INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN 2278 – 0211 (Online)

Effect of Computer Assisted Instruction on Students' Interests and Attitudes in Learning Electricity and Magnetism in a Ghanaian Senior High School

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Abstract:
The study investigated effect of computer assisted instruction (IWebP) on SHS students' interests and attitudes towards some selected concepts of Electricity and Magnetism. The study involved a whole class of Form Two Home Economics students in a Ghanaian Senior High School, selected through purposive and convenience sampling technique, totaling 48 students (46 girls and 2 boys). The students were taken through a series Interactive Webquest Packages (IWebP) developed by the researchers with the help of software from SMART Technologies. Data was collected through the use of Students' Observation checklist (SOC) and Questionnaire on students' attitude towards the teaching and learning of electricity and magnetism (Physics). The findings from the SOC and the Questionnaire indicated that students' interest was highly developed and also showed positive attitude towards the teaching and learning of physics with computer assisted instruction.

Keywords: *Computer assisted instruction (CAI), interest and attitude towards physics, Ghanaian SHS*

1. Introduction

According to Smith and Laslett (1993), the lecture method involves the teacher doing all the talking with little or no input from the students. This method of teaching appears problematic because the student takes on a passive role, and this can hinder learning. Students need to be active learners to keep the brain working and integrating new information. The students of today find it very difficult to sit for a long time and listen to a teacher droning on a topic. Perhaps, it might be due to the fact that they are used to the television screen changing every half a second, and therefore have a difficult time staying focused for a long time during a lecture session.

In Ghana, the Teaching Syllabus for Integrated Science in Senior High Schools was developed by the Curriculum Research and Development Division (CRDD) of the Ministry of Education, to ensure effective teaching and learning of Science; and therefore provided suggestions of the following:

- Teachers must create learning situations and provide guided opportunities for students to acquire as much knowledge and understanding of science as possible through their own activities. Teachers must show, demonstrate and explain concepts in relation to real life situations. Students' learning experience should consist of opportunities to explore various scientific situations in their environment to enable them make their own observations and discoveries and record them.
- Teachers should help students to learn to classify, compare, analyze, look for patterns, spot relationships and come to their own conclusions/deductions. Teachers must avoid rote learning and drill-oriented methods, but rather emphasize participatory teaching and learning in science lessons (CRDD, 2007).

The above suggestions seek to strongly encourage participatory and child-centred learning where all attention and concentration should be on the student doing things on their own to arrive at conclusions, and not the teacher at the centre of delivery.

However, the lecture method seems to be the most prominent strategy employed by most science teachers in the various Senior High Schools in Ghana. The result is that, the learners generally are less apt to ask questions in class, and thus shun the study of the subject. The lecture method has not been of much help to students in their study of science in Senior High Schools in Ghana. In recent times, there seem to be public outcry on the declining standard of Science education in the country. There is obviously a problem with the method of teaching Science in Senior High Schools all over the nation and therefore an urgent need to investigate into this problem and propose solutions to help solve it (Anamuah-Mensah, 2004).

In most African countries studies have highlighted an alarming decline in young people's interests for key Science studies (Omosewo, 1999). Donnellan (2003), Anamuah-Mensah (2004) and Buabeng (2012), all found out in their studies that there were low interests and poor performances of students in the study of Physics, especially females. One major cause or attribute that surfaced in all their studies was how Physics content knowledge was taught and learned at all the academic levels. There is therefore the need for stakeholders in education to find new and innovative ways of approaching the teaching and learning of Physics. New technologies seem to be changing the lives of people all over the world. This is because, over the last two decades, information technologies and the internet appear to be transforming the way students learn, with the new trend of making learners more and more interactive in the teaching and learning process. An innovative approach to teaching and learning could be to capitalize on these new technologies. At a summit in Lisbon in 2000, European Union (EU) leaders acknowledged the fact that future competitiveness in the educational system depended on a renovated educational policy, including e-learning. This has led to the promotion of Europe-wide "e-learning" initiatives and new on-line ways of learning throughout EU countries. Digital technologies, for example, can help improve the quality of knowledge and life for everybody, making Information and Communications Technologies (ICTs) "enabling technologies" in schools and universities.

2. Statement of the Problem

In Ghana, teaching Science in Senior High Schools generally appears to be through lectures, notes–giving and taking, chalkboard illustrations, demonstrations and other teacher-centred methods which enable students to only form mental models of concepts presented to them. This method of presentation of concepts may lead to loss of interest in learning as students tend to forget what they learn easily. Also, since it is the same monotonous order of only the teacher doing the talking and/or teaching, the enthusiasm to learn is absent. Science subjects, especially Physics, tend to be the most affected since most of the concepts presented are abstract and also requires the student to put in a lot of effort in forming mental models to aid understanding. The perceived nature of Physics makes students shun or avoid the subject. In most cases, they regard Physics as a difficult subject. In effect, many students, more especially, girls have lost interest and the enthusiasm to study Physics in Senior High Schools due to the old and traditional ways of teaching the subject (Donnellan, 2003; Anamuah-Mensah, 2004; Buabeng, 2012). This might have led to lack of interest and negative attitudes towards the study of Physics. However, many of these students might have acquired some informal skills through contact with ICT in various forms such as the internet, mobile phones and other digital devices which could be the motivation that they need to sustain their interest in the study of the subject. There was therefore the desire to find out if incorporating ICT into Physics lessons would whip up the interest of students and change their negative attitudes towards the study of the subject. A study was thus conducted on effect of Computer Assisted Instruction on the interest and attitudes of students in learning some concepts in Electricity and Magnetism at the Senior High School level in Ghana.

