

**EFFECT OF COMPUTER AIDED LEARNING OF BASIC SCIENCE
AMONG SECONDARY SCHOOL STUDENTS IN OVIA NORTH LOCAL
GOVERNMENT AREA OF EDO STATE**

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BENIN CITY**

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**A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF
CURRICULUM AND INSTRUCTIONAL TECHNOLOGY, FACULTY OF
EDUCATION, UNIVERSITY OF BENIN, BENIN CITY, IN PARTIAL
FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF
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CERTIFICATION

This is to certify that this project work was carried out by **Progress Okeoghene UKPEGHAROVWE** in the Department of Curriculum and Instructional Technology, Faculty of Education, University of Benin, Benin City under our supervision.

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DEDICATION

This research is dedicated to Almighty God who gave me the grace and good health to successfully complete my academic programme in the University of Benin.

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My inherent gratitude goes to God Almighty who has been the source of my strength in this great institution, for his unfailing love, grace and mercy which sustained me irrespective of the ups and downs I encountered throughout the duration of this course.

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ABSTRACT

This study investigated the effect of computer assisted learning of basic science among secondary school students in Ovia North-East Local Government Area of Edo State. Four (4) research questions were raised to guide the study. The study adopted the descriptive survey research design. The population of the study comprised 1734 JSS3 students in 29 Junior Secondary Schools in Ovia North-East Local Government Area of Edo State. Simple random sampling technique was used to select 120 JSS3 students as sample for the study. The instrument used for data collection was a structured questionnaire titled Questionnaire on Effect of Computer Aided Learning of Basic Science among Students (QECALBSS). It was validated by the researchers' supervisor and two experts in Department of Curriculum and Instructional Technology, Faculty of Education, University of Benin, Benin City. Its reliability was established at 0.84 using Cronbach Alpha method. The data collected for the study was analyzed using frequency tables, simple percentages and mean.

The findings revealed that level of computer aided learning of basic science among the students in was fairly above average (mean=2.73); computer aided learning of basic science had high and positive effect on secondary school students (mean=3.47); social factors affecting the effective use of computer aided learning in basic science are language barrier (mean=2.60) and discouragement of students from taking responsibility for their own learning (mean=2.57) respectively and constraints facing the teaching of basic science using computer aided learning support in schools are inadequate CAL facilities in school (3.90), frequent electricity interruption (3.89), poor network bandwidth (3.88), limited budgetary allocation to basic science education (3.40), lack of/limited ICT skills among teachers(3.20) amongst others respectively.

It was recommended among others that government should invest heavily to provide adequate number of computers CAL facilities in schools and also enhance internet connection in the schools to ensure easy access to teaching and learning materials of Basic Science using CAL. Also, the government should develop pre-service and in-service staff training programmes that are tailored to the school programmes to keep teachers up to date with the technological changes which will promote proper integration of computer aided learning in teaching and learning. Those teachers that are not ICT compliant should be encourage to study further in order to meet up with the new demand.

CHAPTER ONE

INTRODUCTION

Background of the Study

Science is made of subjects that serve as bedrock to most scientific, engineering and medical fields of study. Physics, chemistry and mathematics subject puts a lot of fear in the mind of students. The fear of this subject is generally termed Science Phobia. Effective learning depends on the quality of teaching. The failure to adapt learned subjects to new circumstances is an indication that learning has not been completed, with that being said, the use of computer networks and information technology is becoming an important part of the everyday work on almost any profession, especially in the scientific areas and changed education concepts and many universities and education organizations decided to plan new strategies concerning computer based technologies.

Today, we have knowledge at our fingertips thanks to electronic instruments. As a result of these developments Computer Aided Learning (CAL) methods became popularized. These methods have been utilized and developed more than for fifteen years in many universities and organizations. The goal is to develop the learning capacity of students and increase the teaching productivity and effectiveness of instructors with the help of advanced computer based technology. This technology should be an integrated part in the education. It is also desirable to use this technology to develop attractive courses for distance education. Another area of interest is to use computers, information technology and equipment to develop attractive and understandable demonstrations of basically tasks and typical projects in the field of photogrammetric. Science and technology is what is reigning in the world economy today and as a result, students are encouraged to be technology oriented.

