opportunities for students and teachers have been noted (Dawes, 2001). The use of ICTs in the classroom in this information age is very essential in providing opportunities for teachers and students to learn and work efficiently (Salehi & Salehi, 2012). ICTs have been shown to enhance students' learning skills, knowledge, motivation, completion of learning tasks and enables students to work independently and constructively (Anderson, 2002; Grabe &Grabe, 2007).

Diem and Berson (2010) suggests that the challenge for the social studies teacher is to find how to use the new tools and techniques in ways that will increase content understanding and hone the skills needed to effectively use technology" Such a challenge, Fontana (2007) argues, must be undertaken quickly by social studies educators, if the discipline of social studies is to

maintain its vitality, direction, and integrity. This sense of urgency and concern that comes with failing to utilize technology is easily understood when one begins to explore the actual use and impact of interactive technologies in the social studies, and on the nature of teaching social studies.

Cuban's (2001) revealed that across all disciplines including the social studies, computer technology has not been seamlessly integrated into the classroom and where it is used, little evidence exists to suggest that it has transformed the teaching and learning process. A giant because many social studies educators contend that interactive technologies hold a great deal of potential for the teaching and learning of social studies, yet sleeping because little technology research, development, and implementation has taken place among social studies educators (Ehman & Glenn, 2001).

Despite the potential of computers to provide learning opportunities ranging from drill- and - practice exercises to exploratory activities, social studies educators seem to have been reluctant to integrate computers into their curriculum and instruction. According to a Teaching, Learning, and Computing (TLC) national survey reports (Anderson & Becker, 2001; Becker, 2006), Social studies teachers and mathematics teachers were among the least likely to use technology (12% and 11% respectively) and the least likely to involve students in higher order thinking activities.

It is considered that technology is the main support for the students learning developments and the computers are the main technology support as a tool for effective learning and teaching process. Likewise, Whitworth and Berson (2003) point out that, within the social studies, technology has served a dual role as an important instructional tool that may have a significant effect on

the global, political, social, and economic functioning of society. According to them, as a method or topic instruction, computers and technology may have significant impacts on social studies education.

According to Berson (2006), the disciplines of social studies are intended to develop effective citizens who possess the critical thinking and decision making skills to function in a democratic society. Research showed that technology-supported teaching strategies have crucial roles facilitating development of students' critical thinking, problem solving and decision making skills (Berson, 2006; Rice & Wilson, 2009). A more recent research conducted by Gulbahar and Guven (2008) on computer usage by social studies teachers in Turkey was found to be as follows: 53.1% uses a computer for less than one hour, 30.7% uses a computer for between 1 and 3 hours, 2.8% uses a computer for between 3-5 hours and 1.5% uses a computer for more than five hours a day.

The case in Ghana, seems not to be different because related research conducted by Boakye and Banini (2008) revealed that 71% of teachers (of which social studies are included) in Ghana never use the computer in class (i.e. using a computer during class time or taking students to the computer laboratory). This means it seems that the extent to which the potential of technology is being fully utilized in the social studies classroom has not been sufficiently explored by teachers. Information and communication technologies (ICT) do not automatically add quality to teaching and learning. It is against this background that this study investigates the effects of ICTs on JHS students' knowledge of environment and environmental problems of Twifo Hemang Lower Denkyira District, Central Region.

Statement of the Problem

Environmental education (EE) is important in any nation, even in Ghana. Environmental education in Ghana is being taught in all level of education and it is being taught as part of other school subject like Social Studies, Biology, Physics, Geography and other relevant courses (Stokes, Edge, & West, 2001). Some researchers argue that formal environmental education helps students to develop more favourable attitudes towards environment (Lee, 2008). Therefore, it is reasonable to look at the environmental education context in Ghana within this study. Moreover, textbooks of Social Studies and integrated science in the Junior high School level carry some environmental education concepts, which are presented as part of content in various chapters. There is very little attempt to make connections between concepts, especially between science and environment and vice versa.

Access to information is a key for academic performance of students with advent of ICTs student have acquired additional source for getting information along with the libraries in the university. This research explores the impact of ICTs on students' access to information. Students are facing some challenges such as English Language problem, hearing problems and access problems to information.

Despite a lot of campaigns to shed light in to the problems of environmental degradation, it still continues to be a continual problem in developing countries and there seems to be no tangible environmental health improvement in the majority of those countries including Ghana. Ghana understood the importance of environmental education in solving all of the environmental problems for the past years and this is the reason why it has been

started the program under the Ghana District Education Directorate. But the problem is to what extents do the students of Ghana in both level perceive or understand the environmental problems and management (CRDD, 2007).

At any level of our education system Environmental Education can be taught using different approaches and methods of teaching. One such teaching style involves the use of ICT. Teachers are expected to integrate technology in the teaching processes, in order to supports instructions and enables learners to use ICT tools to meet their information needs and to construct knowledge. ICT as a pedagogical tool is referred to as the use of ICT facilities in the teaching process for students to be able to solve problems, to provoke students' capabilities, and share their perspectives with each other (Jonassen, Howland, Marra, & Crismond, 2008).

To have a positive impact on their surroundings and keep it neat, and to have quality teaching and learning of social studies and increase students' knowledge and understanding of environment and environmental problems, ICTs must be adopted and use in the instructional process and it must go beyond acquisition of skills, for example to access a database, and engage at a higher cognitive level. Considering the environmental issues and problems, it is believed that the use of ICTs in the teaching and learning social studies will increase students' knowledge, awareness, and attitude towards environmental problems. It is against this background that this study investigates the effects of ICTs on JHS students' knowledge of environment and environmental problems in social studies of Twifo Hemang Lower Denkyira District, Central Region.

Purpose of the Study

The main purpose of the study was to investigate the effects of ICTs on JHS students' knowledge of environment and environmental problems in social studies of Twifo Hemang Lower Denkyira District, Central Region, specifically the study was guided by the following objectives, to:

1. Examine JHS students' attitude towards environmental problems.
2. Examine how the use of ICTs affect/impact JHS students' knowledge on environmental problems in social studies.

Research Question

The following research question guided the study:

1. What is the attitude of JHS students towards environmental problems?

Research Hypotheses

H_0 1: There is no statistically significant difference in the environmental degradation knowledge between students in the experimental group and control group on the post-test.

H_A 1: There is a statically significant different in the environmental degradation knowledge between students in the experimental group and control group on the post – test.

H_0 2: There is no statistically significant difference in the environmental degradation knowledge of students in the experimental group on the pre-test and the post-test

H_A 2: There is a statically significant difference in the environmental degradation knowledge of students in the experimental group on pre – test and the post-test

H0 3: There is a statistically significant difference in the attitude between students in the experimental group and control group on the use of ICT.

HA 3: There is a statically significant difference in the attitude between students in the experimental group and control group on the use of ICT

Significance of the Study

The results of this study would benefit the following agencies in these ways: The findings of this study would benefit headteachers and teachers on how ICT can be integrated into Environmental Education curriculum in order to accommodate differences in the learning environment by providing expanded opportunities and individualised learning experience.

The findings of this study are expected to provide strategies that can be adopted to assist teachers and pupils in making decisions on how to adopt and use ICTs in environmental science teaching. Furthermore, the findings of the study can be used by policy makers and planners to revamp the current ICT policy in order to overcome the challenges hindering smooth adoption and use of ICTs in environmental science teaching and learning. Further, this study will also be helpful for environmental science teachers to take into consideration the obstacles that they face during adoption and integration of ICTs into teaching and prepare themselves to become better teachers. The findings of this study will help educational authorities and policy makers to see the need to provide every basic education (Junior High Schools) with technologies, including computers and their accessories to help improve teaching and learning of Social Studies. Finally, the study will also inform my fellow social studies teachers in Ghana on the need to have a positive perception and competence in technology and consequently use it to effectively teach social studies.

Delimitation of the Study

The study was delimited to Junior High Schools (JHS) in the Twifo Hemang Lower Denkyira District. Emphasis was placed on how the use of ICTs can increase students' knowledge and change their attitude towards environmental degradation.

Limitations of the Study

All Junior High Schools in the district offer Social Studies as a core subject in the curriculum. However, this study was confined to only Junior High School that was willing to participate in the study. There are eight (8) Junior High Schools in Twifu Hemang Lower Denkyira of Ghana and yet only 4 Junior High School in the District took part in the study. The sample size makes it difficult to generalize the results to the whole schools District.

The study should have use multiple research instruments like questionnaire, interview guide, observation guide, but only the questionnaire and test were used thus this study narrows the broader view of the real situation on the ground.

Organisation of the Study

This study is organised into five (5) chapters. Chapter One presented the introduction which highlights the background to the study, statement of the problem, purpose of the study and research questions and hypotheses that guided the study. The significance of the study as well as the delimitation and limitations of the study and operational definition of terms are also presented in this chapter. Chapter Two reviews literature related to the study. Chapter Three discusses the research methodology in terms of research design, study population, sample and sampling procedure, data collection instruments, data

collection procedures and data processing and analysis. In Chapters Four, the results are discussed while Chapter Five summaries the main findings of the investigation and provides conclusions, recommendations and suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

Introduction

The purpose of this study is to investigate effects of ICTs on JHS students' knowledge of environment and environmental problems in social studies of Twifo Hemang Lower Denkyira District, Central Region. This chapter first provides a theoretical framework of the study, Social Studies Curriculum in Ghana, a brief overview of the status of technology integration in Ghanaian schools, especially in the discipline of social studies and teachers use of technology in teaching social Studies. Finally, ways in which teachers can use technology in social studies classrooms have also been considered.

Theoretical Framework

The theoretical framework that guides this study is constructivism. Constructivism is a philosophical school of thought that holds the view that the only reality is our individual interpretation of what we perceive. It maintains that knowledge is not received from outside, but we construct knowledge from our heads and that learning is a process of people actively constructing knowledge. Traditional instructional methods such as memorizing, demonstrating and imitating are considered incompatible with the notion that learning is a process of construction. In recent years, Papert (2000) and his colleagues have expanded this approach to the more general notion that people learn most things better through construction of computer programmes, computer games or multimedia compositions rather than through traditional methods of directly teaching content (Papert & Harel, 2001).

Thus presentation of information is downplayed whereas learner activity is stressed. For example, teacher questions are discouraged and learner questions are encouraged (Jonassen, 2008). Constructivism emphasizes the learner exploring, experimenting, doing research, asking questions and seeking answers, which promotes critical thinking and problem solving skills. Another substantial aspect of constructivist thinking is an emphasis on cooperative and collaborative learning (Slavin, 2001). The more general term cooperative, means learners are helping each other rather than hindering or engaging in unhealthy competition, or ignoring one another.

They may be working on individual projects (such as term papers or experiments), but the environment supports learners helping and teaching one another. Collaborative learning goes a bit further, suggesting environments in which learners work on shared project or goal. Both cooperative and collaborative environments have several advantages. Interactivity is enhanced and more multisensory (including conversation between learners and other activities, not just typing and reading), participants play roles of both learners and teachers, motivation is enhanced, social skills are fostered and met cognitive skills are improved (Jonassen et al., 2005).

A criticism that constructivist educators aim at traditional and current educational environments is that the knowledge and skills taught are too simplified. Thus, they are not useful in the real world, because learners recognize them as such and are not highly motivated. Better education environments should be designed with information, problems and multiple solution approaches, such as those people encounter in their real jobs and lives (Savery & Duffy, 2006). It is in this vein that constructivists maintain that what

is taught by traditional methods produces inert knowledge (Renkl, Stark, Gruber, & Mandl (2008), which is not easily applied to new situations. In other words, traditional methods promote knowledge that does not transfer well.

In contrast constructivists suggest that methodologies such as hypermedia, simulation, virtual reality and open-ended learning environments are of more benefit to learners, allowing them to explore information freely, apply their own learning styles, and use software as a resource. More importantly, constructivists support the use of computer-based tools with which learners can design and construct their own knowledge (Jonassen, 2008). Activities such as typing compositions, using simulations and games result in more useful knowledge and skills. They also emphasize using computers for communication, such as e-mail for communication between learners at a distance, Internet chat rooms and video conferencing, and file sharing for group research and project work.

The Concept "Information and Communication Technologies" (ICT)

ICT refers to computer technology, multimedia and networking including the Internet. The term 'technology' or 'information technology' is used, but slowly this appears to be changing to 'ICT' (Anderson, 2008). ICT has become more accessible to people in both developed and developing worlds. So many terminologies have been used to describe various sets of ICT related curricula, which include cognitive tools (Salomon, 2006) and mind tools (Jonassen, 2000). Kaffash, Kargiban, Kargiban, and Remezani (2010) explained it as a tool to extend curriculum method, content, product and process to new information which was not discovered in the past. Previous researchers believe ICT is a combination of computer video and telecommunication technologies

as well as the use of multimedia networks (Vanderlinde, & van Braak, 2009). For the purpose of this study, ICT is information-based technology which can be coordinated with other technologies including communications. Researchers use different terminologies to drive ICT concepts which are probably the purpose for which they are used. In education, these terminologies are mostly a structural unit of society (UNESCO, 2002).

Policy Framework for ICT in Ghanaian Education

Ghana has not reneged in her efforts to equip her citizens with ICT skills to be able to operate effectively in a world that is increasingly being transformed into a knowledge-based one. ICT introduction in all sectors of the economy, including education, has therefore become a public policy priority. Efforts to introduce ICT in schools derive from the national ICT for Accelerated Development policy of 2003 and the ICT in Education policy of 2008.