3. Purpose of the Study

The study aims at boosting the interests, and positively influencing the attitudes of students towards the study of Physics in Senior High Schools through the use of computer technology.

4. Research Question

The research question that guided the study was as follows:

"What influence will the use of computer technology in the teaching and learning of Electricity and Magnetism have on the interest and attitudes of students towards the study of Physics in a Ghanaian Senior High School?"

5. Significance of the Study

- The findings and recommendations of this study would be of much benefit tostudents studying Physics and teachers who teach Physics in the Ghanaian Senior High Schools.
- The findings and recommendations of this study would be of much benefit tostudents, as the use of the computer technology would whip up their interests and make them have a positive attitude towards the teaching and learning of Physics.
- With regard to the teachers, the outcome of this study would enable them to identify some of the causes of students' poor attitudes and lack of interests in the subject. They would also have the opportunity to learn about the use of technology in enhancing their students' attitudes and interests.
- The study would make all stakeholders in the educational sector to be conscious of the need and usefulness in adopting the use of computer technology approach in Ghanaian schools so as to improve students' attitude towards physics.

6. Review of Related Literature

6.1. Students' Attitude and Interest towards the Teaching and Learning of Physics

Students' attitude is likely to play a vital role in any satisfactory explanation of their performance in schools (George, 2006). Yenice (2003) was of the view that attitudes are the best predictor for estimation of students' success. Other researchers have come out that positive attitudes towards physics instruction can lead to better learning abilities among students (Ali & Awan, 2013). As long as teachers continue to use the traditional approach in their teaching rather than the use of active approach which will be student-centred,

the students' interest in the subject will continue to decline and they will not show any positive attitude towards the subject. It is realized that physics is not a popular subject among the students because it is regarded as difficult. If it is taught in traditional teaching style, students are prone to memorize the formulas for exams since they do not follow the physics concepts in the classroom. Hence, the use of traditional approach in physics classes often result in students' failures and negative attitudes towards the subject (Dawodu&Macgregor-Odusanya, (2010).

Omosewo (1992) in his studies also stated that many students, developed negative attitudes towards Physics learning as a result of the fact that teachers are unable to satisfy their aspirations or goals or even their curiosity in Physics topics. Another interesting outcome of the study done by Olugbenga and Adebayo (2012) was that students negative attitude and lack of interest towards Physics and other science subjects was due to, teachers not allowing students to perform practical individually because of insufficient equipment in the laboratories or not enough hands-on experience. Students usually feel that they have lacked motivation for class engagement and as such their presence are not felt in class, though they are present at school (Usun, 2004). It is well known that a negative attitude towards a certain subject makes learning or future-learning of the students difficult. Adebayo (2010) emphasized that developing students' positive attitudes and interest towards science lessons is the most important purpose of science education. Aina (2012) pointed that the method of teaching has gone beyond traditional method of talk and chalk, no wonder Shedd (2004) has suggested that anyone preparing to become teachers must incorporate technology into their class.

6.2. Why Physics is seen as Difficult by Students?

Students find Physics as one of the problematic areas within the field of science (Aina, 2012). Reason for this is that teachers taught Physics using traditional lecture approach. This magnetizes fewer learners than other field of science subjects. Some researchers have proposed that many students, especially female students, find physics teaching and learning as uninteresting, boring and a course reserved for exceptionally brighter students (Varank, 2005).This goes to show that many students including those offering physics themselves at school have developed negative attitude towards the subject.

The declining number of students choosing to take physics during their further studies continues to be a cause for concern for scientific and educational communities around the world (Yenice, 2003).Students find physics difficult as they have to contend with different representations such as experiments, formulae and calculations, graphs and conceptual explanations at the same time. According to Redish (1994), students describe physics as difficult due to the fact that it is a discipline which requires learners to employ a variety of methods of understanding and to rephrase from one form to the other, dealing with tables of numbers, graphs, equations, diagrams and maps as well as the ability to use algebra and geometry which relate to mathematical subjects. This makes the learning of physics particularly difficult for many students especially those students who do not like problem solving.

According to Lee and Schuele (2010), the teaching of electricity and magnetism is a bit difficult for teachers to deliver in class as students hardly see what really goes on inside a circuit especially. The teaching of electricity and magnetism involves extremely complex and highly abstract concepts, so without the use of models students may find the concepts difficult to understand. For students to visualize and understand these concepts quite well the introduction of ICT (Information and Communications Technology) by teachers can help the teachers in explaining the abstract concepts.

6.3. The use of ICT in Improving Students' Interest and Attitude in Science Lessons

According to Oludipe and Oludipe (2010), Integrated Science plays a vital role in Science Education Programme, because it prepares pupils at the Junior High School level for the study of core Science subjects at the Senior Secondary School level, which in turn brings about students' interest in Science oriented courses at the tertiary institutions. Despite Government's efforts to encourage Ghanaian science teaching and learning among students right from the basic level, the enrolment of students in core Science subjects and Science oriented courses at the Senior High School level and tertiary institution level respectively, is not encouraging. This is as a result of Junior High School students' negative attitude towards Integrated Science. Researchers indicated that this negative attitude was caused by teachers' traditional lecture method of teaching Integrated Science. However, a research reported on the effectiveness of constructivist-based teaching strategy revealed that the strategy enhanced students' academic performance.