The word science comes from a Latin word *Scientia*, meaning knowledge. Knowledge attained through the study or practice or knowledge covering general truths of the operation of general laws and tested through scientific study method concerned with the physical world. With the difficulty pronounced there is need for students to study by making use of tools they will love to use so as much so that their attention can be drawn to the basic subjects, just as kids are meant to learn with toys. This work is intended to reduce this phobia through the use of multimedia accesses available on the computer. It is also aimed at making science subjects easier, friendlier and less stressful. The user can also carry out some other activities in his system while learning. This idea, its invention and its level of development are treated in detail using the senior secondary school.

Computer use in schools has become widespread from primary education through the university level and even in some preschool programs. (Encyclopedia Britannica, 2015) Oka (2014) posits that information and communication technologies enable man to timely and efficiently increase his speed of operation, interact in flexible ways, utilize his potentials to become innovative and creative. This flexible way of interaction and abilities to become creative and innovative can also be successfully integrated into the educational venture for effective teaching and learning of sciences. In Alumode, Fafunwa sees education as the aggregate of all the processes by which a child or young adult develops the abilities, attitudes and other forms of behavior which are of positive value to the society in which he lives. He advised that when evaluating any educational system, one must determine the extent to which it is meeting the needs of a particular society at any given time hence, its effectiveness to the society The Encyclopedia Britannica (2014) posits that the use of computers in educational instruction provides one-to-one interaction with a student, as well as an instantaneous response to the

answers elicited, and allows students to proceed at their own pace. Computers are particularly useful in subjects that require drill and constant practice. A computer program can be used diagnostically, and, once a student's problem has been identified, it can then focus on the problem area. Igwe (2003) observed that science cannot be practiced without equipping both the teacher and the students with the adequate knowledge on the resource materials to be used. Computers provide this service to both the teacher and the students in a more fascinating and comprehensive manner. Computer Aided learning is a diverse and rapidly expanding spectrum of computer technologies that assist the teaching and learning process.

Statement of the Problem

Basic science formally known as Integrated Science is a subject taught at both public and private schools at Secondary School level (Nwafor, 2012). It is an introduction to the study of the sciences in the Secondary School Level. Basic Science is the study of the basic sciences because they provide a fundamental understanding of natural phenomena and the processes by which natural resources are transformed.

The need to develop and improve the teaching of the basic science subjects is of importance for many reasons. Students have poor follow-up after teaching by the teacher, poor performance of students in basic science subject examination, Decline in the number of students wishing to study science because of what they feel and the science phobia. We also have the inability of students to cope with science due to poor science background build up and materials presented to students without proper illustration by the teacher. Therefore, students' attitudes change in their learning process either directly or indirectly through observation, experiences, and the learning environment. Hence the change in attitude is mostly influenced by teachers, parents, peers' characteristics, and classroom environment (George, 2000).

Research Questions

The following research questions guided the study:

1. What is the level of computer aided learning on basic science among secondary school students?
2. What is the effect of computer aided learning on basic science among students?
3. What are the social factors affecting the effective use of computer aided learning in basic science?
4. What are the constraints facing the teaching of basic science using computer aided learning support in schools?

Purpose of the Study

The main purpose of this study is to establish the effect of computer assisted learning of basic science among secondary school students in Ovia North-East Local Government Area of Edo State. Specifically, the study sought:

1. To determine the level of computer aided learning of basic science among secondary school students;
2. To ascertain the effect of computer aided learning on basic science among students;
3. To examine the social factors affecting the effective use of computer aided learning in basic science;
4. To identify the constraints facing the teaching of basic science using computer aided learning support in schools.

Significance of the Study

This study is significant because it will help to reveal the relevance of CAL in education especially in effecting a more appropriate method of teaching basic science in schools. It will therefore be beneficial to the school administrators, stakeholders in education and the society, teachers, students and to the researchers.