The Ghana ICT for Accelerated Development was the outcome of a three-phase course of action to develop ICT-led socio-economic policies aimed at ushering Ghana into a knowledge-based information society in the shortest possible time (Kwapong, 2007). Some of the concerns the policy sets out to address include:

1. The transformation of the country into a competitive ICT-led Foreign Direct Investment within the West African sub-region.
2. The transformation of the education system at all levels to impart the needed skills required to usher Ghana into the information and knowledge- based society.
3. The development of human resource capacity in ICT skills to be able to harness the full benefits of the information age.

4. The Enhancement of efficiency of administration service delivery through ICT.

The policy mandates all sectors of the economy to draw-up their own ICT policy frameworks that are consistent with the aims and aspirations of the national ICT policy in order to facilitate a multi-sectoral application of ICT. In this regard, the District Education Directorate in 2008 came up with the ICT in Education policy which outlines the plans and strategies for integrating ICT in education at all levels.

The overall vision of the ICT in Education policy is to use ICTs to support the District Education Directorate's policies, objectives and strategies to facilitate equitable access to education, quality of teaching, educational administration, science and technology and labour market demands (District Education Directorate, 2008). The specific objectives of the policy are to:

1. Facilitate the deployment, utilization and development of ICT within the educational system to improve educational access and delivery to support teaching and learning from the primary level upwards.
2. Transform the education system in order to improve the quality of teaching and training at all levels of the educational system and expanding access to education, training and research resources.
3. Orient all levels of the country's educational system to the teaching and learning of science and technology in order to accelerate the assimilation of science and technology in society.
4. Achieve universal basic education and improve the quality of basic education and computer literacy in the nation.
5. Ensure that all citizens are at least functionally literate and productive.

6. Expand and increase access to secondary and tertiary education.
7. Strengthen science education at all levels of the educational system, especially at the basic and secondary levels.

Four key factors underlie the strategies for achieving the specific objectives outlined in the policy. They are equity in the allocation of resources, affordable and continuous access to ICT infrastructure, capacity building of users and the development of norms and standards with regard to ICT use. Additionally, the policy has seven thematic areas. These areas outline the guiding principles and strategies to be put in place to accomplish the goal of integrating ICT in education. The first thematic area seeks to enhance education management by building the capacity of the District Education Directorate and all its agencies. By doing so, ICT can be effectively used to generate data for informed decision making.

The second thematic area concerns building the ICT capacity of all persons involved in education delivery, especially teachers, to facilitate the incorporation of ICT into teaching and learning at all the levels of education in Ghana. The third thematic area is concerned with infrastructure provision, e-readiness and equitable access to ICT in all schools. Other areas of concern are content development, ICT integration into the curriculum, technical support, maintenance and sustainability of ICT infrastructure. The topmost priority of the policy is to support and build the capacity of staffs of the District Education Directorate and its agencies. Colleges of Education are the next in the prioritization scale as they train teachers for basic schools. Building their capacity in ICT will go a long way to facilitate the implementation of the policy at the basic level.

ICT Integration in Ghanaian Education

Information and communication technologies (ICT) have become indispensable tools in today's information age, making a dramatic impact on the lives of people globally. This effect is most significant in education. The computer has become a motivating tool for teaching and learning in schools (World Bank, 1999). At the inception of the millennium, Ghana's education authorities embarked on a number of projects to introduce (ICTs) into the Ghanaian education set up; especially at the basic and secondary school levels.

For instance, in the middle of the 1990s, educational providers realized that Ghanaian professionals could not compete on the global market for jobs, because they were limited in skill, especially in the area of Information Technology. Subsequently, the authorities incorporated the study of ICTs as part of the study of science. The government of Ghana with the Ohio University and in collaboration with Non-Governmental Organizations (NGO), philanthropists and Parent-Teacher Associations (PTAs) built about 110 science resource centres to help the teaching of science and ICT. However, initiators found that the various programs were disintegrated, unstructured and did not cover all the schools (Nyarko, 2007).

In the later part of 1990s, Ghana was host to a number of ICT initiatives supported by the government and NGOs. The District Education Directorate in conjunction with the Ghana Education Service (GES) and its allied partners undertook a critical situational analysis and review of the utilization of ICT in education under the auspices of the United Nations Global E-Schools and Community Initiatives (GESCI). Many lapses were identified for which the stakeholders agreed to work together to make education complete with ICT as

a facilitator. According to a Ghana News Agency (GNA) July, 2004 report, - Ghana is making inroads in the introduction of Information and Communication Technology (ICT) into Education, Mr. Kwadwo Baah-Wiredu, the then Minister of Education said in Abuja. Mr. Wiredu said some of the basic schools in almost all the district capitals have ICT while most private schools no matter their location whether in the rural or urban setting have ICTs commonly called the computer centres.

For example, he said, Data Link, an ICT company is linking various schools in the Tano District of the Brong Ahafo Region to the computer and the Internet. The then Minister said over 300 out of the 476 senior secondary schools (SSS) in the country have one form of ICT facility while all the 38 teacher training colleges are being hooked onto the ICT. In addition to all these, the Government of Ghana signed a memorandum of understanding with the Microsoft on the Partners in Learning Programme on March 6, 2004 to provide schools in the country with software to upgrade the operating systems (GNA, 2004). The government of Ghana, in order to create the enabling environment for the use of ICT in the area of education, a Wide Area Network called the Research and Educational Network (REN) was established in 2000 with the help of the World Bank INFODEV project.

Presently this basic infrastructure is functioning satisfactorily with the University of Ghana, hosting the main server and linking up other institutions such as University of Cape Coast, Kwame Nkrumah University of Science and Technology, University of Education Winneba, Center for Scientific and Industrial Research, Ghana Atomic Energy Commission and University for Development Studies. The nodes are also serving as service providers to the

senior secondary schools that use the dial up access to reach these nodes. (Government of Ghana, 2003). Other developments have been establishment of computer laboratories in most secondary schools in the country.

Information, Communication and Technology has made tremendous advances which could effectively be put to advantage to enhance educational delivery. Many Ministries of Education has recognised this potential and have reformed their educational system take advantage. Teachers have been urged to integrate technology into school curriculum by the media, teacher education accrediting organizations, professional development programs, teachers, parents, and administrators. National reports and literature reviews (Ringstaff & Kelley, 2002) all indicating that technology can help improve students' performance on tests and academic work, promote higher-order thinking skills, and increase students' motivation and self-concepts.

In a case study of some pioneer schools in ICT integration (Boakyi & Banini, 2006) it was discovered that some schools in both the public and private sector in the education industry had taken advantage of the ICT innovation and were making good progress. Their study identified ICT integration approaches being applied to include the use of pre-identified websites for teaching and learning right off the internet, the use of interactive CD ROMs, as well as, teaching children to do presentations or research with the help of the computer. It also involved the use of the PowerPoint software to teach as well as referring pupils and students to some radio programmes which were considered educative.

The study identified some positive effects of ICT integration to include "increased teacher student interaction, pupil/student-centred learning, increased

level of capability on the part of students to do independent learning and the practicalisation of hitherto theoretical and abstract concepts on the part of both students and teachers". They however raised some critical issues about the sustainability of the ICT integration innovation. These included the high cost of maintenance of computers, high utility bills, power fluctuations and poor telecommunication networks (Ertmer & Otternbreit-Leftwich, 2010).

The purpose of integrating ICT in education and the curriculum as a whole is to enhance the quality of teaching and learning and to improve learners' comprehension skills of what is being taught. However, the potential of ICT to motivate pedagogy is yet to be fully realised due to the lack of expertise to help effect the adoption of ICT for curriculum delivery. Some authors have explained ICT integration as ways and approaches for the use of ICTs in teaching and learning; technology integration is more cross-curricula than an individual subject. From the definitions given, one can say that ICT integration in the 21st century involves all essential elements of a system combined to make a whole (Earle, 2002). This simply means in education that integration takes place if ICT and other elements of education such as content are combined into one body.

Watts-Taffe, Gwinn and Horn (2003) realised that educators can play the role of facilitators in the classroom where there has been a successful integration of ICT in the curriculum. As Reid (2002) indicated, ICT offers learners the opportunity to be reflective and ultimately the motivation to continue to learn throughout their lives. Similarly, Anderson (2008) in a study has summarised the implications of the needs of the knowledge required in teaching and learning. Anderson (2008) further discussed the importance of helping learners to develop ICT-related skills which may include finding,

organising, and retrieving information and ICT usage. The integration of ICT into education, teachers tend to adopt technology in ways that are consistent with their personal perspectives on curriculum and instructional practice. ICT has a clear impact on the development of educational curricula. It is concerned with what is taught and how teaching and learning occur. What is taught includes objectives, content and learning outcomes, and attitudes that learners tend to demonstrate (Pelgrum, 2001).

Lowther, Inan, Strahl and Ross (2008) have noted that the integrated approach places ICT in a pivotal role in the already transforming learning process. The authors argued that its success as an approach lies in the ability of teachers to set tasks that require learners to use these skills and information. According to them, this is appropriate and necessary at a time when teachers are being encouraged to adopt new teaching strategies to disseminate knowledge to learners. The introduction of ICT in the education system would call for redefinition of Environmental Education where ICT will no longer be the transmitters of knowledge but rather facilitators of the learning process.

Junior High Schools Social Studies Curriculum in Ghana

Social Studies is one of the subjects that can help change attitudes of citizens and thereby contribute to the socioeconomic development of a nation, but educators of the subject have long argued over what exactly is meant by Social Studies. It was introduced in the United States of America based upon recommendations in the 1916 report of the Social Studies Committee of the Commission on the Reorganisation of Secondary Education (Kissock, 2001). According to Jarolimek (2007), the introduction of social studies, as one of the curricula in American schools was a response to certain social pressures

mounting at the time, on the need to inculcate certain values and sense of nationalism into the youth of America.

Over the past several years, Social Studies has become a more visible school subject and conception of learning Social Studies has evolved from doing and knowing to experiencing and making meaning. The tacit and piecemeal curriculum that has long characterized the Social Studies classroom seems to be gradually giving way to a more coherent and integrated set of objectives, benchmarks, and performance indicators. This approach is goal oriented with an emphasis on learner outcomes: the knowledge, skills, attitudes, values and disposition to action that teachers wish to develop in students (Banks,2000).

The above citation precisely describes the evolution of social studies as a single discipline of study among the school curriculum in Ghana. It has evolved from a collection of specific History and Geography topics, which used to characterize the early Social Studies curriculum into an issue centred (trans-disciplinary) subject. In much of Africa, the introduction of Social Studies as part of the school's curriculum was preceded by the formation of the African Social Studies Programme (ASSP) in 1968 (Kissock, 2001).

The introduction of Social Studies in Ghana thereafter was preceded by a follow up of Educational Conference of Mombasa in Winneba, Ghana, in 1969 during which it was adopted as part of the school curriculum. It was first introduced in the Primary Schools in 1972, where it was called Social/Environmental Studies. Also in 1976, all Teacher-Training Colleges in Ghana were asked to start the preparation of Basic School teachers. The above continued to be the situation until the new Educational Reforms of 1987. Social

Studies was introduced and confined to the Junior Secondary Schools (JSS), now Junior High School (JHS) and the teacher-training institutions.

The subject in the primary schools became known as Environmental Studies, now citizenship education which is taught at the upper primary. In 1998 Social Studies was introduced in the Senior Secondary Schools (SSS), now Senior High School (SHS) to replace Life Skills. This recommendation was done by the 1994 Educational Review Committee, which provided the basis for continuation of learning in the discipline from the JSS to the SSS level. This committee, however, succeeded in transforming social studies from amalgam (Quartey, 2004) of discrete traditional social science disciplines, which it used to be, to one that is issues centred and problem solving in nature (Martorrela, 1994; CRDD, 2010).

This is because the panel that designed the new SSS syllabus was different, both in composition and orientation, from the panel that designed the JSS Social Studies curriculum in 1987. Social Studies is now a compulsory course for teacher-trainees offering general programme of study in Colleges of Education in Ghana. The problem under review is that the aim of Social Studies in Ghana according to the teaching syllabus for Social Studies (CRDD, 2010) is that the subject is the study of society and its problems. This shows that the aim of Social Studies is Citizenship Education.

Rationale for Teaching Social Studies

Social Studies is a study of the problems of society. The subject prepares the individual to fit into society by equipping him/her with knowledge about the culture and ways of life of their society, its problems, its values and its hopes

for the future. The subject is multi - disciplinary and takes its sources from Geography, History, Sociology, Psychology, Economics and Civic Education.

Essential elements of the knowledge and principles from these disciplines are integrated into a subject that stands on its own. As a subject, Social Studies helps students to understand their society better; helps them to investigate how their society functions and hence assists them to develop that critical and at the same time developmental kind of mind that transforms societies. Our society has been a slow-moving society. It is hoped that as students understand the Ghanaian society better, and are able to examine the society's institutions and ways of life with a critical and constructive mind, the country will surely be on the path to better and faster growth in development (Jonassen, Howland, Marra, & Crismond, 2008).

Environmental Education in Ghana

Environmental education is a process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment. Environmental Education (EE) is a process in which individuals gain awareness of their environment and acquire knowledge, skills, values, experiences, and also the determination, which will enable them to act - individually and collectively - to solve present and future environmental problems (Stapp, 2009). Environmental education is a learning process that increases people's knowledge and awareness about the environment and associated challenges, develops the necessary skills and expertise to address the challenges, and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action (UNESCO, 2014a; 2014b).