A study was conducted by Ali and Awan (2013) to examine the relationship of attitude and interest of secondary school students towards Science with the achievement in the subjects of Physics, Chemistry, Biology and Mathematics. The results of the study indicated that attitude towards Science had significant positive relationship with the achievement of Science students at secondary level.

6.4. Multimedia and ICT used in Education

Multimedia is any combination of text, graphic art, sound, animation, and video that is delivered by computer. When you allow the user to control what and when these elements are delivered, it is interactive multimedia. When you provide a structure of linked elements through which the user can navigate, then the interactive multimedia becomes hypermedia (Beáta, 2005).Optimally all physics classes should include the following: real hands-on experiments, demonstrations, experiments performed by the teacher, simulations, embedded videos, or other new technologies.

Now that students are losing interest in learning and the teachers are no longer committed (Awolaju, Akinloye&Ilori, 2010) to teaching; we need a modern way of teaching and learning so that students' academic achievement in science can improve in all our institution. Science is dynamic, new discoveries are coming up every day both in Science and in the teaching method; we can only benefit from these new development when we are connected to the world through ICT. It is not an overstatement if one says "without

ICT scientific knowledge would not be taught adequately in any school of the world", not surprising Olugbenga and Adebayo (2010) argued that ICT has become a central focus in many developed and developing countries. Countries of the world such as Austria, Finland, Sweden, Denmark and UK, teachers and students have a generally positive attitude towards e-learning and relatively advanced in IT competences (EU, 2005).

Nowadays there is an enormous pressure on the schools from the society, and from the media to ensure that students are competent in the area of learning technologies. The majority of the teachers tend to change their attitude and introduce new ICT tools and technologies into their physics classes. The computer assisted instructional package used for the study is entitled Interactive Web quest Package (IWebP), developed by the researchers with the aid of SMART Notebook Software version 10.8 by SMART Technologies ULC. SMART Technologies is a leading provider of technology solutions that enable inspired collaboration in schools and workplaces around the world by turning group work into a highly interactive, engaging and productive experience. SMART delivers an integrated solution of hardware; software and services designed for superior performance and ease of use, and remains a world leader in interactive displays. The use of the CAI (IWebP) activities on the computer, has come to give teachers a big help to use digital materials prepared and tested. It has brought innovation in teaching and learning to its key stakeholders: Ministries of Education, schools, teachers and researchers (Vaughan,1993).

In this study, the researchers used a good resource materials created and sometimes modified by themselves for teaching of electricity and magnetism in a Ghanaian Senior High School. The resource materials were quite helpful to students by allowing them to grasp some fundamental concepts or serve as reinforcement of students' level of knowledge in electricity and magnetism. Some multimedia elements, like video recording, presenting hands-on experiments, trial and error questions and quizzes were created for students to interact with the computer to promote active learning.

7. Methodology of the Study

7.1. The use of Observation Checklist

In gathering the qualitative data, a students' observation checklist was developed, and this was used to record students' behaviour during the intervention. An observation checklist is listing of specific concepts, skills, processes or attitudes and it is designed to allow the observer to quickly record the presence or absence of specific qualities or understanding (Saskatchewan, 1994). Hence after careful planning on what behaviour to look out for, the Students' Observation Checklist (SOC) was developed by the researchers.

According to Johnson, Johnson and Holubec (1998), there are two types of observation procedures: Formal Observation Form which is used to record how often target actions take place and Informal Observation which is a teacher's impressions of what is happening in the classroom. The Student Observation Checklist which is an Informal Observation Form was used to gather data in this study. During the observation, data was gathered about students; eagerness to learn and changes in their attitudes.

In using the Students' Observation Checklist (SOC), twelve (12) attributes were used to assess changes in the students' behaviour during teaching and learning (Appendix 1). Observed behaviour and activities of students during lessons were recorded as observation notes.

7.2. The Use of Questionnaire

Questionnaire items based on students' attitudes towards physics, cooperation and participation among students during teaching and learning of Physics, students' attitudes towards tests and the extent of teacher's support were used to determine students' attitudes during the period.

On the questionnaire, the students' opinions and attitudes towards Physics teaching and learning were assessed after the intervention to determine any attitudinal changes due to the new instructional approach. The questionnaire on students' attitudinal change was categorized into *Pre* and *Post. Pre* refers to students' attitude towards physics teaching before the intervention, and *Post* was their attitude towards physics teaching after the intervention.

The Students' Attitudes Questionnaire (SAQ) used for this study (Appendix 2) was adapted from Martin-Dunlop and Frazer (2007). The first part of the SAQ required of students' personal information on age and gender. Students were not to include their names and identity numbers, to free their minds from fear of being victimized. The second part sought students' opinions about the type of instructional methods, learning environments and activities used in the teaching and learning of Physics. It consisted of four (4) categories with seven (7) questions each, and required the students to rate their responses using a five-point Likert scale ranging between strongly - disagree SD (1), disagree - D (2), not sure - NS (3), agree -A (4) and strongly agree - SA (5).

7.3. Validity and Reliability of Instruments

To grant the instrument face and content validity, the pre-attitude and post-attitude questions were given to colleagues and senior lecturers in the Department of Physics Education, University of Education, Winneba (UEW) to go through, check spellings of words, grammatical and functionality of the instrument. Necessary and constructive corrections and suggestions made were taken into consideration. The Students' Observation Checklist was checked for its validity through the corrections and suggestions of colleagues and senior lecturers.