The findings of the study will be beneficial to the school administrators especially the Ministry of Education especially Post Primary Education Board by appraising the CAL facilities supplied to schools, their state and the need to increase the supply. This is necessary for the realization of set goals and objectives of not only basic science education but science education in general at the junior secondary level. Government may also use this medium to train teachers on how to fully utilize these facilities.

It will also be beneficial to the stakeholders in education and the society in general by exposing areas where necessary policies and methods for implementation of integrated need to be put in place in order to save the country from technological enslavement prevailing in the country by identifying the missing links and factors that have stalled the realization of basic science education goals in the past.

The benefits of this study to teachers include the following:

- CAL will help to motivates teachers –The exposure to CAL can help to motivate, promote and enable professional development of teachers particularly in teaching of basic science;

- CAL will help teacher to create more learner centric learning environment – CAL facilities are seen as important tool to enable and support the move from traditional teaching style to more modern method of teaching;
- Lesson plan will be done easily when using CAL – Teachers are at the advantage of achieving the best in lesson plan if they adopt the use of CAL;
- The use of CAL will enable the teacher to make whole class teaching of basic science more dynamic;
- The use of CAL by the teachers will enable them to develop interactive materials which authoring software, which can be used to enable students to focus during the teaching of basic science.

The benefits of this study to Students also include the following:

- Develop learning states – Students can work with CAL to develop their understanding, analytical and organizational skills in basic science and other science subjects;
- Learn in more varied ways – Students can work effectively at their own pace and level, using differentiated materials, and other CAL resources;
- Students can work flexibly away from classroom, and receive feedback immediately on a particular topic on basic science via the use of CAL;
- Students can communicate with their peer students using e-mail, video conferencing, blogs, wikis, social networking sites and text messages to develop their target topic on basic science with their peers in other part of the world;
- Students will also be encouraged to take responsibility for their own learning.

Lastly, the findings of this study will add to the existing body of knowledge as researchers will find it useful on related work.

Scope and Delimitation of the Study

The study focused on the effect of computer assisted learning of basic science among secondary school students in Ovia North-East Local Government Area of Edo State. This study is delimited to only to JSS3 students in public junior secondary schools in the Local Government Area because they are more exposed to the subject.

Definition of the Terms

Effect: means to bring about a result or influence on someone or something

Computer: This is an electronic machine that can store, organize and find information, and workout arithmetic. Also, it controls other machine with high speed and accuracy.

Computer Aided Learning: This is a process of acquiring knowledge or skills through the use of computer by students in schools.

Science: refers to the intellectual and practical activity encompassing the systematic study of the structure and behaviour of the physical and natural world through observation and experiment.

Basic Science: The basic sciences are defined as the scientific disciplines of mathematics, physics, chemistry, and biology. They are called basic sciences because they provide a fundamental understanding of natural phenomena and the processes by which natural resources are transformed.

CHAPTER TWO

LITERATURE REVIEW

The chapter consists of a review of related literatures that are relevant to the study. The reason for this is to give the reader a broad understanding of the past research and works that this study is built on. It was done under the following sub-headings:

- Concept of Computer Aided Learning
- History of Computer Aided Learning
- Basic Science
- Computer Aided Learning and Basic Science Subject
- Effect of Computer Assisted Learning on Basic Science
- Social Factors affecting the Effective Use of Computer Aided Learning in basic science
- Constraints facing the Teaching of Basic Science using Computer Aided Learning Support
- Summary of Reviewed Literature

Concept of Computer Aided Learning

Computer Aided Learning is a learning Technique employed in order to educate students via the use of computers or we can also define it as a computer program or file developed

specifically for educational purposes of science subjects. Computer aided learning is becoming a popular tool of teaching, utilizing computers in the explanation, tutoring and testing of subject matter. In the discipline of physics, mathematics there is a large potential for the use of CAL, for instance in both the teaching and testing of science subject (usually called computer aided assessment) computerized diagnostic tests are an integrated part of testing at schools, especially during the first few weeks when tutors want to understand the level of knowledge of new students. As technology continued to grow and with the introduction of the Internet, information on CAL of science subjects programs became more interactive, reflecting a social need for flexible learning outcomes. There is now a multitude of Computer Assisted Learning platforms designed for every market, from school based edutainment packages to computer based management learning environments (Whalley, 1998).