Environmental education may best be defined as a process directed at creating awareness and understanding about environmental issues that leads to responsible individual and group actions (Gruenewald, 2004). Environmental Education (EE) is a methodology in which people pick up familiarity with their surroundings and secure learning, abilities, values, experiences, and passion, all of which will empower them to act (Lieberman, 2013). Environmental education may best be defined as a process directed at creating awareness and understanding about environmental issues that leads to responsible individual and group actions. The components of environmental education are:

a) Awareness and sensitivity to the environment and environmental challenges
b) Knowledge and understanding of the environment and environmental challenges
c) Attitudes of concern for the environment and motivation to improve or maintain environmental quality
d) Skills to identify and help resolve environmental challenges
e) Participation in activities that lead to the resolution of environmental challenges (UNESCO, 2014a; 2014b).

Successful environmental education focuses on processes that promote critical thinking, problem solving, and effective decision-making skills. Environmental education utilizes processes that involve students in observing, measuring, classifying, experimenting, and other data gathering techniques. These processes assist students in discussing, inferring, predicting, and interpreting data about environmental issues (Stapp, 2009). Environmental education, properly understood, should constitute a comprehensive lifelong

education, one responsive to changes in a rapidly changing world. It should prepare the individual for life through an understanding of the major problems of the contemporary world, and the provision of skills and attributes needed to play a productive role towards improving life and protecting the environment with due regard given to ethical values (Lieberman, 2013).

Environmental education teaches individuals how to weigh various sides of an issue through critical thinking and it enhances their own problem-solving and decision-making skills. Environmental education enhances critical thinking, problem-solving, and effective decision-making skills, and teaches individuals to weigh various sides of an environmental issue to make informed and responsible decisions. Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution (Wals, 2014).

Environmental education (EE) is important in any nation, even in Ghana. Environmental education in Ghana is been taught in all level of education and it is being taught as part of other school subject like Social Studies, Biology, Physics, Geography and other relevant courses. It is important to note that in Ghana, EE is not taught as a separate subject. However, EE concepts like energy, greenhouse effect, pollution; microorganism, recycling, and ecosystem have been incorporated in the science curriculum of the primary and secondary classes. In some countries, however EE is taught via an interdisciplinary approach. At the upper secondary level, there may be a range of specialised environmental study courses in addition to environmental topics being included in subjects such as biology or geography (Stokes, Edge, & West, 2001). Some

researchers argue that formal environmental education helps students to develop more favourable attitudes towards environment (Lee, 2008). Therefore, it is reasonable to look at the environmental education context in Ghana within this study. Moreover, textbooks of Social Studies and integrated science in the Junior high School level carry some environmental education concepts, which are presented as part of content in various chapters. There is very little attempt to make connections between concepts, especially between science and environment and vice versa.

Despite a lot of campaigns to shed light in to the problems of environmental degradation, it's still continue to be a continual problem in developing countries, there seems to be no tangible environmental health improvement in the majority of those countries including Ghana. Ghana understood the importance of environmental education in solving all of the environmental problems for the past years and this is the reason why it has been started the program under the Ghana District Education Directorate. But the problem is to what extents do the students of Ghana in both level perceive or understand the environmental problems and management (CRDD, 2007).

Covered in the media almost every day, environmental issues are now an important element of the political agenda. As citizens we are expected to understand and contribute to the public debate surrounding such issues that directly affect our future. Environmental education (EE) obviously plays an important role in preparing citizens for participation in such deliberations. It is widely assumed that EE is a modern initiative arising from the growing concern about the environment that has arisen in recent decades. However, EE is by no means a new arrival in the educational sphere. Influential philosophers, authors

and educational thinkers such as Jean-Jacques Rousseau, John Dewey and Maria Montessori, to mention but a few, have drawn attention to the necessity of including issues relating to nature and the environment in schools (Palmer 2008).

In other words, EE should promote problem-solving skills, critical thinking and action-oriented insights in relation to central and practical problems that are interdisciplinary in nature. As Stevenson (2007) points out, 'Teaching and learning (EE) are intended to be co-operative processes of inquiry into and action on real environmental issues', that is, students should be put in the position of active thinkers prepared to act in response to issues in collaboration with fellow students. This line of argument regarding pedagogy echoes the claims made by scholars studying teaching and learning in the context of so-called socio-scientific issues, that is, controversial and multidisciplinary issues such as the greenhouse effect, energy use, gene modification of organisms and many others, which are central to citizenship (Sadler, Barab, & Scott, 2007; Makitalo, Jakobsson & Saljo, 2009).

Such learning also involves understanding how to approach, formulate and analyse complex issues and where to turn for relevant knowledge, and not merely the reproduction of what is already known (albeit in various different disciplines). In such settings, student-active and problem-based instructional approaches have been argued as providing a suitable context in which to develop knowledge (Ratcliffe & Marcus, 2003; Khishfe & Lederman, 2006). Thus, the pedagogy and philosophy behind EE can be regarded as challenging traditional approaches to schooling, which tend to focus on the acquisition of factual knowledge presented in the classroom by the teacher in order to solve

problems with an already existing, single and correct solution (Sheehy, Wylie, McGuinness & Orchard, 2000). Traditional schooling is also highly fragmented in terms of disciplines and is based on abstract problems, with students put in the rather passive position of simply reproducing information and standard procedures (Stevenson 2007).

Social Studies Curriculum and Environmental Education

Social Studies essentially represent an interdisciplinary approach to the curriculum regarding the study of man with reference to their physical and social environments. More emphatically, it underscores the preparation and mobilization of learners for effective citizenship and national productivity. "Okam (2002) viewed the role of social studies as building citizens who are expected to positively explore opportunities to develop their own potentialities and to contribute their maximum efforts to an improvement of group living within the society". Social Studies as a socializer of the societal network have a role to play in the crusade against environmental related problems. It provides the learners with the skills to recognize environmental problems, causes and consequences and proffer solution.

In view of this, Bozimo and Ikwemelu (2009) declare that it is difficult to draw a line between environmental education and Social Studies. They discussed further that: It is probably a matter of emphasis more than clear theoretical differences whereas an environmental studies approach might begin with the local environment and might stress geographical, physical and scientific aspect of the environment. Social Studies approach would stress the social aspect of a child's environment, especially the groups that he belongs. The above submission has a far reaching implication. It stresses the fact that the

issue of environmental management goes beyond scientific principles and theories. It accommodates desirable human behaviour or attitudes towards environment.

This therefore explains the significant role Social Studies is set to play in creating the necessary awareness classroom wise among the young generations in the Ghanaian schools. Hence, the scientific approach is meaningless without positive human behaviour. Supporting this thought pattern, Abdullah (2002) laments that we must admit that not all our science teachers possess the skills, nor are aware of the methodologies needed to present environmental science concept to students on inter-disciplinary bases. Further, not all the teachers charged with the responsibilities of making the students aware of environmental issues are science teachers. It is clear from the above, environmental education deserves and inter-disciplinary approach and this interdisciplinary approach is inbuilt in social studies education as a distinguished curriculum package. The philosophy behind teaching of this subject area is the production of effective citizens who are ready to make contributions to national development in all its ramifications (Kankam, Bekoe, Ayaaba, Bordoh, & Eshun, 2014).

In this process, Social Studies uses inbuilt mechanism or strategies for inculcating skills and desirable attitudes required to build the culture of environmental sanitation in the learners. Some of these strategies are: discussion method, panel discussion technique, dramatization technique, play way technique, field-trips, inquiry techniques, etc. which are relevant means of tackling environmental issues. Social Studies deals with man as he interacts

with his socio-physical environment (Eshun, Bordoh, Bassaw, & Mensah, 2014).

Aspects of Social Studies Curriculum that Promote Environmental Education

Social Studies Education Curriculum is designed to enrich the students' understanding of societal problems and do something positive about it. That is why the curriculum of this subject area is interdisciplinary in nature- drawing its contents from diverse disciplines to proffer solution to various degrees of human problems through critical thinking approach. Thus, the central focus of Social Studies Education is "man and Environment". At this juncture, it is pertinent to state that the perception of Social Studies of the word "environment" is broader (Margaret, 2001).

No wonder therefore, that at both primary and secondary levels of the Ghanaian educational system, considerations are given to topics like man's encounter with other men in and outside his immediate environment, encounter with nature and other man-made elements in the society, physical and social environment, cultural pattern, science and technology and its effects on man and his environment, national economic life, People and government, Our values, Citizenship, National Consciousness and National Identity, National resources, Human Rights and Rule of Law, Civic Duties, responsibilities and Obligations of Citizens and Ghanaian Constitution, leadership and followership among others (Ngada, 2008).

All this core topics are taught to cover three aspects of learning development in cognitive, affective and psychomotor. Moreover, Social studies is "value-oriented subject" and can therefore be tailored towards the realization

of values that are inherent in environmental education. It could do this through the inculcation of right types of attitudes and values which Kazi (2004) perceived as "standards that guide a person's judgment and behaviour in a community or society" such as sense of appreciating the beauty of both natural endowment and man-made activities, tolerance, co-operation, obedience, responsibility and patrotism among other social values into the young ones as well as the preservation of the environment for overall development of the society. Some of the social practices such as dumping of refuses, cutting down of tree, artificial environmental pollution, and others can be preached against in social studies class (Kankam et al., 2014).

Social Studies and environmental education are multidisciplinary in nature whose purpose is geared towards the quality of life for mankind. Each of them does not only represent a broad field that encompasses much more than the subject matter of a single subject discipline but respectively constitutes applied area of knowledge which selects facts, concepts, theories and generalization for the purpose of bringing solution to human problems. Thus, the strong point behind any course of instruction in social studies is the production of efficient and effective citizens who are capable of using knowledge from diverse disciplines in making positive decision about their environment. Moreover, it is this "socio-civic" nature of this course of study that makes it plausible to be used as an instrument per excellence to create awareness through a carefully planned course of instruction on environmental issues among the young stars of the Ghanaian society (Quashigah, Dake, Bekoe, Eshun, & Bordoh, 2014).

As it has earlier on been stated, the environmental issues are beyond the limit of scientific theories. It deserves a collaborative curriculum approach, hence the need for the development of environmental education as a curriculum design and the strength of social studies education to accommodate some environmental matters beyond the present practice. In this context, the schools have roles to play by ensuring that this subject area is handled the competent specialists so that the subject will not become a misplaced priority in the school system. Margaret (2001) maintained that the school of the past was a training ground for initiative adjustment to an established society. If this is so, then new knowledge on environmental problems, issues, insight and concern must be brought into curriculum independently like other subjects in order to engender behavioural change for mutual coexistence with our environment most especially now that the country is vigorously pursuing Millennium Development Goals and Vision 2020 objectives.

Relevance of Social Studies Curriculum to Environmental Education

Social studies is indeed relevant to environmental education. As a curriculum subject, social studies is the study of how man influences his environment and how the environment in turn influences man (Fadeiye, 2005). Its methodology lays emphasis on finding out, understanding and coping with various problems confronting man in the course of survival in his environment. Environmental Education is a new area of interest to social studies educators (Fageyinbo, 2004). Thus, virtually everything that relates to human living and surviving are potential areas of study to social studies education.

Social studies provide opportunities for exploring the key dimensions of environmental education. Learning in social studies can be undertaken through

education in the environmental topics. The question now is, how does environmental education relevant to social studies? According to Kuranga (2006) environmental education offers opportunities for study under each of the ten themes of social studies education identified by the National Council for the Social Studies (NCSS). According to him, Environmental Education spans the social studies due to its multi-disciplinary nature. Social studies themes are appropriate in teaching Environmental Education. Also, Environmental Education is excellent integration tools that can help students explore historical, economic, political, geographic, and scientific aspects of environmental topics.

The relevance of social studies to Environmental Education if it is viewed against the contribution of Fageyinbo (2004) where he states that the central focus of social studies is the holistic study of man in his various relations either in groups or as individual with diversified aspects of his environment. Environmental degradation as a social problem offers justification for the infusion of Environmental Education in schools. The degradation of the environment no doubt constitutes a great threat to both human and materials resources. Every nation was therefore more sensitive to environmental problems and continues to promote and develop environmental Education Programmes (Ogunsanya, 2002; Kuranga, 2006).

Of course, environmental degradation which environmental education intends to address is better achieved through relevant social studies content. By solving problem of environmental degradation, the society becomes a better place to live. To expatiate on this, Adara (2006) conceptualizes social studies as an organized integrated study of man and his environment; both physical and social, emphasizing cognition, functional skills, desirable attitudes and actions

for the purpose of creating effective citizenry. More importantly, social studies help the child to examine his environment and to determine his own place in it. Social studies do this by providing knowledge and information about environmental issues (Ogundare, 2001). It is envisaged that the introduction of environmental education into the school curriculum will bring about the development and inculcation of citizenry.

According to UNESCO (2005), Environmental Education is an educational concept which considered the environment as a scientific and aesthetic resource to be used in life long educational process, thus making people knowledgeable and aware of the environment and its problems as well as their own roles in environmental conservation, preservation and management. The objectives of Environmental Education are to produce people who will find solution to environmental problems. The knowledge of Environmental Education will also make it possible to exploit natural resources without endangering the survival of the nation it intends to develop.

Students' Knowledge and Attitude about Environmental Problems

Changing of people's attitude towards environment due to considering and regarding of environmental rule, policies and regulations is the only way of realizing significant environmental achievement. Many researchers gave more focuses on the study of environmental behaviour (Culen, 2005). They believed that attitude and knowledge toward the environment influence environmental behaviour. Many studies have also been conducted on environment education from various perspectives in different countries (Jeronen, & Kaikkonen, 2002). Since human activities show a negative effect to Ghanaian environment as other countries in the world and Ghana is suffering some environmental problems,

environmental education is important in Ghana. However, there is a need for describing the current level of students' knowledge and perceptions.