In determining the reliability of the instrument for this study on students' attitude towards Physics teaching and learning, as adapted from Martin-Dunlop and Fraser (2007), it turned out that the Cronbach's alpha reliability was in the range between 0.70 and 0.91. The Cronbach's alpha reliabilities of the various scales are represented in Table 9. It was necessary to determine the Cronbach's alpha

values before using the questionnaire on the target group as the questionnaire had been adapted and also used in a Ghanaian context which is different from where it was originally used.

8. Data Collection Procedure, Discussion and Analysis

8.1. Analysis of Students' Observation Checklist with respect to the research question

Data was collected with the aid of students' observation checklist and students' attitude questionnaire. The researchers had about 12 continuous lessons with students on electricity and magnetism. Students' Observation Checklists for each other week (ie. six weeks) have been presented in Tables 1 to 6.

RQ: "What influence will the use of computer technology in the teaching and learning of Electricity and Magnetism have on the interest and attitudes of students towards the study of Physics in a Ghanaian Senior High School?"

Attribute	Observation Notes
Attendance in class	Thirty-three (33) students out of a total of forty-eight (48) attended the class. None of the absentees had sought permission from the class prefect, and various flimsy excuses were provided by those present to explain the reasons for their peers' absenteeism.
Arrival in class (internet café) on time	More than half of the class (26) arrived very late in class; they could not give any tangible reason(s) for attending class late.
Pre-reading assignment	None of the students had read the specified pages on the lesson before coming to class.
Level of Activity and Involvement in lesson	Most students were not too involved in the lesson. They did not seem to be interested in the lesson. Many appeared unready for the class.
Eager to learn and use of class time wisely without delays	Students wasted time in carrying out instructions to perform an operation on the computer.
Stays focused and listens attentively to teacher at all times	Most of the students did not pay much attention anytime teacher engaged them.
Works independently with minimum teacher support	Majority of the students could not do much without teacher's help. The girls constantly needed teacher's attention on working with the computer.
Actively engages the computer when instructions are given	Computer use was left to only the high achievers among the group. The others just sat and watched. A lot of the girls were observed idling behind their computers anytime an instruction was given.
Brings learning materials to class	Twenty-four (24) students attended the class without any learning material even though they had been asked to do so. Only three (3) students had all the required learning materials like notebooks, pens and calculators. The rest had either one of these materials only.
Asking and responding to questions promptly	Students did not ask too many questions and were quite dull throughout the lesson. However, response-time to questions was relatively short compared to traditional lesson periods.
Seeking and receiving help from peers instead of teacher	Teacher had to attend to almost all the students in the class due to their difficulty in carrying out operations on the computer. They could not seek help from their friends since they were also at a loss in handling the computer.
Jotting down points during presentation and learning	Many of the students could not perform this task since they attended the class without learning materials like notebooks and pens.

Table 1: Students' Observation Checklist (Duration of Observation: 1hr 20mins, Topic: Electrostatics)

From Table 1, it is realized that students' attitude and interest towards the teaching and learning of electrostatics was very poor. This could be seen from their attendance, arrival, involvement and their response to questions in class.

Attribute	Observation Notes
Attendance in class	The class was attended by thirty-nine (39) students. Six (6) of the absentees had sought permission from the class prefect to be away to the market. They had gone shopping for items for their cookery practical the next day. The rest had no tangible reason(s) for being absent.
Arrival in class (internet café) on time	Eighteen (18) of the students still arrived in class about 20 minutes late. However, majority were prompt in arriving in class.
Pre-reading assignment	Nineteen (19) students did their pre-reading assignment before coming to class
Level of Activity and Involvement in lesson	Majority of the students (more than half) were observed not to be participating in the lesson; many appeared not very comfortable with the computer, however, a few were quite involved in the class.
Eager to learn and use of class time wisely without delays	Students were quite eager to start their computers and use it. Delays in carrying out operations on the computer were minimal.
Stays focused and listens attentively to teacher at all times	Most of the students were observed to be attentive anytime teacher engaged them.
Works independently with minimum teacher support	Many of the students could not do much without teachers' help. However, few of them were able to do independent work without teacher's help.
Actively engages the computer when instructions are given	Majority of the students were observed not to be too involved in the use of the computer anytime an instruction was given. It appeared some were still not comfortable with the use of the computer.
Brings learning materials to class	More than half of the class attended the class with the requisite learning materials. The rest gave very flimsy excuses like forgetfulness, lack of money to buy the items and their items being stolen. They were however encouraged to bring them the following week.
Asking and responding to questions promptly	Students were quite active throughout the lesson. Response-time to questions was relatively short compared to the previous lesson. Most of the students used questioning to get details explained to them by teachers.
Seeking and receiving help from peers instead of teacher	Teachers had to attend to only some students who still had problems in handling the computer. Most of the students were also observed giving help to others with difficulties.
Jotting down points during presentation and learning	Many of the students were observed jotting down notes from the computer and also the teacher's instructions and guidelines.

Table 2: Students' Observation Checklist (Duration of Observation: 1hr 20mins, Topic: Current Electricity)

From Table 2, it is observed that students' attitude and interest towards the teaching and learning of current electricity has improved a bit. Their attendance and involvement in class have improved. Perhaps they were intrigued with the constant use of the computer technologies.