Computer programmers have been able to create science computer-assisted-instruction programs that have served to increase science student learning by affecting cognitive processes and increasing motivation. Current research shows the mechanisms by which computer programs facilitate this learning:

- (1) Personalizing information in science,
- (2) Animating question objects and structures on the screen for memorizing,
- (3) Providing practice activities that incorporate challenges and curiosity,
- (4) Providing a fantasy context and
- (5) Providing a learner with choice over his/her own learning of Physics, Chemistry and Mathematics.

Personalizing information allows computer-assisted-instruction of science to increase learner interest in the given tasks Padma and Ross (1987) and increase the internal logic and

organization of the material Anderson (1984). New information can be more easily integrated into existing schema if a student's name or other familiar contexts appear in a problem. The animation Text, Question and materials of objects involved in the explanation of a particular concept, for example, Newton's First Law of Motion, increases learning by decreasing the cognitive load on the learner's memory thereby allowing the learner to perform search and recognition processes and to make more informational relationships (Reiber, 1991).

Computer-assisted-instruction increases motivation by providing a context for the learner that is challenging and stimulates curiosity (Whalley, 1998). Activities that are intrinsically motivating also carry other significant advantages such as personal satisfaction, challenge, relevance and promotion of a positive perspective on lifelong learning (Keller & Suzuki, 1988). Parker and Lepper (1992) have also found, apart from using computer programs, that involvement in fantasy is often highly intrinsically motivating. They added that a fantasy context increases learning by facilitating engagement.

Moreso, providing students with choice over their own learning provides learner-controlled instruction, which contributes to motivation. Increased motivation in turn increases student learning, Kinzie, Sullivan and Berdel (1988). Also, program-controlled instruction, as opposed to learner-controlled, may get in the way of the learner by requiring the learner to study all of the given subject matter rather than only the elements the learner needs. Further, learner-controlled instruction makes it possible for individuals to make certain choices in an activity and to affect certain outcomes. As a result, the individual feels competent and self-determining.

- **Learning Stages using CAL**

Without an understanding of the stages of learning, a manager may think that more than enough time and resources have been spent training someone and are then disappointed when the level of knowledge is less than desired or worse, the subject are being without merit because results are expected too soon. If an organization is serious about developing its ability to create its own future, there must be a way to develop a critical mass of people at the competent level in the desired knowledge areas. Stages involved in learning are.

1. **Novice:** beginning awareness of subject are, but only abstract concepts and ideas. Novice possesses little or no ability to put ideas into practice in a reliable way. They apply their learning by following a set of rules without regard for context.

- * Situation decomposition: needs elements to be clearly and objectively defined.

- * Decision making behaviour follows rules without consideration of context.

- * Skills and tools exposed and able to apply if directed.

- * Formal training time- 2 - 5 days.

- * Training with practice 1 - 2 months.

2. **Advance Beginner:** marginal learning to an acceptable performance level after gaining experience coping with real experiences. Start to understand the scope of the subject area and knowledge about the discipline.

- * Situation decomposition perceives similarity with prior examples.

- * Decision making behaviour matches situation to proper rule set.

- * Skills and tools recognize and apply in structure setting.

- * Formal training time 5-10 days.

- * Training with practice 3 - 6 months.

3. **Competent:** exposes to and a working knowledge of a number of areas making up the subject. New skills and capacities are being internalized with the ability to go beyond rule bound procedures in a highly structured setting being able to adopt their learning to different situations by analyzing changed circumstances and selecting among viable alternatives.

- * Situation decomposition considers various alternatives.

- * Decision making Behaviour analytical determination of best alternative.

- * Formal training time 20 – 20 days.

- * Training with practice 12 - 18 months.

4. **Expert:** fully internalized both perception and action into their normal work processes. When things are going normally, all work is routine, doing “just what works” reaching this stage involves a close relationship with another expert where additional learning is gained through continued exposure, observation and other interaction.