Therefore, Abdullahi and Tuna (2014) conducted a study to assess Nigerian students' knowledge and perceptions about environmental problems and management using 470 students' secondary schools. The results revealed that Nigerian students' average knowledge of environmental issues was not satisfactory. However, their average perception towards environment was quite good. They were conscious of environmental problems around them even in secondary schools. Yousuf and Bhutta (2012) examined high school students' attitudes toward the environmental issues (pollution of air and water, overuse of resources, global changes of the climate etc.) with respect to school system. The results of the study indicate that there were significant difference between government and private schooling systems students' attitudes. Private schools students reported to have a significantly high degree of positive attitude towards environmental issues as compared to their government counterparts. The results of the study provide significant insights into students' attitude towards environmental issues towards discipline in both government and private secondary schools.

De Lavega (2004) examined environmental attitude, knowledge, and awareness (AKA) to improve the overall behaviour of future citizens toward the environment. An instrument was developed to measure the groups' levels of awareness, knowledge, and attitude as well as their levels of self-efficacy. This study found statistically significant differences among the groups regarding the levels of awareness, knowledge, and attitude as related to environmental issues.

The environmental specialists scored highest for all AKA components as compared to the lowest levels presented by parent awareness, parent attitude, and high school student knowledge. This study supports the evaluation of AKA levels among participants as an appropriate approach to the evaluation of environmental curriculum objectives.

A few studies have been made, where they studied the link between science, environmental education and the promotion of positive attitudes towards the environment (Yount & Horton, 2002). It is well known that individuals, who are well educated and develop concerned environment view, also behave responsibly regarding the environment. Many researchers agree that knowledge in itself will not motivate individuals to adopt a new behaviour and it is clear that the lack of knowledge may present a barrier for behavioural changes (Mobley et al., 2010; Schultz, 2002).

However, knowledge is not the only thing that affects the environmentally aware individuals but there is also a combination of awareness, attitudes, values and social, cultural and psychological factors. The problem, which occurs in the early years of primary education, is definitely too extensive frontal teaching that only expands in higher grades. It is well known that students learn the material by heart, without deeper understanding and connecting concepts with each other. It is also important to emphasise that some curricula are overwhelmed with the definitions and information that students need to know but its understanding is often neglected (McCrea & deBettencourt, 2000).

Azizan (2008) says that pupils have a good awareness of environmental issues, but in practice their attitude and behaviour has not changed yet. These

results of the study were also supported by Wahid, Rahbar and Shyan (2011), who state that the awareness of the society about environmental issues and awareness of the need to preserve the environment has increased, but the level of activity involved in environmental protection is still at a low level. The main goal of environmental education is to gain awareness of individuals and establish a conscious interaction with the environment which influences the development of a critical perspective and let the future generations enjoy a healthy and clean environment.

Palmer (2008) points out that pupils should acquire appropriate level of knowledge and understanding of the concepts related to the environment in order to achieve a critical judgement. In addition it would be necessary that the experiences and thinking would be focused on environmentally focused knowledge and lead to the appropriate development of attitude and awareness towards the environment. These three components, attitude, knowledge and awareness, play an important role for students regarding the impact on the time they spend inside and outside of the classroom. Knowledge, caring attitude and practical competence are the basis for ecological literacy. If individual acknowledges the existence of environmental problem, it means that he is aware of the state of the environment and in this degree of environmental awareness he is bound to solve the environmental problems (Lenka, 2005).

The Role of ICT in Environment Education

Environmental Education has been embedded in most subjects like social studies, natural sciences and integrated science. The main goal of Environmental Education is to help learners develop methods in solving environmental problems. Environmental Education is part of the curriculum

since it helps the learners to be knowledgeable of their environment and how to solve problems. Through Environmental Education, learners will be expected to have opportunities to develop skills such as questioning, observing and interpreting observation (Marcinkowski, 2007).

UNESCO (2005) emphasizes the role of education in shaping attitudes, values, and behaviour, while developing the capacities, skills, and commitments needed for building a sustainable future. Pupils Behaviour is generally supported by the knowledge and attitude, but the direct connection from knowledge to attitude and on to the behaviour does not always exist (Monroe et al., 2000). It is necessary to start developing positive attitudes and values towards the environment in early childhood, because the patterns of behaviour in later years only strengthen and develop further. This results in a positively oriented environmental behaviour of the individual and society, which leads to a sense of responsibility and care for the environment while at the same time these behavioural patterns are transmitted to subsequent generations.

The central challenge of environmental education is how to encourage children and develop their sense of relationship to the environment, which in adulthood leads to positive environmental management (Littledyke, 2008). Therefore, understanding of the environment is associated with love and respect for nature with a sense for living creatures, which can lead to motivation for action and the sense of responsibility and concern for the protection of the environment (Cotton, 2006a). A few studies have been made, where they studied the link between science, environmental education and the promotion of positive attitudes towards the environment (Gurevitz, 2000). It is well known that individuals, who are well educated and develop concerned environment

view, also behave responsibly regarding the environment (Mobley et al., 2010). Palmer (2008) points out that pupils should acquire appropriate level of knowledge and understanding of the concepts related to the environment in order to achieve a critical judgement. In addition it would be necessary that the experiences and thinking would be focused on environmentally focused knowledge and lead to the appropriate development of attitude and awareness towards the environment

ICTs can be utilized for teaching EE by facilitating information, gathering and dissemination. Educators have within their power the opportunity to shift their own beliefs and understanding about new technologies and about their place in teaching Environmental Education. The use of ICT in teaching Environmental Education lends itself to more learner-centred settings. According to Tella and Adu (2010), applying ICT as a tool for teaching in the curriculum areas enables students to become "competent, discriminating, creative and productive users of ICT. Learners are better able to achieve skills and develop capacity to select and use ICT to inquire, develop new understanding, and also create and communicate with others in order to participate effectively in society.

There is currently considerable interest within the field of Environmental Education in developing learners' abilities to apply their knowledge and to solve environmental problems. Signs of improvement in using ICT still reveal significant shortcomings. These shortcomings together with the importance of developing ICT knowledge and skills have led to calls for light to be thrown on pedagogy for ICT to be used in teaching and learning (Yellend, 2001). Teaching and learning through ICT is used to describe

situations where ICT facilities become the whole teaching and learning environment by providing learning material and acting as assessor or a tutor (Paas, & Creech, 2008). The traditional role for teachers has been as presenters of ready-made information and as organisers of learning experiences. One way in which ICT can be used in the classroom is to take over these presentational and organisational roles. This has implications for both the teachers and learners; by providing an additional source of knowledge, the computer may reduce the dependency of learners upon the teacher (Adu & Olatundun, 2013).

There is learner autonomy in learning, which means the teacher no longer needs to adopt a didactic approach but gain freedom to function increasingly as "enablers of quality learning experience (Somekh & Davies, 2001). The teacher acts as a facilitator of learning, drawing on a range of information sources, trusting in technology's ability to offer greater sufficiency and effectiveness of student learning, and ICTs' growing prevalence in society at large. Computer-aided tasks in Environmental Education of any kind can be more authentic than the traditional teacher-centred tasks. For example, through the wide range of information sources that modern technology makes available, learners can be exposed to many opportunities which open up spontaneity in learning in Environmental Education.

In order to be precise, effective teaching and learning of EE has been positively affected and enhanced by ICT (Yusuf, 2005). A number of researchers have identified many benefits of ICT in promoting the quality of education (Al-Ansari, 2006). ICT has the ability to enrich, deepen skills, accelerate, motivate and engage learners to help relate school experience to work practices and create economic viability as well as strengthen teaching and

helping schools to change (Fien, 2003). The use of ICT in teaching Environmental Education can help teachers improve the quality of education by providing support. According to Zhao and Cziko (2001), three conditions are necessary for educators to introduce ICT as pedagogy: educators should believe in its effectiveness, the use of technology should not cause any disturbances, and educators should have control over it. ICT usage significantly prepares learners for their future careers in the modern workplace where computers, the Internet and related technologies have become increasingly indispensable and commonplace.

Several experts in educational technology suggested that the reason for the low level of ICT integration in teaching Environmental Education in high schools is a conflict between the educator-centred educational values and learner-centred educational values expressed in most forms of information technology. ICT plays an important role in a school which provides new frameworks that can help improve the teaching and learning culture. There has been a remarkable breakthrough in the use of ICT on a large scale, and teachers are benefiting from the easy access to educational resources such as software packages, the Internet and other electronic resources (Kozma, 2005).

The use of ICT tools offer opportunities to 'liberate' learners in the classroom while providing teachers with the opportunity to pay more attention to individual needs. It is also emphasises the complexity of environmental problems like poaching, waste and littering. It is therefore appropriate to say that using ICT in Environmental Education is more than learning about the environment. It deals with changing behaviours in such a way that people will not act against the environment (Koehler, Mishra, & Yahya, 2007). The

transformative nature of Environmental Education signifies that teachers' perspectives and actions within the environment will radically change in order to deal with its problems. A whole school approach similar to that conducted by exemplary schools in New Zealand, Sweden, China, United Kingdom, Canada (Henderson & Tilbury, 2004) and integral education in Brazil (Haddad, 2009) could be seen to offer the transformative potential of EE in schools.

In such cases, the use of ICT in EE can help teachers take advantage of the computer integration and multimedia possibilities to raise their students' awareness. At the same time, teachers can help learners get to know their environment and the issues concerning this environment. Virtual environments and settings point out the need to work towards the development and integration of environmental knowledge by means of more appealing and effective communication strategies.

CHAPTER THREE

RESEARCH METHODS

Introduction

In this chapter, the methods used in the study were explained. These include research design, population, sample and sampling procedures, instrument, data collection and data analysis procedure.

Research Design

The objective of this study was to investigate the effects of ICTs on JHS students' knowledge of environment and environmental problems in social studies of Twifo Hemang Lower Denkyira District, Central Region. To this end, the study employed the quasi experimental pre-test-post-test control group design explore the effect of ICT on JHS students' knowledge of environment and environmental problems in social studies and the relationship that exist between the experiment and control group. The quasi experimental pre-test-post-test control group design was appropriate for this study because it involved human behaviour and did not permit complete randomisation of the subjects and control variables. The design for the study is as represented below:

E= O1 X1 O2

C= O3 X2 O4

Where O1, O3 are the pre-test in the two groups while O2 and O4 represent the post-test in the two groups and X1 and X2 represent the treatment group and the conventional method in the control group respectively. In the control group, researcher used traditional method which uses the dialog and discussion technique for teaching. After this, the teacher taught students from an experimental group using intervention. Thus, in the experimental group, the

researcher using a ICTs (computer) in teaching the pupils 'environmental degradation'. Both groups were subjected to pre-test and post-tests in the subject tackled by the lecture.

Study Population

A population is all the individuals or units of interest. The population is the set of entities under study. Population is the broader group of people to whom you intend to generalize the results of your study. A population is a group of individuals' persons, objects, or items from which samples are taken for measurement. The study population composed of all JHS one (Form 1) students in public Junior high schools in Twifo Hemang Lower Denkyira District, Central Region. The first year students (Form 1) were used because they were about to learn the topic "environment and environmental problems" in the first year social studies syllabus. Also, it is believed that they might have knowledge on the concept "environment and environmental problems" from other subjects such like science in the basic school (Primary schools).

Sample and Sampling Procedures

A sampling frame is a list of all the items in your population. It is a complete list of everyone or everything you want to study. Sample is the group of individuals who actually participate in your study. A sample is a subset of the individuals in a population. A sample is a finite part of a statistical population whose properties are studied to gain information about the whole. It is a set of respondents (people) selected from a larger population for the purpose of a survey. Sampling is the act, process, or technique of selecting a suitable sample, or a representative part of a population for the purpose of determining parameters or characteristics of the whole population.

Four public JHS were purposively selected according to their BECE results in Twifo Hemang Lower Denkyira District, Central Region. The first and third schools were used in the control group and the second and fourth schools were also used in the experimental group. All the students in the four selected schools were used for the study. Each school contained 30 students in the Form one classes. So all the 120 students from the four-selected public junior high school were purposively used in the study. The control group and experimental group had 60 students each.

Data Collection Instruments

Test and structured Questionnaire was used in data collection for the study. The test items were teacher made test developed by the researcher based on Environmental degradation in Form one Social Studies syllabus. The teacher made test was one administered twice. The first test administration was pre-test and the second test administration was post-test. Both pre-test and post-test was used to find students' knowledge on environmental degradation. The content of test instrument was under three (3) headings in the area of land pollution, water pollution and air pollution according to the syllabus. The questionnaire was used to measures students' attitude towards environmental degradation after the intervention and the traditional teaching. The questionnaire has only two section, the first section contained information about the students' background information and the second section looked at the attitude of students towards environmental degradation. Before the actual administration of the test and questionnaire, pre-testing of the instruments was carried out to check whether instruments are reliable and valid.

Pre- test of Instruments

Pre – testing of instruments is useful in fine tuning aspects of the questions that could otherwise make it difficult for respondents to interpret questions as intended (Foddy, 1995). Borg and Gall (1996) have stressed the need for pre – testing of survey instruments before administering the instruments to the respondents.