Attribute	Observation Notes
Attendance in class	Students' attendance in class was quite high and impressive (45). Only three (3) students were absent with tangible reasons and also with the class prefects' permission.
Arrival in class (internet café) on time	Majority of the students arrived in class in time, early enough to prepare for the lesson.
Pre-reading assignment	Majority (39 students) did their pre-reading assignments. The rest gave various reasons for not doing it.
Level of Activity and Involvement in lesson	Students' level of activity and involvement in the class was very high. Most of them were observed reviewing the previous lessons just before the beginning of the lesson.
Eager to learn and use of class time wisely without delays	Students did not waste much time in preparation towards the lesson. They were observed starting their computers and settling down without delay.
Stays focused and listens attentively to teacher at all times	Students stayed focused and were very attentive anytime teacher needed their attention.
Works independently with minimum teacher support	Only a few students could not work independently with their computers. Teacher had to provide some support for them to work.
Actively engages the computer when instructions are given	Students were observed to be actively engaging their computers whenever an instruction was given.
Brings learning materials to class	All students had at least two learning materials needed for the lesson. Some were observed borrowing some of the items from friends.
Asking and responding to questions promptly	Students quickly responded to questions, and they were also eager to ask teacher questions for clarification during the lesson.
Seeking and receiving help from peers instead of teacher	Students were observed interacting with their peers more often instead of seeking help from the teacher.
Jotting down points during presentation and learning	All students were observed to be intermittently putting down notes in the course of the lesson.

Table 3: Students' Observation Checklist (Duration of Observation: 1hr 20mins, Topic: Electric Circuits)

From Table 3, students' attendance has improved tremendously during the lesson on electric circuits. They did their pre-preparatory assignment and they were active in class. Their response to questions has improved and they seemed to be showing positive attitude towards the subject.

Attribute	Observation Notes
Attendance in class	Students' attendance in class was very high (45). Only three (3) students were absent with tangible reasons and also with the class prefects' permission.
Arrival in class (internet café) on time	Majority of the students arrived in class in time, early enough to prepare for the lesson.
Level of Activity and Involvement in lesson	Students' level of activity and involvement in the class was very high. Most of them were observed reviewing the previous lessons just before the beginning of the lesson.
Eager to learn and use of class time wisely without delays	Students did not waste much time in preparation towards the lesson. They were observed starting their computers and settling down without delay.
Stays focused and listens attentively to teacher at all times	Students stayed focused and were very attentive anytime teacher needed their attention.
Works independently with minimum teacher support	Almost all the students were observed doing their work independently. The teachers were just going round observing the students as they did their work.
Actively engages the computer when instructions are given	All students were observed busily engaging their computers either in groups or individually during the lesson.
Brings learning materials to class	Almost all the students had the necessary learning materials required for the lesson.
Asking and responding to questions promptly	Students promptly responded to questions asked by teacher. Majority of them did not hesitate to ask questions whenever they needed any clarification from the teacher or their mates.
Seeking and receiving help from peers instead of teacher	Most of the students were found to be interacting and helping each other during the lesson. Some were found working on others' computers whenever the need arose.
Jotting down points during presentation and learning	This was observed to be happening every now and then by the students.

Table 4: Students' Observation Checklist (Duration of Observation: 1hr 20mins, Topics: Magnetic and Non-magnetic Materials

From Table 4, the students were responding positively towards all the 12 attributes in the "Students' Observation Checklist". Students showed signs of positive attitude towards the subject.

Attribute	Observation Notes
Attendance in class	Students' attendance in class was very high (47). Only three (3) students were absent with tangible reasons and also with the class prefects' permission.
Arrival in class (internet café) on time	Majority of the students were punctual to class, early enough to prepare for the lesson.
Level of Activity and Involvement in lesson	Students' level of activity and involvement in the class was very high. Most of them were observed reviewing the previous lessons just before the beginning of the lesson.
Eager to learn and use of class time wisely without delays	Students did not waste much time in preparation towards the lesson. They were observed starting their computers and settling down without delay.
Stays focused and listens attentively to teacher at all times	Students stayed focused and were very attentive anytime teacher needed their attention.
Works independently with minimum teacher support	Students worked independently during lesson. Teacher's support was quite less as most students did independent work.
Actively engages the computer when instructions are given	Was highly observed during this lesson.
Brings learning materials to class	All materials needed were presented for the lesson.
Asking and responding to questions promptly	Highly observed in this lesson.
Seeking and receiving help from peers instead of teacher	This was highly observed during this lesson.
Jotting down points during presentation and learning	Students did this frequently.

Table 5: Students' Observation Checklist (Duration of Observation: 1hr 20mins Topics: Magnetic Field

From Table 5, more positive signs are being shown to all the attributes. The attendance has also improved and students have also developed interest the learning of the Magnetic Field with the use of ICT.

Attribute	Observation Notes
Attendance in class	Students' attendance in class was very high (48). Only three (3) students were absent with tangible reasons and also with the class prefects' permission.
Arrival in class (internet café) on time	Majority of the students arrived in class in time, early enough to prepare for the lesson.
Level of Activity and Involvement in lesson	Students' level of activity and involvement in the class was very high. Most of them were observed reviewing the previous lessons just before the beginning of the lesson.
Eager to learn and use of class time wisely without delays	Students did not waste much time in preparation towards the lesson. They were observed starting their computers and settling down without delay.
Stays focused and listens attentively to teacher at all times	Students stayed focused and were very attentive anytime teacher needed their attention.
Works independently with minimum teacher support	All students were observed doing independent work.
Actively engages the computer when instructions are given	Students were actively carrying out instructions given.
Brings learning materials to class	Necessary materials were brought to class by students.
Asking and responding to questions promptly	Students were prompt to ask and respond to questions during lesson.
Seeking and receiving help from peers instead of teacher	Students were found helping each other and going about lessons cooperatively during the lesson.
Jotting down points during presentation and learning	Highly observed during the lesson.