- * Situation decomposition internalized, now intuitive.

- * Decision making Behaviour act in an unconscious, automatic manner.

- * Skills and tools intuitive and applies unconsciously in all settings.

- * Formal training time informal through interaction with other experts.

- * Training with practice 5 - 10 years.

- **Communication Technologies Used in Computer Aided-Learning**

Communication technologies are generally categorized as asynchronous or synchronous. *Asynchronous* activities use technologies such as blogs, wikis, encyclopaedias, encarta and discussion boards. The idea here is that participants may engage in the exchange of ideas or information without the dependency of other participants’ involvement at the same time.

Electronic mail (Email) is also asynchronous in that mail can be sent or received without having both the participants' involvement at the same time.

Synchronous activities involve the exchange of ideas and information with one or more participants during the same period of time. A face to face discussion is an example of synchronous communications. *Synchronous* activities occur with all participants joining in at once, as with an online chat session or a virtual classroom or meeting. Virtual classrooms and meetings can often use a mix of communication technologies.

In many models, the writing community and the communication channels relate with the E-learning and the M-learning communities. Both the communities provide a general overview of the basic learning models and the activities required for the participants to join the learning sessions across the virtual classroom or even across standard classrooms enabled by technology. Many activities, essential for the learners in these environments, require frequent chat sessions in the form of virtual classrooms and/or blog meetings. Lately context-aware ubiquitous technology has been providing an innovative way for written and oral communications by using a mobile device with sensors and RFID readers and tags (Lioyand & Lionard, 2009).

History of Computer Aided Learning

History of Computer

It is necessary to first discuss the history of computer in order to have better understanding of the history of computer aided learning. According to Whalley and Fredrick (1994), computer first emerged into two stages.

- 1). Abacus Stage
- 2). Mechanical Clock Stage

Abacus Stage: The earliest known device to record computations was the abacus. It dates back to ancient times and was invented by the Chinese. Ten beads were strung onto wires attached to a frame. Addition and subtraction were read from the final positions of the beads. It was considered the first manual tool used in calculating answers to problems that provided information and in a primitive way storing the results.

Mechanical Clock Stage (Era):“Advancing to computer Era Whalley and Fredrick (1994). During the middle ages the first closed system in terms of calculating information was invented by use of a mechanical clock. The parts of the clock calculated the time of day. The time was displayed through the position of two hands on its face. The inventor pre-programmed the clock instructions through the manner in which the pull of the weights and the swing of the pendulum with the movement of the gears established the position of the hands on the clock face.

First Generation of Computer:

The first generation of computers started with the UNIVAC (Universal Automatic Computer) built by Mauchly and Eckert. It was sold to the UNIVAC, US census Bureau (John & Eckert, 1951).

Characteristics of first generation computers

1. Use of Vacuum Tubes in electronic circuits: These tubes controlled internal operations and were huge. As a consequence the machines were large.
2. Magnetic Drum: As primary internal storage medium, electronic currents passed through wires which magnetized the core to represent on and off states.
3. Heat and maintenance problems: Special air conditioning and maintenance were required of machines. The tubes gave off tremendous amounts of heat.

4. Application: Payroll processing and record keeping though still oriented toward scientific application than business data processing.

Second Generation of Computers:

According to Whalley and Fredrick (1994) generation of computer in the second phase started from (1959 - 1964) and it took place hierarchically.

Characteristics of second generation computers

1. It uses of transistors: for internal operations, tiny solid state transistors replace vacuum tubes in computers. The heat problem was then minimized and computers could be made smaller and faster.

2. It has a magnetic core as primary internal storage medium. Electric current pass through wires which magnetized the core to represent on and off states. Data in the cores can be found and retrieved for processing in a few millionths of a second.

3. Faster Input/Output: tape orientation devices could be connected directly to the computer and considered directly to the computer and considered online. This allowed for faster printing and detection and correction of errors.

4. High level programming languages (Cobol, FORTRAN): These languages resembled English FORTRAN (formular Translator) was the first high level language that was accepted widely. This language was accepted widely. This language was used for scientific applications. COBOL (Common Business Oriented Language) was developed in 1961 for business data processing its main features includes file processing, editing and input/output compatibility.