The researcher did pre – testing of the instruments by using 20 students from Twifo Atti – Mokwa District. The students in this district were selected and used for the pilot test because it has similar characteristic at Twifo Hemang Lower Denkyira District in the Central Region where the main study took place. The reason for pilot testing the instruments was to the realiability of the instruments. It also gave the advance warnings about where the main research project could fail, where research protocols might not be followed, or whether proposed methods or instruments were inappropriate or too complicated. Finally, it was pilot tested mainly to improve the internal validity of the instruments.

The reliability of the instruments was confirmed by examining the individual test items with the Crombach's alpha (Gall et al., 1996). The Crombach alpha values for the pilot test were 0.83 and 0.83 for the first and second set of the questionnaires respectively. This co-efficient could be considered high because, according to Fraenkel and Wallen (2000), reliability co-efficient of .70 is seen to be highly reliable for research purpose. This value is in line with that of Tavakol, Mohagheghi and Dennick (2008) that acceptable values of alpha, ranges from 0.70 to 0.95. Hence, the alpha value of 0.83 was accepted and used for the study.

Validity and Reliability of Instrument

The questionnaire and teacher – made assessment test were pretested to ensure their validity and reliability where necessary. Effect early modification if possible as suggested by Cooper and Schindler (2001). According to Fraenkel and Wallen (2000), an instrument is valid if it measures what it is intended to measure and accurately achieves the purpose for which it was designed. They added that validity should involve the appropriateness, meaningful and usefulness of inferences made by the researcher on the basis of the data collected.

After designing the instruments, copies were submitted to one of the social studies Tutors in Mampong College of Education to check for the representativeness and completeness of items. The tutor helped me to edit and correct the mechanical and grammatical errors from the instruments. After the Tutors' comments and constructive criticisms, some refinements were made where necessary. Sarantakos (2007) also found that pre – tests are small test of single elements of the research instruments, which are predominantly used to check eventual mechanical problems of the instruments.

Data Collection Procedures

Before the data collection, an introductory letter was collected from the Department of Information Technology of the College of Distance Education, University of Cape Coast, to sought permission from the Headteachers of the participating JHS. With the introductory letter, permission was sought from the various heads of the schools to conduct the study in their schools. The purpose of this introductory letter was to solicit for cooperation and also to create rapport between the researcher and the respondents who served as the key participants

of the study. With the consent from the Headmasters, the teachers and students were informed about the study.

Intervention (Computer Based-Teaching)

After the results of pre-test to determine the level of the students' knowledge on environment and environmental problems, the experimental group pupils were taught using computer-based instruction (computer) on environment and environmental problems (environmental degradation) in each school for three weeks. A three week lesson was prepared and developed using the topic 'environment and environmental problems' in JHS One Social Studies Syllabus. In week one, pupils were taught 'Water Pollution' in three days using ICT (computer). In week two, the pupils in the experimental group were also taught 'Air pollution in three days using ICT (computers) and the third week, the pupils were finally taught 'Land Pollution' in three days using ICT (computer). However, the control group received instruction using traditional method of teaching. Both the control group and the experimental group had one hour lessons for two weeks.

Pre-Intervention (Pre-Test)

On the first day, the pre-test was administered to students in all the schools. The pre-test reflect the content environmental degradation in the JHS Social Studies syllabus for Ghanaian schools (See Appendix A). The primary purpose of the pre-test was to determine the level of the students' knowledge on environment and environmental problems before the intervention. Each test was made up of 20 questions and comprises items for low, average and high level abilities of pupils in three areas namely land pollution, water pollution, and air pollution according to the syllabus. The participants responded by choosing the

correct or best option from four options (A-C). The time allocated for both the pre-and post-test was 30 minutes. The researcher invigilated the test himself.

Intervention (Computer Based Teaching)

After the results of pre-test to determine the level of the students' knowledge on environment and environmental problems, the experimental group pupils were taught using computer-based instruction (computer) on environment and environmental problems (environmental degradation) in each school for three weeks. A three week lesson was prepared and developed using the topic environment and environmental problems' in JHS one Social Studies Syllabus. In one week, pupils were taught Water Pollution' in three days using ICT (computer).In week two, the pupils in the experimental group were taught Air Pollution 'in three days using ICT(computers) and the third week, the pupils were finally taught Land 'Pollution' in three days using ICT (computer). however, the control group received instruction using traditional method of teaching. Both the control group and the experimental group had one hour lessons for two weeks.

Post-Intervention (Post-test)

After the intervention, a post-test was administered to the two groups (See Appendix B). The post- test is of parallel forms to pre-test and reflect the content environmental degradation in the JHS Social Studies syllabus for Ghanaian schools. The main objective of the post-test was to find out whether there were any statistically significant differences in the final knowledge score of the treatment groups. The time allocated for the post-tests was 40 minutes. The researcher invigilated the test himself. After the post-test administration, the both groups were given questionnaires to fill. The questionnaire was used to

assess the students' attitude towards environmental problems (degradation) after the intervention.

Data Processing and Analysis

The data processing and analysis was done after the data was collected. After the completed questionnaire, have been collected, the data was entered into a spreadsheet in the SPSS program. Then, the data will then be summarized using descriptive statistics (mean, standard deviation, frequency and percentages) and inferential statistics (pair sample t-test and independent sample test-test).

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents the results and discussion of the data analysed based on the research questions and hypotheses. This was done in three sections; the first section presents descriptive statistics of the demographic characteristics of the respondents. The second presents the results in response to the research question and the third part presents the results from the research hypotheses. The results were presented in tables

Socio-Demographic Characteristics of the Respondents (Control Group)

The background data of the pupils who took part in the study were sought. These include sex distribution. The results on the distribution of the pupils by gender were presented as shown in Table 1.

Table 1: Gender Distribution of Respondents by Groups

Groups	Gender	Frequency	Percentages
Control Group	Male	33	55.0
	Female	27	45.0
Total		**60**	**100.0**
Experimental Group	Male	36	60.0
	Female	24	40.0
Total		**60**	**100.0**

Source: Field data, (2016)

From Table 1, in the control group, out of 60 pupils, 55% of them were males while 45% of them were female's and in experimental group, out of 60 respondents, 60% of them were males while 40% of the pupils were females.

These results reveal that the male pupils in both the experimental and control group were more than their female counterparts.

Research Question 1: What is the attitude of JHS students towards environmental problems?

The purpose of this research question was to assess student's attitude towards environment and environmental problems after the traditional teaching in the control group and administration of intervention in the experimental group. The results were presented in Tables 2 and 3.

Table 2: Students Attitude towards Environment and Environmental Problems Control Group

Statement	SA N (%)	A N (%)	SD N (%)	D N (%)
I think each of us can make a significant to environmental protection	30 (50)	24 (40)	3 (5)	3 (5)
Science and technology can solve all environmental problems	36 (60)	24 (40)	0 (0)	0 (0)
People should care more about protection of the environment	39 (65)	18 (30)	0 (0)	3 (5)
I always pick up trash or rubbish lying on the floor	27 (45)	24 (40)	3 (5)	6 (10)
I always separate the solid waste from the liquid waste	30 (50)	21 (35)	3 (5)	6 (10)
Motorcycles and cars use in our country increase the rate of air pollution	33 (55)	27 (45)	0 (0)	0 (0)
Industries should be sited far away from the cities in order to reduce of global warming	33 (55)	27 (45)	0 (0)	0 (0)

Table 2 Continued

Statement	SA N (%)	A N (%)	SD N (%)	D N (%)
Deforestation has negative effects on the environment	30 (50)	18 (30	6 (10)	6 (10)
Reduction of carbon dioxide emission to the atmosphere to prevent ozone depletion is important	33(55)	24 (40)	0 (0)	3 (5)
Environmental problems can be solved with a big changes in our way of living	27 (45)	21 (35)	3 (5)	9 (15)

Source: Field data, 2016

Table 3: Students Attitude towards Environment and Environmental Problems (Experimental Group)

Statement	SA N (%)	A N (%)	SD N (%)	D N (%)
I think each of us can make a significant to environmental protection	30 (60)	18 (30)	0 (0)	0 (0)
Science and technology can solve all environmental problems	42 (70)	18 (30)	0 (0)	0 (0)
People should care more about protection of the environment	42 (70)	18 (30	0 (0)	0 (0)
I always pick up trash or rubbish lying on the floor	30 (50)	27 (45)	3 (5)	0 (0)
I always separate the solid waste from the liquid waste	33 (55)	24 (40)	0 (0)	3 (5)
Motorcycles and cars use in our country increase the rate of air pollution	39 (65)	21 (35)	0 (0)	0 (0)
Industries should be sited far away from the cities in order to reduce of global warming	36 (60)	24 (40)	0 (0)	0 (0)

Table 3 continued

Statement	SA N (%)	A N (%)	SD N (%)	D N (%)
Deforestation has negative effects on the environment	30 (50)	24 (40)	0 (0)	0 (0)
Reduction of carbon dioxide emission to the atmosphere to prevent ozone depletion is important	24 (60)	24 (40)	0 (0)	0 (0)
Environmental problems can be solved with a big changes in our way of living	33 (55)	21 (35)	3 (5)	3 (5)

Source: Field data, 2016

In Tables 2 and 3, it was realised that most of the students (n=100; 83.3%) both in control and experimental group had positive attitude towards the environment and environmental problems (environmental degradation). This could be a result of increase in knowledge and understanding of environment and environmental problems. For example, all the 120(100%) pupils both in experimental and control group agreed with the statement that science and technology could solve all environmental problems. Similarly, all the 120 (100%) pupils both in experimental and control group indicated that motorcycles and cars used in our country increase the rate of air pollution These results suggest that most of the pupils in both experimental and control group had positive attitude towards environmental degradation hence it is believed that the use of ICT in implementing the Social Studies curriculum could have positive impact on students' knowledge, attitude, perception and practices towards environmental degradation in the society.

To the statement "Industries should be sited far away from the cities in order to reduce effect of global warming", it was found that all the 120 (100%)

pupils both in experimental and control group agreed with the statement. Again, the majority (n=107; 89.2%) of the pupils agreed with the statement that people should care more about protection of the environment. Equally, 105 pupils both in experimental and control group representing 87.5% revealed that that reduction of carbon dioxide emission to the atmosphere to prevent ozone depletion is important. The majority (n=97; 80.9%) of the pupils both in in experimental and control group agreed with the statement that "I think each of us can make a significant contribution to environmental protection". This result implies that most of the pupils are willing to make meaning contribution to the society as a result of their knowledge, attitude and perception towards environmental degradation. These results suggest that most of the pupils in both experimental and control group had positive attitude towards environmental degradation hence it is believed that the use of ICT in implementing the Social Studies curriculum could have positive impact on students' knowledge, attitude, perception and practices towards environmental degradation in the society.

From these results, it is concluded that on average, the majority, 100(83.3%) of the pupils both in experimental and control group had positive attitude towards environment and environmental problems. This could be a result of the increase in their knowledge and understanding of environment and environmental problems. The results of the current study are consistent with the findings (Taye, 2008) which revealed that the students show a favourable attitude towards conservation of resources. This study strengthened the finding of Engidasew (2010) which revealed that students are ready and willing to engage and participate in activities that promote environmental sustainability and protection of the environment for better living. The results of the current

study confirmed the findings of Birhanu (2014) which found that students have positive attitude towards land degradation and related environmental problems and students were ready and willing to participate in environment friendly activities that cures and prevents land degradation and related environmental problems.

Research Hypothesis 1: There is no statistical significant difference in the environmental degradation knowledge between pupils in the experimental group and control group on the post-test

Table 4: Results of Independent Sample T-Test Comparing Experimental and Control Group Pupils Knowledge on Post-Tests

Group	N	Mean	SD	t-value	Df	Sig (2-tailed)
Post – control test	60	32.18	19.15	-2.591	119	0.00
Experimental	60	39.62	22.76			

Source: Field data, 2016 *Significant, p<0.05

As shown in Table 4, an independent samples t-test was used to compare means from independent groups. That is, the researcher evaluates whether the means for two independent groups are significantly different from each other. As indicated in Table 3, the result of independent sample t-test showed that there was significant differences between the two groups in the post-test. The mean score of students' knowledge of environment and environmental problems in the control group was 32.18 with a standard deviation of 19.15 and that of the experimental group was 39.62 with a standard deviation of 22.76. This result indicates that the students who received intervention or treatment using ICTs in the instructional process did significantly better in the knowledge test than those students in the control group who received traditional teaching and the difference between the control group and experimental group reached a

significant level after being examined by the independent sample t-test, t(119)= -2.591, p=0.000, therefore the null hypothesis is rejected.

It could be concluded from Table 3 that ICTs instruction is an effective methods in increasing students' knowledge, awareness and understating of environment and environmental problems in Social Studies curriculum. In other words, ICTs instructions are obviously effective in the increment of students' knowledge and understanding of environment and environmental problems. The result of the current study corresponds to the findings of the previous studies on efficacy of ICTs in environmental education in Social Studies and science curriculum that ICTs. ICTs usage in teaching and learning process supplement class curriculum experiences which increases students' positive exposure to natural environments and help children assimilates new ideas into their existing base of knowledge (Kellert, 2005).

When teacher uses ICTs in teaching environments and environment problems, it provides hands-on learning approach which raises students' interest and awareness of environmental issues and therefore, a greater emphasis should be placed on the usage of ICTs in the class activities that integrate ecological concepts into educational structures (Kellert, 2005). Using contemporary ICTs in the social studies can help to improve and develop the quality of environmental education by providing curricular support in difficult subject areas (Reeves & Jonassen, 2006).