Table 6: Students' Observation Checklist (Duration of Observation: 1hr 20mins, Topics: The Earth as a Magnetic Field)

From Table 6, which was the last week of the entire lesson on Electricity and Magnetism, there was the full attendance of the class. Students have fully developed interest and positive attitudes towards the teaching and learning of subject. Due to their eagerness to learn and their interest with the use of the computer, they were highly concentrated on doing their own work without involving the teacher unnecessarily. They have become prompt in responding to questions and could do cooperative learning with their peers. They also listened to the teacher anytime the teacher needed their attention.

8.2. Demographic Description of Respondents

Demographic description may be referred to as how people are classified into groups using common characteristics such as race, gender, income level or age. Demographic information provides data regarding research participants and is necessary for the determination of whether the individuals in a particular study are a representative sample of the target population for generalization purposes (Lee & Schuele, 2010). The profile of the respondents in this study is looked upon in terms of age and gender.

8.2.1. Age of Respondents

The students' ages are presented in Table 7:

Age (Years)	Frequency	Percent (%)
16	7	14.6
17	28	58.3
18	12	25.0
19	1	2.1
Total	48	100

Table 7: Ages of Students

Majority of the students are between the ages of 17 (58.3%) and 18 (25.0%) years. 14.6% of them are 16 years of age while only 2.1% are 19 years. Hence majority of the students fall within the standard age for their academic level.

8.2.2. Gender of Respondents

Gender	Frequency	Percentage (%)
Male	2	4.2
Female	46	95.8
Total	48	100

Table 8: Gender of Participants

The SHS two (2) Home Economics class is a female dominated class.Out of the total of 48 students, 46 (95.8%) are girls while only 2 (4.2%) are boys. Ever since the introduction of Home Economics as a course into the second cycle educational system of Ghana, the enrolment of boys has always been low. In the Ghanaian culture or tradition, certain roles or duties are specifically done by females.

For example, kitchen related jobs like cooking and food management among family members at home are organised by the women in the families (Oludipe&Oludipe, 2010). Since cooking of food and home management form part of the Home Economics programme, most Ghanaians have misconstrued the programme to be for only females. Men who are involved in this course are usually belittled in the Ghanaian society. This has been the major reason why most males shy away from the Home Economics Programme and it has become a female dominated one (Awumbila, 2001).

8.3. Analysis of Questionnaire with Respect to the Research Question

RQ: "What influence will the use of computer technology in the teaching and learning of Electricity and Magnetism have on the interest and attitudes of students towards the study of Physics in a Ghanaian Senior High School?"

Students' interests and attitudes towards physics teaching and learning were determined through the use of a questionnaire. The students answered pre- and post- items about their attitudes towards Physics teaching and their learning environment. Their *pre-* and *post-*responses were compared to see if there were any significant differences in their mean values. Pre- is the reflection of the students' responses on their attitudes towards physics teaching and learning environment before the intervention and post is the reflection of students' position after going through the lesson with the aid of computer-assisted instructions. To avoid equal rating as suggested by Antwi (2013), the pre- and post-responses of students were compared at the same time, after the use of the intervention (CAI).

	Pre/Post	**N**	**Mean**	**Sig.**	**Standard Deviation**	**Alpha Reliability (α) for Pre and Post**
Students' Attitudes towards Concept Tests	Pre	48	1.95		0.71	
	Post	48	3.82	0.010	0.71	0.90
Students' Participation and Co-operation	Pre	48	2.18		0.92	
	Post	48	4.07	0.000	0.63	0.88
Teacher's Support	Pre	48	2.30		0.98	
	Post	48	4.06	0.000	0.72	0 .87
Students' Attitudes towards Physics Teaching and Learning	Pre	48	2.19		0.71	
	Post	48	3.55	0.000	0.73	0.71

Table 9: Comparing Students Mean Values of Pre- and Post-responses on their Attitude towards Physics Teaching and Learning Environment

In Table 9, the students' mean values of pre- and post-responses on attitudes towards concept tests, cohesiveness and participation, teachers' support and their (students) attitudes towards Physics teaching and learning were compared. The mean scores of the students' pre-responses were relatively lower than their mean scores for post-responses for the same category of items. To determine whether the differences in the pre- and post-responses were statistically significant, an independent t-Test analysis was used. The results confirmed that the differences in most of the pre- and post-responses were statistically significant. Thus, the students' interests and attitudes towards the teaching and learning of Physics, and their learning environment significantly improved after their exposure to computer assisted instructional (CAI).

The result with respect to the research question indicated that the use of the computer assisted lessons impacted positively on the students' interests and attitudes towards the teaching and learning of Physics. It indicated that before the intervention, the students had low interests in and negative perceptions about the conceptual physics tests (Mean= 1.95, SD= 0.71), however, after the intervention their interests were whipped up and their mean score had increased Mean=3.82, SD = 0.71(Table 9). The reasons being that, they had become used to the routine of pre- and post-tests being conducted before and after lessons. Hence, they no longer had a dislike for the tests as was revealed in the pre-intervention results, but rather saw it as an important part of their lessons.