Third Generation (1965-1970)

Characteristics of third generation computers

1. Use of integrated circuits: the use of integrated circuits (ICs) replaced the transistors of the second generation machines. The circuits are fetched and printed and hundreds of electronic components could not be put on silicon circuit chips less than one eighth of an inch square.
2. Magnetic Core and solid state main storage: Greater storage capacity was developed.
3. Smaller Size and better performance and reliability: advances in solid state technology allowed for the design and building of smaller and faster computers. Breadboards could easily be replaced on the fly.
4. Applications: such as airline reservation systems, market forecasting, credit card billing. The applications also include inventory control and scheduling labour and materials. Multitasking was developed both scientific and business application could be run on the same machine.

Fourth Generation

Advanced search result has the characteristics and era of fourth generation computers to be

1. Use of large scale integrated circuits
2. Modular design and compatibility between equipment.
3. Special application program
4. Increased use of minicomputers.

Basic Science

Ukpabi (1985) in Omiko (2005) defined Basic Science as a science in undifferentiated form which stresses the fundamental unity of science. Basic science involves the study of elementary biology, anatomy, earth/solar system, ecology, genetics, chemistry and physics as a single science subject in the Junior Secondary school. It offers the basic training in scientific skills required for human survival, sustainable development and societal transformation. Basic

science studies also involve bringing together traditionally separate science subjects so that students grasp a more authentic understanding of science.

The study of Basic Science (Integrated science) is a new way of studying science, according to Omiko (2012) and Anaeke et al (2010), Basic Science was introduced into this country Nigeria a few decades ago. It started with few schools, and now all the junior secondary schools in the country have adopted it.

According to the National Policy on Education (FRN, 2004), the aims of Basic Science (Formerly Integrated Science) should be directed at enabling students who are exposed in it, to acquire the following skills:

1. Observe carefully and thoroughly
2. Report completely and accurately what is observed.
3. Organize information acquired
4. Generalizing on the basis of the acquired information
5. Predicting as a result of the generalization
6. Designing experiments (including control where necessary) to check predictions.
7. Using models to explain phenomena where appropriate; and
8. Continuing the process of inquiry when new data do not conform to predictions.

To achieve these objectives, it is suggested that the teaching and learning of Basic science should involve the use of innovative methods of teaching like discovery, problem-solving, open-ended field trips and laboratory methods and among others (Omiko, 2016).

Computer Aided Learning and Basic Science Subject

It is widely accepted that the integration of modern Information and Communication Technologies (ICT) into the teaching learning process has great potential. In fact, it could be the

most important way by which states can meet their educational aspirations within reasonable time and resources. Computer assisted learning (CAL) is not a new phenomenon. This field of education has been growing since the introduction of computers into the learning environment. Starting with the humble digital textbook, CAL has moved into the realm of creating learning environments, where the participant has the ability and necessary tools to produce their own learning paths and outcomes.

The use of computers in Post Primary class of SS1 classes is basically vision as a teaching and learning aid besides to develop computer literacy amongst the children and Teenagers. Computer aided learning will help us to make the present teaching learning process joyful, interesting and easy to understand through audio-visual aids. Teachers will be resourced with Multimedia Contents to explain topics better. Overall it will help us to improve quality of education in long learn.

Computer Aided Learning of Science can be traced back to 1980s when it started but was slow as a result of low technology used. Early science learning, based on computer aided learning/ training often attempted to replicate autocratic teaching styles whereby the role of the A-Learning system was assumed to be for transferring knowledge as opposed to systems developed later based on computer supported collaborative learning, which encouraged the shared development of knowledge.

Whalley (1998) stated widely that the use computer aided instruction is spreading widely. In the 1980 the first computer assisted learning of science became available for masters student looking for an alternative to the traditional textbook of real programming which made use of DOS environment. The second was for university students and program used only digital files transferred onto a CD-ROM to give students highly portable and accessible learning material.