The use of ICT in teaching and learning "environment and environmental problem" in social studies can provides opportunities for students to access an abundance of information using multiple information resources and viewing information from multiple perspectives, thus fostering

the authenticity of learning environments (Smeets & Mooij, 2001). Kennewell et al. (2000) feel it is essential that ICTs be placed in the classroom, in order to maximize the opportunities for curriculum activity.

Research Hypothesis 2*:* There is no statistical significant difference in the environmental degradation knowledge scores of pupils in the experimental group on the pre-test and the post-test.

Table 5: Results of Pair Sample Test Comparing Students' in the Experimental Group Knowledge of Environmental Education (Pre-Test and Post-Test)

Group	N	Mean	SD	Mean Diff	SD	t-value	Df	Sig (2-tailed)
Pre – test Experimental Group	60	24.20	4.44					
Post – test	60	30.62	2.86	6.42	2.1		4.194*	0.000

Source: Field data, 2016 *Significant, p<0.05

As shown in Table 4, the paired t-test was utilized to compare the mean scores of the pre-test and the post-test of students in the experimental group on their knowledge of environment and environmental problems. The paired comparison t-test was used to test if the means of the pre-test and the post-test of the two measures differ significantly. Table 4 shows that in the sample, the pre-test knowledge mean score is 24.20 with a standard deviation of 24.44 while the post-test knowledge mean score is 30.62 with a standard deviation of 22.86.

The findings of the paired samples test show the paired differences between the students' knowledge and understanding of the environment and environmental problems pre-test (24.20) and the post-test (30.62) is -6.42. Students' knowledge and understanding of the environment and environmental problems increased during the intervention using ICTs in teaching the concept

"environmental degradation". A gain of 6.42 points in the mean of the students' knowledge and understanding of the environment and environmental problems was found. At the 0.05 level the gains were significant. The pre-test and the post-test were significant at the 0.05 level. The hypothesis that there is no difference between the two means of the pre-test knowledge and post-test knowledge means is rejected (Table 4).

The results of the current study confirmed the findings of previous studies. The use of ICT in teaching and learning "environment and environmental problem" in social studies can provides opportunities for students to access an abundance of information using multiple information resources and viewing information from multiple perspectives, thus fostering the authenticity of learning environments (Smeets & Mooij, 2001). Kennewell et al., (2000) feel it is essential that ICTs be placed in the classroom, in order to maximize the opportunities for curriculum activity.

When teacher uses ICTs in teaching environments and environment problems, it provides hands-on learning approach which raises students' interest and awareness of environmental issues and therefore, a greater emphasis should be placed on the usage of ICTs in the class activities that integrate ecological concepts into educational structures (Kellert, 2005). Using contemporary ICTs in the social studies can help to improve and develop the quality of environmental education by providing curricular support in difficult subject areas (Reeves & Jonassen, 2006).

Research Hypothesis 3: There is no statistical significant difference in the attitude mean score between students in the experimental group and control group

Table 6: Results of Independent Sample T-Test Comparing Students' Attitude towards Environment and Environmental Problems

	Group	N	Mean	SD	t-value	Df	Sig (2-tailed)
Attitude towards Environment	Control	60	36.84	2.28			
	Experimental	60	40.28	7.79	2.822*	119	0.00

Source: Field data, 2016 *Significant, p<0.05

Table 5 shows the result of independent samples t-test of students concerning their attitude towards Environment and Environmental Problems after the intervention and traditional teaching. Preliminary analyses were performed to ensure no violation of the assumptions of random sampling, level of measurement, independent of observations, normal distribution and homogeneity of variance.

As shown in Table 5, the independent samples t-test showed that the control group had a mean score (M=36.84; SD=12.28) while the experimental group had a mean score of (M=40.28; SD=17.79). By implication, the students in the experimental group had better attitude (relative positive attitude) than the students in the control group. When the means scores of the two groups were tested using the independent samples t-test at 5% significant level, two-tailed, the results revealed that there was statistical significant difference in the attitude mean scores of the students in the control group (M=36.84; SD=12.28) and experimental groups of [M=40.28; SD=17.79; t(119)= 2.822, p = 0.000). These results could be credited to students increase in knowledge as result of the

integration and use of ICTs in teaching the environment and environmental problems, therefore, the null hypothesis was thereby rejected.

Pupils' behaviour is generally supported by the knowledge and attitude, but the direct connection from knowledge to attitude and on to the behaviour does not always exist (Monroe, Day, & Grieser, 2000). It is necessary to start developing positive attitudes and values towards the environment in early childhood, because the patterns of behaviour in later years only strengthen and develop further. A few studies have been made, where they studied the link between science, environmental education and the promotion of positive attitudes towards the environment (Gurevitz, 2002). It is well known that individuals, who are well educated and develop concerned environment view, also behave responsibly regarding the environment (Mobley, Vagias, & DeWard, 2010).

Many researchers agree that knowledge in itself will not motivate individuals to adopt a new behaviour (Schultz, 2002) and it is clear that the lack of knowledge may present a barrier for behavioural changes (DeYoung, 2000). Azizan (2008) says that pupils have a good awareness of environmental issues, but in practice their attitude and behaviour has not changed yet. Dunlap, Gallup and Gallup (2003) conducted an international survey on environmental values and found that citizens of many developing nations were highly concerned about the state of the environment. Larijani (2010) examined students' environmental attitudes across gender and found overall positive attitude towards environment across gender.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter provides summary of the study. Based on the summary and the key findings of the study, conclusions were drawn. The chapter also provides recommendations and suggestions for further study.

Summary of the Study

The objective of this study was to investigate the effects of ICTs on students' knowledge of environment and environmental problems in among Junior High Schools students of Twifo Hemang Lower Denkyira District, Central Region. Quasi Experimental research the pre-test-post-test control group design was used for the study. The sample for the study was 120 students from four selected Junior high Schools (JHS). The sample for each of the group was 60 students. Teacher made test and questionnaire was used for data collection. The data was processed using SPSS version 21 and analysed using descriptive (frequency and percentages) and inferential statistics (pair sample t-test and independent sample test-test).

Key Findings

1. The majority (n=100; 83.3%) of the students both in experimental and control group had positive attitude towards environment and environmental problems.
2. There was significant differences between the control group and experimental group in the post-test results.

3. There was significant differences (gain) between the experimental group students' knowledge of the environment and environmental problems on pre-test and the post-test
4. There was statistical significant difference between control and experimental group attitude towards environment and environmental problems.

Conclusions

Concern for the environment is not a sole preserve of environmentalists. Nowadays, caring for the planet is a particularly relevant issue for citizens. The environmental crisis the world is facing today requires an innovative approach to ensure sustainability. Environment degradation is one of the key problems confronting Ghana today. There is therefore the urgent need for Ghanaians to become aware of this problem so as to adopt the necessary measures to solve the problem. Knowledge of the value of the environment and how to sustain it is vital for the continued existence of humanity.

This study was set out to explore the role of ICTs in enhancing students' knowledge in environment and environmental problems among Junior High Schools students of Twifo Hemang Lower Denkyira District, Central Region. It has been found that ICTs constitute a range of potentials to enhance students' knowledge, awareness and understanding of environment and environmental problems. It could be concluded that ICTs instruction is an effective method in increasing students' knowledge, awareness and understating of environment and environmental problems in Social Studies curriculum.

These results imply that the fuse and use of ICTs in teaching environmental and environmental problems in Social Studies Curriculum would

bring about a change in attitudes, values and behaviours, for both mental and perceptive processes, demanding new methodologies and pedagogical approaches in accordance with the needs of the new generations. Environmental and environmental problems are one aspect to which ICTs can be applied. The use of ICTs in teaching the environment and environmental problems in Social Studies would allow sharing the best practices and raising awareness of benefits of using ICT for environmental protection among students'.

Environmental Education as currently being taught in the school derived parts of its contents from social studies. Indeed, social studies is primarily concerned with environmental issues and man's relationship within his social and physical environment. As a problem-solving discipline, social studies could improve the quality of human environment through inculcation of appropriate norms and values for effective citizenship. By adopting and using ICTs in teaching social studies themes in environmental Education, it is expected to create an awareness and understanding of the evolving social and physical environment as a whole in its natural, manmade, cultural and spiritual resources, together with rational use of these resources for national development. Social Studies teachers are therefore encouraged to create necessary awareness among the students on the danger of unclean and unsafe environment condition. In order to reduce environment problems to the barest minimum if not totally eradicated.

Recommendations

Based on the key findings and the conclusions, the following recommendations were made:

1. In order to exploit the existing opportunities of ICTs for environmental sustainability, it is recommended that the District Directorate of Education through school administrators need to encourage the adoption and use of ICT in teaching Social Studies in school levels.
2. It is recommended that District Directorate of Education through CRDD should make concerted efforts that ICTs are infused with environmental and sustainability themes and activities in Social Studies Curriculum, so that the teachers would be able to understand, appreciate, adopt multidisciplinary perspective of environment and its conservation in children.
3. ICT changes rapidly and affects both discipline knowledge and pedagogical possibilities in ways that influence teachers' perspectives for employing ICT as a constant part of the learning process. Social Studies teacher indicators that capture these evolving needs are also important to identify and develop the students' of Twifo Hemang Lower Denkyira District and the District Assembly should support the teachers by providing computers and projectors to aid this.
4. Lastly, it is important to recognise that teacher training and usage of ICT do not take place in a vacuum, and therefore need to be viewed within a larger system where the teacher is central to several conceptual domains including ICT in education policy, curriculum development through the provision of digital content, ICT-enabled pedagogy, ICT infrastructure, and organization

and administration at schools and the District Directorate should support the teachers of Twifo Hemang Lower Denkyira District.

REFERENCES

Abdalla, U. A. (2002). Environmental problems: The Nigeria Case. In K. A Mezieobi (Ed). *Understanding social studies education in Nigeria* (pp. 1-5). Lagos: Warri Genteel Publishing Company.

Abdullah, I. K., & Tuna, F. (2014). Nigerian students' knowledge and perceptions about environmental problems and management: A case study of Kano State. *International Journal of Scientific Knowledge,* 4(6), 26-34.

Adams, N. B. (2002). Concerns of educational computing postsecondary faculty. *Research on Technology Education, 6,* 285-303.

Adu, E. O., & Olatundun, S. A. (2013). The use and management of ICT in schools: Strategies for school leaders. *Education Journal of Computer Science and Information Technology, 1*(2), 10-16.

African American college students. *The Journal of Environmental Education, 40*(1), 29-42.

Al-Ansari, H. (2006). Internet use by the faculty members of Kuwait University. *The Electronic Library, 24*(6), 791-803.

Anderson, R. (2008). Implications of the information and knowledge society for education. In J. Voogt & Knezek (Eds.), *International handbook of information and technology in primary and secondary education* (pp. 522). New York: Springer.

Anderson, R. E., & Becker, H. J. (2001). *Teaching, learning, and computing: 1998 national survey report.* Irvine, CA: Center for Research on Information Technology and Organizations.

Anderson, R.E. (2002). Guest editorial: International studies of innovative uses of ICT in schools. *Journal of Computer Assisted Learning, 18*(2), 381-386.

Azizan, A. S. (2008). *Kita hanya menumpang.* Pemanasan global. Estidotmy, *76*, 16-17.

Banks, J. A. (2000). *Teaching strategies for the Social Studies: Inquiry, valuing and decision-making.* New York: Longman.

Becker, H. J. (2006). *Instructional use of school computers: Reports from the 1985 national survey.* Baltimore, MD: Johns Hopkins University.

Bekoe, S. O., & Eshun, I. (2013c). Influence of the differences in social studies teachers' curriculum conceptions on curriculum implementation in Senior High Schools in Ghana: Implication for national curriculum policy. *Development Country Studies, 3*(6), 105-113.

Berson, M. J. (2006). Effectiveness of computer technology in the social studies: A review of the literature. *Journal of Research on Computing in Education, 2*(4), 486-499.

Birhanu, A. (2014). Environmental knowledge, attitude and participatory behaviour towards land degradation in Injibara secondary and preparatory school, Northwestern Ethiopia. *Journal of Environment and Earth Science, 4*(17), 89-95.

Bluhm, T. L. Volk, & J. M Ramsey (2005). *Essential readings in environmental education* (3rd ed.). Champaign, IL: Stipes Publishing.

Boakye, K. B., & Banini, D. A. (2008). Teacher ICT readiness in Ghana. In K. Toure, T. M. S. Tchombe, & T. Karsenti. (Eds.), *CT and changing mindsets in education.* Bamenda, Cameroon: Langaa; Bamako, Mali:ERNWACA /ROCARE.

Borg, W. R. &Gall, J. P. (2003). *Educational research: An introduction (7th ed.).* Toronto, ON: Allyn and Bacon.

Bozimo, G., & Ikwumelu, S. N. (2009). *Issues in social studies education in Nigeria.* Owerrie. Whyte and Whyte Publishers.

Cavas, B., Cavas, P., Tekkaya, C., Cakiroglu, C., & Kesercioglu, T. (2009). Turkish students' views on environmental challenges with respect to gender: An analysis of rose data. *Science Education International, 20*(1-2), 69-78.

Cotton, D. R. E. (2006a). Implementing curriculum guidance on environmental education: the importance of teachers' beliefs. *Journal of Curriculum Studies, 38*(1), 67-83

Cuban, L. (2001). *Oversold and underused: Computers in the classrooms.* Cambridge, MA Harvard University Press.