The increased student-student interactions, and also, active student participation in the interactive lessons also led to a significant improvement in the students' interests and attitudes towards Physics (Table 9). Before the intervention, the emphasis had been on individual student's mastery of contents and ability to recall facts, definitions and proving of formulae. This was done without recourse to students' conceptual understanding. The students seemed to be in competition with each other and so there were less or no interactions among them during lessons. This could have led to poor attitudes for the subject since students who could not "chew and pour" facts were disadvantaged. The mean score value for student participation and cooperation was 2.18 (SD = 0.92). However, the IWebP encouraged co-operation among the students and active participation in the lessons. This was achieved through the friendly atmosphere created by the researchers, lessons being activity-based and student-centred with a lot of hands-on exercises, and also the non-existence of usual individual competitiveness among the students. Also key was students' ability to express their opinions without any apprehension or fear of being ridiculed by peers or researchers. These strategies resulted in an increased mean value of 4.07 (SD = 0.63) for the post-intervention responses; an indication that the use of the Interactive Webquest Package had positively influenced the students' attitudes towards the teaching and learning of Physics.

These findings are in congruent with those of Yusuf and Afolabi (2010), Abdullah and Abass (2006) and Newberry (1999), which concluded that the performance, attitudes and eagerness towards learning of students exposed to computer instructional approach in cooperative learning settings was better than their counterparts in individualized or competitive learning settings. On the basis of these

findings it is suggested that computer assisted instructional packages should be administered in cooperative learning settings to maximize their effect on students' attitudes and performance.

Another important factor for the students' improved change in attitudes was the keen interest and support the teachers provided the students during the teaching and learning process. The students saw the teachers as guides and not as sages on stage, hence they were able to interact freely and seek help whenever the need arose, leading to improved attitudes towards the study of the subject. The teachers took personal interests in each of the students and as such knew each by his/her name. The researchers also attended to students' problems individually, thereby endearing them to the students. According to Etkina and Mestre (2004), a teacher's role in students' attitudinal change is very essential in the teaching and learning process. To them, providing the opportunity and the learning environment for the students to reconstruct their own conceptual knowledge and understanding leads to a lasting improvement in students' attitudes toward learning and to greater chances of success in their studies and lives.

From the discussions made so far, there seemed to be growing evidence that students who possess positive attitudes towards science will perform better academically. According to Rogers and Ford (1997), a positive attitude towards science may improve students' academic performance not only in science classes, but in other classes as well. Russell and Hollander (1975) who created the Biology Attitude Scale- a tool designed specifically to measure students' attitudes towards Biology-supports this claim. "The tool was developed on the assumption that an important consequence of instruction is a positive change in the student's attitude towards the subject, and the authors argue the importance of focusing on attitudes by stating that there usually exists a positive correlation between attitudes and achievement".

The main purpose of this study was to investigate effect of Computer-Assisted Instruction (CAI) on SHS Two (2) Home Economics students' attitudes in the study of Electricity and Magnetism. The study revealed that the students' negative attitudes towards the study of Physics had been replaced with improved and positive attitudes. It was thus concluded that the use of computer assisted instructional approaches should be encouraged in teaching Physics at the Senior High School level in Ghana.

9. Summary of the Major Findings

Does the use of computer assisted instruction lead to changes in students' interests and attitudes towards the study of Physics?

Students' attitudes after exposure to computer assisted instruction highly improved. There was a positive change towards their concepts tests. Student-student and teacher-student interactions, as well as their eagerness to learn physics after they had been exposed to the IWebP also improved. For instance, results from the observation checklists and the questionnaire indicated that the students started seeking help from their peers instead of the teachers. Also, it was realised that the students related to the teachers more freely than before without any fear of reproach or being victimized. The interactive nature of the computer lessons gave the students the ability to visualize abstract concepts and this resulted in effective learning and an appreciation of the concepts taught. For instance, in the lesson on electrostatics, the students watched a video on how charges on hair and balloon got separated after being rubbed together. The charged balloon was then used to roll an empty can along without actually touching it. The interactive nature of the video made the concepts of separation of charges and the buildup of charges on bodies real to them.

10. Conclusions

The CAI (IWebP) learning activities provided an equal support for every student to eventually achieve an enhanced conceptual understanding of the concepts taught. From the Observations and the Questionnaire it was revealed that students largely developed conceptual understanding in Electricity and Magnetism due to the intense student-student interactions, peer support, active participation of all students in the interactive lessons, maximum teacher support and increased teacher-student interactions coupled with the high levels of motivation during lessons.

Results from this study also indicated that majority of the students enjoyed the interactive lessons with CAI (IWebP) and thus, they were motivated more to participate actively in the lessons, and were also eager to be in the next lesson. Furthermore, it also revealed from the Questionnaire and Observations that the CAI supported student-centred lessons in a number of ways. The interactive lessons which were basically activity oriented and also involved series of group work, made the students learn collaboratively and provided opportunity for them to interact and discuss with their colleagues intensively.

Finally, teaching with the IWebP made the lessons practical and teaching and learning more effective. This is in line with Vygotskian view of teaching and learning which aimed at a more effective education. According Lev Vygotsky (1978), a more effective education may be induced by the use of technology.

This goes to imply that for schools to be effective and make a difference in student learning, interest and positive attitude towards physics they must hold teaching and learning at the centre of their work. Additionally, realizing teachers have a significant impact on student learning, teachers should strive to ensure that students are at the centre of learning and that classroom instruction provides rich and meaningful curriculum for the full range of students in schools.

11. Recommendations

Recommendations have been grouped into three:

11.1. Recommendations for Teachers and Schools Who Want to Use Computer Assisted Instructional Approaches in the Teaching and Learning Process

From the study, the following guidelines are recommended to schools and teachers who would like to include computer assisted instructional methods in the teaching and learning of Physics.

- A common problem with many students in Senior High Schools is their laziness towards learning especially in the Science subjects. This study revealed that one effective measure teachers could use to nip this attitude of students in the bud is to adopt the use of concept tests at the beginning of every lesson, with the scores being part of the continuous assessment. This would make them prepare adequately before coming to class. Also, students' participation in the teaching and learning process and teachers' support could make students adopt positive attitudes towards Physics teaching and learning and therefore maximize their performance.
- Teachers should ensure that students are made more responsible for their own learning through group activities and discussions, sharing of ideas and cooperating with peers with some guidance from the teacher. This implies that Physics teachers should model their instructions to enforce student-student interactions. For instance, using computer instructional packages that will enhance group discussions or active learning among students.

11.2. Recommendations for CRDD, the Ghana Education Service, the Ministry of Education and all other Stakeholders Associated with Science Education in Ghana

Based on the findings of this study, the following recommendations are made for the stakeholders in Science Education in Ghana:

- Curriculum planners and developers, all stake holders associated with Science Education in Ghana should introduce innovative computer assisted instructional approaches in the Physics programme. This would motivate the Physics students to develop positive attitude towards the subject.

11.3. Recommendations for Further Research

Reflecting on the findings of this study, the following recommendations are made for further research with respect to the use of computer instructional packages on Physics teaching:

- The sample size was quite small due to the focus of this study. It is therefore recommended that the study be replicated using larger samples to provide a basis for more generalisations of the conclusions drawn from the findings of the study about the effectiveness of computer assisted instructional packages in the teaching and learning of Electricity and Magnetism.

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Appendix 1

1. Students' Observation Checklist

Attribute	Observation Notes
Attendance in class	
Arrival in class (internet café) on time	
Pre-reading assignment	
Level of Activity and Involvement in lesson	
Eager to learn and use of class time wisely without delays	
Stays focused and listens attentively to teacher at all times	
Works independently with minimum teacher support	
Actively engages the computer when instructions are given	
Brings learning materials to class	
Asking and responding to questions promptly	
Seeking and receiving help from peers instead of teacher	
Jotting down points during presentation and learning	

Table 1

Appendix 2

2. Students' Attitude Questionnaire (SAQ)

This questionnaire is aimed at soliciting your views and opinions on how Physics teaching and learning is done in your school. Your responses would be confidential and used for research purposes only.

Please tick (√) the response which appropriately suits your opinion from the list of responses provided for each question.

2.1. Part A

Sex: Male [ ] Female [ ]

Age: _ _ _ _

2.2. Part B

Pre-Intervention						Post-Intervention				
SD (1)	**D (2)**	**NS (3)**	**A (4)**	**SA (5)**		**SD (1)**	**D (2)**	**NS (3)**	**A (4)**	**SA (5)**
					1. I wrote a test before and after each Physics lesson					
					2. The test I wrote before each lesson helped me to do my pre-reading assignments before coming to the Physics class					
					3. The test I wrote at the end of each Physics lesson helped me to pay much attention during Physics lessons					
					4. The pre-reading assignments helped me to understand concepts in Electricity and Magnetism					
					5. The tests I wrote helped me to participate actively in class					
					6. I disliked being tested before and after each Physics lesson					
					7. I enjoyed being tested before and after each Physics lesson					

Table 2: Concept Test

Pre-Intervention						Post-Intervention				
SD (1)	D (2)	NS (3)	A (4)	SA (5)		SD (1)	D (2)	NS (3)	A (4)	SA (5)
					8. I was able to participate actively during Physics lessons					
					9. I learned from other students in the class					
					10. I worked well with other students in the class					
					11. I cooperated with other students during class activities					
					12. Other students worked with me to achieve class goals					
					13. I helped other students who were having difficulties with work					
					14. I got help from other students in the class					

Table 3: Students' Participation and Cooperation

Pre-Intervention						Post-Intervention				
SD (1)	D (2)	NS (3)	A (4)	SA (5)		SD (1)	D (2)	NS (3)	A (4)	SA (5)
					15. My Physics teacher helped me when I had difficulties with work					
					16. My Physics teacher talked with me					
					17. My Physics teacher talked with me					
					18. My teacher took a personal interest in me					
					19. My Physics teacher was interested in my problems					
					20. My Physics teacher moved about the class to talk with me					
					21. My teacher's questions helped me to understand concepts in Electricity and Magnetism I got help from other students in the class					

Table 4: Teacher's Support

Pre-Intervention						Post-Intervention				
SD (1)	D (2)	NS (3)	A (4)	SA (5)		SD (1)	D (2)	NS (3)	A (4)	SA (5)
					22. I look forward to (eagerly anticipate) the next Physics lesson					
					23. Physics lessons were fun					
					24. I enjoyed being in the Physics class					
					25. Lessons in the class were a waste of time					
					26. Lessons in the class bored me					
					27. The lessons made me interested in Physics					
					28. Physics lessons were one of the most interesting classes					

Table 5: Students' Attitudes towards Physics and Learning

Any comments, hints and suggestions?

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