Curriculum Research and Development Division (CRDD) (2007). *Social.*

Curriculum Research and Development Division (CRDD) (2008). *Social Studies teaching syllabus for Junior High Schools.* Accra: District Education Directorate.

Curriculum Research and Development Division (CRDD) (2010). *Social Studies syllabus for Senior Secondary Schools.* Accra: District Education Directorate.

Dawes L. (2001). What stops teachers using new technology? In L. M. Leask (ed.), Issues in *Teaching using ICT* (pp.67-79). London: McMillian Publication

De Lavega, E. L. (2004). *Awareness, knowledge, and attitude about environmental education: Responses from environmental specialists, high school instructors, students, and parents.* Unpublished Doctoral dissertation, College of Education, University of Central Florida Orlando, Florida.

DeYoung, R. (2000). Expanding and evaluating motives for environmentally responsible behaviour. *Journal of Social Issues, 56*(3), 509-526.

Diem, R., & Berson, M. J. (Eds.). (2010). Technology in retrospect: Social studies in the information age 1984-2009. Charlotte, NC: Information Age Publishing

Dunlap, R., Gallup, G. & Gallup, A. (2003). Results of the health of the planet survey. *Environment, 35*, 7-39.

Earle, R. S. (2002). The Integration of instructional technology into public education: Promises and challenges. *Educational Technology, 4*2(1), 5-13.

Engidasew, T. A., and Barbieri, G., (2014), "Geo-engineering evaluation of Termaber basalt rock mass for crushed stone aggregate and building stone from Central Ethiopia." *Journal of African Earth Sciences, 99.* 581–594.

Ertmer, P. A., & Otternbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education, 42,* 255-284.

Eshun, I., Bordoh, A., Bassaw, T. K., & Mensah, M. F. (2014). Evaluation of social studies students' learning using formative assessment in selected Colleges of Education in Ghana. *British Journal of Education, 2*(1), 39-48.

Fageyinbo, M. O. (2004). *Foundations of social studies.* Ogun State: Lucky Publishers.

Fien, J. (2003). *Education for the environment: Critical curriculum theorising environmental education.* Geelong: Deakin University Press.

Fontana, L. A. (2007). Online learning communities. Implications for the social studies. In P. Martorella (Ed.), *Interactive technologies and the social studies* (pp. 1-26). New York, NY: State University of New York Press.

Fraenkel, J. R. & Wallen, N.E. (2000). *How to design and evaluate research in education*. Boston: McGraw-Hill.

Gall, M.D., Norg, W.R., & Gall, J.P. (1996). *Educational research: An introduction.* White Plains, NY: Longman.

Government of Ghana (2005). *Government of Ghana ministerial ICT policy statement.* Accra: NBS Multimedia.

Government of Ghana. (2003). *The Ghana ICT for Accelerated Development (ICT4AD) Policy*. Retrieved on 7/25/016 at http://www.moc.gov.gh/moc/P DFs/Ghana ICT4AD Policy.pdf.

Grabe, M., & Grabe, C. (2007). *Integrating technology for meaningful learning* (5th ed.). New York, NY: Houghton Mifflin Company.

Gruenewald, D. A. (2004). A foucauldian analysis of environmental education: Toward the socioecological challenge of the earth charter. *Curriculum Inquiry, 34*(1), 71 -107.

Gulbahar, Y., & Guven, I. (2008). A survey on ICT usage and the perceptions of social studies teachers in Turkey. *Educational, Technology & Society, 11*(3), 37-51.

Gurevitz, R. (2000). Affective approaches to environmental education: Going beyond the imagined worlds of childhood? *Ethics, Place and Environment, 3*(3), 253-68.

Gurevitz, R. (2002). Affective approaches to environmental education: Going beyond the imagined worlds of childhood? *International Journal of Science Education, 24*, 645-660.

Henderson, K., & Tilbury, D. (2004). Whole school approaches to sustainability: An intervention review of sustainable school programs. *Journal of Curriculum Studies, 12*(4), 67-88.

Hennessy. S., Ruthven, K., &Brindley, S. (2013). Teacher perspectives on integrating ICT into subject teaching: Commitments, constraints, caution and change. *Journal of Curriculum Studies, 36*(7), 1 -16.

Hew, K.F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational Technology Research & Development, 55*, 233-253.

Higgins, S., & Moseley D. (2001).Teachers' thinking about information and communications technology and learning: Beliefs and outcomes. *Teacher development, 4*(9), 191-210.

Huang, H. P., & Yore, L. D. (2003). A comparative study of Canadian and Taiwanese grade 5 children's environmental behaviours, attitudes, concerns, emotional dispositions, and knowledge. *International Journal of Science and Mathematics Education, 1*(4), 449-448.

Incekara, S., Tuna, F., & Dogan, Z. (2011). Upper primary school students' perceptions of environmental issues: A case study from Turkey. *Ozean Journal of Applied Sciences,* 4(3), 245-250.

Jamilah, A., Shuhaida, N., & & Nurzali, I. (2015). Investigating students' environmental knowledge, attitude, practice and communication. *Asian Social Science,* 11(16); 284-293.

Jeronen, E., & Kaikkonen, M. (2002). Thoughts of children and adults about the environment and environmental education. *International Research in Geographical and Environmental Education, 11*(4), 341-353.

Jersey: Prentice Hall Inc.

John Wiley & Sons. Koehler, M. J., Mishra, P., & Yahya, K. (2007). Tracing the development of teacher knowledge in a design seminar: Integrating content, pedagogy and technology. *Computers and Education, 49*(3), 740-762.

Jonassen, D. (2000). *Computers as mindtools for schools: Engaging critical thinking.* Michigan: Merrill.

Jonassen, D. (2008). *Meaningful learning with technology.* New Jersey: Pearson.

Jonassen, D., Davidson, M., Collins, M., Campbell, B., & Hagg, B. (2005). Constructivism and computer-mediated communication in distance education. *The American Journal of Distance Education,* 9(2), 7-25.

Jonassen, D., Howland, J., Marra, R., & Crismond, D. (2008). Meaningful learning with technology. New Jersey: Pearson. Kaffash, H. R., Kargiban, Z. A., Kargiban, S. A., & Ramezani, M. T. (2010). A close look into the role of ICT in education. *International Journal of Instruction, 3*(2), 64-82.

Kankam, B., Bekoe, S. O., Ayaaba, D. A., Bordoh, A., & Eshun, I. (2014). Curriculum conceptions of the scope of content of social studies in the colleges of education in Ghana. *American Journal of Social Sciences,* 2(6), 137-144.

Kazi, N. P. (2004). Value education. In G. Bozimo, M. G. Gotep, R. Zwalchir, & O. A. Obanya (Eds) *Current trends in social studies education.* Jos. WAIS Printing press.

Kellert, S.R. (2005). Experiencing nature: Affective, cognitive, and evaluative development in children. *In Children and nature: Psychological, sociocultural and evolutionary investigations, ed. Peter H. Kahn Jr. and Stephen R. Kellert, 117–51*. Cambridge, MA: MIT Press.

Kennewell, S (2001). Using Affordances and Constraints to Evaluate the Use of Information and Communications Technology in Teaching and Learning. *Journal of Information Technology for Teacher Education 10*(1 & 2): 101 - 116.

Khishfe, R., & Lederman, N. G. (2006). Teaching nature of science within a controversial topic: Integrated versus non-integrated. *Journal of Research in Science Teaching*, 43(4), 395-418.

Kissock, C. (2001). *Curriculum planning for social studies teaching.* New York:

Kozma, R. B. (2005). National policies that connect ICT-based education reform to economic and social development: *An Interdisciplinary Journal of Humans in ICT environment, 1*(2), 117-156.

Kuranga, A. (2006). Enhancing the teaching of environmental education in Nigerian schools for sustainable development. *Journal of Professional Trainers,* 7(1/2), 184-191.

Kwapong, O. (2007). Problems of policy formulation and implementation: The case of ICT use in rural women's empowerment in Ghana. *International Journal of Education and Development using ICT,* 3(2), 12-32

Larijani, M. (2010). Assessment of environmental awareness among higher primary school teachers. *J Hum Ecol, 31*(2), 121-124

Lecturer. University of Ilorin: Unilorin press. Okam, C. C. (2002). *Reading in new development in Nigerian education: Issues and insights.* Jos. Deka Publication

Lenka, S. K. (2005). Awareness of environmental education among the PG students. *Edutracks, 8,* 35-38.

Lieberman, G. A. (2013). *Education and the environment: Creating standards-based programs in schools and districts.* Cambridge, MA: Harvard Education Press.

Littledyke, M. (2008). Science education for environmental awareness: Approaches to integrating cognitive and affective domains. *Environmental Education Research, 14* (1), 1 - 17.

Lowther, D. L., Inan, F. A., Strahl, J. D., & Ross, S. M. (2008). Does technology integration work when key barriers are removed? *Education Media International, 45,* 195-213.

M. A. (2001). *The need to improve health habits of Nigerians through the teaching of hygiene in primary schools. Journal of education,* 6(1), 123-132.

Makitalo, A., Jakobsson, A., & Saljo, R. (2009). Learning to reason in the context of socio-scientific problems. Exploring the demands on students in 'new' classroom activities. In K. Kumpulainen, C. Hmelo-Silver, & M. Cesar. *Investigating classroom interaction. Methodologies in action* (pp. 7-25). Rotterdam: Sense Publishers.

Makki, M. H., Abd-El-Khalick F., & Boujaoude S. (2003). Lebanese secondary school students' environmental knowledge and attitude. *Environmental Education Research, 9,* 21-33.

Marcinkowski, T. (2007). Assessment in environmental education. In R. Wilke (Ed.) *Environmental education, teacher resources handbook, a practical guide for K-12 environmental education.* (pp.144-197).Thousand oaks, CA: Corwin Press, Inc. Margaret.

McCrea, E. J., & deBettencourt, K. (2000). *Environmental studies in the classroom: A teacher's view.* Wheeling, WV: North American Association for Environmental Education.

Ministry of Education. (2008*). The report of the expanding needs for the information education infrastructure plan.* Retrieved July 26, 2005, from http://www.edu. tw/EDU_WEB/EDU_MGT/MOECC/ED789 2001/ informat ion/itstatus/report/expanding.htm.

Mobley, C., Vagias, W. M., & DeWard, L. S. (2010). Exploring additional determinants of environmentally responsible behaviour: The influence of environmental literature and environmental attitudes. *Environment and Behaviour, 42,* 420-447.

Mobley, C., Vagias, W. M., & DeWard, S. L. (2010). Exploring additional determinants of environmentally responsible behaviour: The influence of environment literature and environmental attitudes. *Environment and Behavior, 42*(4), 420-447.

Monroe, M., Day, B., & Grieser, M. (2000). GreenCOM weaves four strands.In B. Day & M. Monroe (Eds.), *Environmental education & communication for a sustainable world. Handbook for international practitioners* (pp. 3-6).Washington, DC: Academy for Educational Development.

Moonen, J. (2008). Evolution of IT and related educational policies in international organizations. In J. Voogt & G. Knezek (Eds.), *International handbook of Information Technology in Primary and Secondary education* (pp. 1071-1082). Berlin: Springer Verlag.

Ngada, J. A. (2008). Factors affecting the sustenance of quality education in Nigeria. In A. A. Fejonyomi, & I. A. Njodi. *Reforms in higher education in Nigeria.* Maiduguri. Awemark Press. Nigeria, Ibadan: Akin-Johnson Press.

Nyarko, E, (2007). *Developing ICT enabled education -the future for Ghana: I connect on line* Retrieved on March 12, 2008 http://www.iconnect online.

Ogundare, S. F. (2001). *Principles and concepts of social Studies:* Oyo: OYSCE publication series.

Ogundare,S.A. (2008). *Effects of cooperative active learning strategies on junior secondary school students'achievement and attitude to integrated science*. An Unpublished M.Ed Project. University of Ibadan.

Ogunsanya, A. A. (2002). *Maker and baker of cities. The 59th Inaugural* org/Documents/Ghana%20Elearning%202007%20eng%20iConnect.pdfNorris

Okam (2002). *Humanities and Social Science*. The Teacher's knowledge has to derive essentially from a curriculum.

Paas, L. C., & Creech, R. (2008). How *information and communications technologies can support education for sustainable development.* Canada: International Institute for Sustainable Development.

Palmer, J. A. (2008). *Environmental education in the 21st century: Theory, practice, progress, and promise.* USA: Routledge.

Papert, S. (2000). What's the Big Idea? Steps toward pedagogy of idea power. *IBM Systems Journal,* 39(3&4), 123-144.

Papert, S., & Harel, I. (2001). Situating constructionism. In S. Papert & I. Harel (Eds.), *Constructionism.* New York: Ablex Publishing.

Pelgrum, W. J. (2001). Obstacles to the integration of ICT in education: Results from a worldwide educational assessment. *Computers and Education.*

Quartey, S. M. (2004): The 1987 JSS Social Studies syllabus in Ghana: An analytical content review. *International Journal of Educational Studies,* 2(1), 1-12.

Quashigah, A. Y., Dake, Y. G., Bekoe, S. O., Eshun, I., & Bordoh, A. (2014). Evaluation of colleges of education (CoE) social studies curriculum vis-a-vis the junior high school (JHS) social studies curriculum in Ghana. *European Journal of Training and Development Studies, 1*(2), 1-13.

Rahardyan, B., Matstuto, T., Kakuta, Y., & Tanaka, N. (2004). Resident's concerns and attitudes towards solid waste management facilities. *Waste Management, 24,* 437-451.

Ratcliffe, M., & Marcus, G. (2003). *Science education for citizenship: Teaching socio-scientific issues.* Maidenhead: Open University Press.

Reid, S. (2002). The integration of ICT into classroom teaching. *Alberta Journal of Educational Research, 48,* 30-46.

Renkl, A., Stark, R., Gruber, H., & Mandl, H. (2008). Learning from worked-out examples: The effects of example variability and elicited self-explanations. *Contemporary Educational Psychology, 23,* 90-108. doi:10.1006/ceps.1997. 0959.

Rice, M. L., & Wilson, E. K. (2009). How technology aids constructivism in the social studies classroom. *Social Studies, 90*(1), 28-33.

Ringstaff, C., & Kelley, L. (2002). *The learning return on our educational technology investment: A review of findings from research 2002.* San Francisco: WestEd.

Sadler, T., Barab, S., & Scott, B. (2007). What do students gain by engaging in socio-scientific inquiry? *Research in Science Education,* 37(4), 371391.

Salehi, H., & Salehi, Z. (2012). Challenges for using ICT in education: Teachers' insights. *International Journal of e-Education, e-Business, e-Management and e-Learning,* 2(1), 40 -44.

Savery, J. R., & Duffy, T. M. (2006). Problem-based learning: An instructional model and its constructivist framework. In Wilson, B. G. (Ed.) *Constructivist learning environments: Case studies in instructional design* (pp. 135-148). New Jersey: Educational Technology Publications.

Schultz, P. W. (2002). Knowledge, information, and household recycling: Examining the knowledge-deficit model of behaviour change. In T. Dietz and P.C. Stern (Eds.), New *Tools for environmental protection: Education, information, and voluntary measures* (pp. 67-82). Washington DC: National Academy Press.

Schultz, P. W. (2002). Knowledge, information, and household recycling: Examining the knowledge-deficit model of behaviour change. In: Dietz, T., & Stern, P.C. (Eds.) *New tools for environmental protection: education, information and voluntary measures* (pp. 345-366). London: Committee on the Human Dimensions of Global Change, national Research Council.

Sheehy, N. P., Wylie, J. W., McGuinness, C., & Orchard, G. (2000). How children solve environmental problems using computer simulations to investigate systems thinking. *Environmental Education Research, 6*(2),72-83.

Slavin, R. E. (2001) Synthesis of research on co-operative learning. *Educational Leadership, 2*(1), 73-82.

Somekh, B., & Davies, R. (2001). Towards a pedagogy for information and technology. *The Curriculum Journal, 2*(2), 153-70.

Stevenson, R. B. (2007). Schooling and environmental education: Contradictions in purpose and practice. *Environmental Education Research, 13*(2), 139-153.

Stokes, E., Edge, A., West, A. (2001). *Environmental education in the educational systems of the European Union.* Retrieved from 15 March, 2016 http://europa.eu.int/comm/environment/youth/pdf/envedu en.pdf *Studies teaching syllabus for junior high schools.* Accra: Ministry of Education.

Tavakol, M., Mohagheghi, M., & Dennick, R. (2008). Assessing the skills of surgical residents using simulation. *Journal of Surgical Education, 65*(2), 77-*83*. doi: 10.1016 /j.jsurg.2007.11.003.

Taye, T. (2008). Attitudes toward computers: A study of post-secondary students in Singapore. Interactive Learning Environments, *14*(1), 17-24. http://dx.doi.org/10.1080/10494820600616406.

Tella, A., & Adu, E. O. (2010). Information communication technology and curriculum development: The challenges for education for sustainable development. *Indian Journal of Science and Technology, 2*(3), 55-59.

Tuncer, G., Tekkaya, C., Sungur, S., Cakiroglu, J., Ertepinar, H., & Kaplowitz, M. (2009). Assessing pre-service teachers' environmental literacy in Turkey as a mean to develop teacher education program. *International Journal of Educational Development, 29,* 426- 436.

UNESCO (2002). *Information and communications technology in education. A curriculum for schools and programme for teachers' development.* Paris: UNESCO.

UNESCO (2005). *Guidelines and recommendations for reorienting teacher education to address sustainability. Technical Paper N° 2*. Paris, France: UNESCO Education Sector.

UNESCO (2007). *Educating for a sustainable future: A transdisciplinary vision for a concerted action.* Paris: UNESCO.

UNESCO (2009). *Bonn declaration in: World conference on education for sustainable development.* Available from http://www.esd-world-conference-2009.org/.

UNESCO (2014a). *Ecological sciences for sustainable development.* Paris: UNESCO.

UNESCO (2014b). *Shaping the future we want: UN decade of education for sustainable development.* Paris: UNESCO.

Vanderlinde, R., & van Braak, J. (2009). Educational technology on a turning point: Curriculum implementation and challenges for schools. *Educational Technology Research and Development, 57*(4), 573-584.

Wahid, A. N., Rahbar, E., & Shyan, T. S. (2011). Factors influencing the green purchase behaviour of Penang environmental volunteers. *International Business Management, 5*(1), 38-49.

Wals, A. E. (2014). Convergence between science and environmental education. *Science, 344*(6184), 583-584.

Watts-Taffe, S., Gwinn, C.B., & Horn, M.L. (2003). Preparing pre-service teachers to integrate technology with the elementary literacy programme. *The Reading Teacher, 57,* 13-138.

Whitworth, S., & Berson, M. J. (2003). Computer technology in the social studies: An examination of the effectiveness literature (1996-2001). *Contemporary Issues in Technology and Teacher Education, 2*(4), 472-509.

World Bank. (1991). *Lifelong learning in the global knowledge economy: Challenges for developing countries.* Washington, DC: World Bank.

Yellend, N. (2001). *Teaching and learning with ICT for numeracy in the early childhood and primary years of schooling.* Australia: Department of Education, Training and Youth Affairs.

Yount, J. R., & Horton, P. B. (2002). Factor influencing environmental attitudes: The relationship between environmental attitude defensibility and cognitive reasoning level. *Journal of Research in Science Teaching, 29*, 1059-1078.

Yousuf, A. & Bhutta, S. (2012). Secondary school students' attitude towards environmental issues in Karachi Pakistan. *International Journal of Scientific & Engineering Research, 3*(10), 1-11.

Yusuf, M. O. (2005). Information and communication education: Analysing the Nigerian national policy for information technology. *International Education Journal, 6*(3), 316-321.

Zhao, Y., & Cziko, G. A. (2001). Teacher adoption of technology: A perceptual of control theory perspective. *Journal of Technology and Teacher Education, 9*(1), 5-30.

APPENDICES
APPENDIX A
UNIVERSITY OF CAPE COAST

DEPARTMENT OF EDUCATION

COLLEGE OF DISTANCE EDUCATION

PRE-TEST ON ENVIRONMENTAL PROBLEMS

1. Environment degradation refers to.....

   a) air pollution

   b) land pollution

   c) water pollution

   d) all of above

2. The undesirable change in physical, chemical or biological characteristics of air, land water is referred as.....

   a) Pollutants

   b) Pollution

   c) All of the above

3. What is land pollution?

   a) This is the contamination of the environment with bad toxic, chemical and waste

   b) Contamination of the one's home

   c) Cutting down of trees and using them to make furniture

4. Nature source of pollution is.....

   a) Rain forest

   b) Forest fire

   c) Mining minerals

5. While driving John throws his coke bottle in a near buy open, this is a form of land pollution

a) True

b) False

6. Most of the rubbish our family throws away each day ends up getting

a) Recycled

b) Burned

c) Landfill

7. Which of the materials do we throw away most?

a) Glass and Plastic

b) Paper

c) Aluminium

8. Harmful substance released by power plant, vehicles and cars is .....

a) Carbon dioxide

b) Oxygen

c) None of the above

9. Fuel oils and coal are classified as

a) Deoxygenated fuels

b) Allotropic fuels

c) Fossil fuels

10. The 3R principle of reducing wastes is .....

a) Reduce, Reuse and recycle

b) Reduce, Re-organise and recycle

c) Reuse, Recycle and Rein crease

11. Global warming' leads to .....

a) Low level of oxygen

b) High level of carbon dioxide

c) Floods and droughts

12. Large number of organisms can die if there is.....

a) low level of oxygen

b) low level of carbon dioxide

c) low level of methane

13. Causes of air pollution includes

a) cars and motor vehicles

b) power plants and industries

c) all of above

14. Rain in which acids are combined is classified as

a) acid rain

b) allotropic rain

c) fossil rain

15. Disease that are caused by air pollution includes

a) lung cancer

b) skin diseases

c) all of above

16. Farming activities, sewage, mining activities and soil erosion are causes of

a) land pollution

b) air pollution

c) noise pollution

17. Incomplete burning of petrol or diesel in vehicles creates ..... gas which is very poisonous

a) Carbon dioxide

b) Carbon monoxide

c) None of the above

18. Which gas is responsible for depletion of Ozone layer around earth which protects us from harmful Ultraviolet rays?

a) Chloro Fluro Carbons

b) Nitrogen

c) Oxygen

19. The disease Cholera, Typhoid and Jaundice are due to pollution of .....

a) Air

b) Water

c) Food items

20. Death of fish in lakes and rivers in some countries has been attributed to

a) Water pollution

b) air toxics

c) pollution

APPENDIX B
UNIVERSITY OF CAPE COAST

DEPARTMENT OF EDUCATION

COLLEGE OF DISTANCE EDUCATION

POST-TEST ON ENVIRONMENTAL PROBLEMS

1. Environment degradation refers to.....
   a) air pollution
   b) land pollution
   c) water pollution
   d) **all of above**
2. The undesirable change in physical, chemical or biological characteristics of air, land water is referred as.....
   a) Pollutants
   b) **Pollution**
   c) All of the above
3. What is land pollution?
   a) **This is the contamination of the environment with bad toxic, chemical and waste**
   b) Contamination of the one's home
   c) Cutting down of trees and using them to make furniture
4. Nature source of pollution is.....
   a) Rain forest
   b) **Forest fire**
   c) Mining minerals

5. While driving John throws his coke bottle in a near buy open , this is a form of land pollution
   a) **True**
   b) False
6. Most of the rubbish our family throws away each day ends up getting
   a) Recycled
   b) Burned
   c) **Landfill**
7. Which of the materials do we throw away most?
   a) Glass and Plastic
   b) **Paper**
   c) Aluminium
8. Harmful substance released by power plant, vehicles and cars is .....
   a) Carbon dioxide
   b) Oxygen
   c) None of the above
9. Fuel oils and coal are classified as
   a) Deoxygenated fuels
   b) Allotropic fuels
   c) **Fossil fuels**
10. The 3R principle of reducing wastes is .....
    a) **Reduce, Reuse and recycle**
    b) Reduce, Re-organise and recycle
    c) Reuse, Recycle and Rein crease

11. Global warming' leads to .....

    a) Low level of oxygen

    b) High level of carbon dioxide

    c) **Floods and droughts**

12. Large number of organisms can die if there is.....

    a) **low level of oxygen**

    b) low level of carbon dioxide

    c) low level of methane

13. Causes of air pollution includes

    a) cars and motor vehicles

    b) power plants and industries

    c) **all of above**

14. Rain in which acids are combined is classified as

    a) **acid rain**

    b) allotropic rain

    c) fossil rain

15. Disease that are caused by air pollution includes

    a) lung cancer

    b) skin diseases

    c) **all of above**

16. Farming activities, sewage, mining activities and soil erosion are causes of

    a) **land pollution**

    b) air pollution

    c) noise pollution

17. Incomplete burning of petrol or diesel in vehicles creates ..... gas which is very poisonous

    a) Carbon dioxide

    b) **Carbon monoxide**

    c) None of the above

18. Which gas is responsible for depletion of Ozone layer around earth which protects us from harmful Ultraviolet rays?

    a) **Chloro Fluro Carbons**

    b) Nitrogen

    c) Oxygen

19. The disease Cholera, Typhoid and Jaundice are due to pollution of .....

    a) Air

    b) **Water**

    c) Food items

20. Death of fish in lakes and rivers in some countries has been attributed to.....

    a) **Water pollution**

    b) air toxics

    c) pollution

APPENDIX C
DEPARTMENT OF EDUCATION

COLLEGE OF DISTANCE EDUCATION

UNIVERSITY OF CAPE COAST

QUESTIONNAIRE FOR STUDENTS

Dear Respondents

I hereby kindly request you to fill in this questionnaire which will enable the researcher to obtain important information for the research. The researcher assures you that the information gathered will be treated with utmost confidentiality and for academic purposes only. Your assistance and cooperation will be greatly appreciated. Thank you.

Instructions: tick (V) where appropriate or fill in the required information.

SECTION A

Background Information of Students

1. What is your gender?

a) Male [ ]

b) Female [ ]

Indicate the extent to which you agree or disagreed with the following statements on environment and environmental problems by ticking: Strongly Agree = SA, Agree = A, Strongly Disagree = SD, Disagree = D

Statements	SA	A	SD	D
1. I think each of us can make a significant contribution to environmental protection				
2. Science and technology can solve all environmental problems				
3. People should care more about protection of the environment				
4. I always pick up trash or rubbish lying on the floor				
5. I always separate the solid waste from the liquid waste				
6. Motorcycles and cars use in our country increase the rate of air pollution				
7. Industries should be sited far away from the cities in order to reduce effect of global warming				
8. Deforestation has negative effects on the environment				
9. Reduction of carbon dioxide emission to the atmosphere to prevent ozone depletion is important				
10. Environmental problems can be solved with a big changes in our way of living				