The popularization of this form of learning and the increased aid increased ownership of personal computer system which led to the development of widely distributed educational CD-ROMS such as Encarta (Rochelle, et al, 2005). As technology continued to grow and with the introduction of the internet, information on CAL programs became more interactive, reflecting a social need for flexible learning outcomes. There is now a multitude of computer Assisted learning of science subjects platforms design for every market, from school based edutainment packages to computer based management learning environment.

Lankshear and Knobel (2007) note that young learners in the developed nations have a new attitude to life that is fundamentally different from conventional attitudes, and is enhanced by a sense of reality that extends to virtual space. Blogging, online chatting, online gaming, iPods, smartphones and instant messaging are all normal activities. According to Warschauer and Meskill (2000) these digital tools promote the socio-cognitive pedagogy for CAL by emphasizing the value of communicative and interactive instruction in authentic contexts.

Numerous studies have shown that the mere availability of technology does not guarantee its effective use and integration in education. Yet the material availability of the technology and access to it are prerequisites for its incorporation into classroom activities. Teacher's attitudes towards technology and their skills in using it are also crucial in determining instructional choices for normalising CAL (Kreijns, Van Acker, Vermeulen, & Van Buuren 2013; Elsaadani 2013). According to Zaid (2011) and Oyaid (2009) provision of resources, motivation and training issues are among the key challenges still faced by introducing CAL in schools. Covert barriers to use include negative attitudes toward the internet and CAL.

Aims of Computer Aided Learning of Basic Science Subject

According to Griswell (1989), the aims of computer aided learning in basic science learning are to:

- Improve teachers and students learning and productivity.
- Make students better prepared for getting into secondary real science education and continue with science education at higher level.
- Allowing students to study at their own pace.
- Getting an environment that promotes an active approach to learning.
- Encourage students take responsibility for their own learning.
- Make students have time to mull over ideas, check references, refer back previous messages and take time to prepare a comment rather than having to react on ones fact.

Advantages of Computer Aided Learning of Basic Science Subject

Advantages of Computer aided learning are of two categories

1. The Trainer.
2. The Learner.

The Trainer:

- Reduced overall cost.
- Expert knowledge communicated
- Proof of completion and certification.

The Learner:

- **Reduced learning cost:** students do not need to pay excess money again looking for continuing education centres where they will acquire additional knowledge.

- **On demand Availability:** enables students to complete training conveniently at off – hours or from home.
- **Self pacing:** for slow or quick learners reduces stress and increases satisfaction.
- **Interactivity:** Enables users pushing them rather than putting them through training.
- **Confidence:** quick reference materials are available, reduced burden of responsibility of mastery.

Drawbacks of Computer Aided Learning

To Trainer:

- Cultural acceptance.
- Technology issues.
- Up front investment.

To Learner:

- Technology issues of the learners are most commonly techno phobia and unavailability of required technologies.
- Portability, training has become a strength of aided learning with proliferation of network linking points, notebook computers, PDA'S and mobile phones, but does not rival that of printed workbooks or reference materials.
- Reduced social and cultural interaction. The impersonality, suppression of communication mechanism such as body language, and elimination of peer-to-peer learning that are part of this potential disadvantage are lesser with advances in communication.

Effect of Computer Assisted Learning on Basic Science

Given the current limited availability of Computer aided learning for Information and Communication and the inherent problems of Computer aided learning production it is necessary to ask whether it worth producing Computer aided learning material. Theoretically Computer aided learning might be considered attractive in that it is learner centered, Jelovsek, et al, (1993) and may be designed according to good educational strategies Laurillard (1993). Although a meta-analysis of published work suggested that students learnt more in less time than with CAL than conventional methods of learning. Nevertheless scalability, interactivity, information interconnectivity, automatic student logging and multimedia content are important features of CAL, which may not only justify CAL production but make CAL a genuinely cost effective option.

Several positive impacts and benefits have been ascribed to the application of computer aided learning in schools. According to Nwosu (2003) the utilization of CAL in education could lead to cost-effectiveness in learning, bridging the gap between teachers-students' ratio, and improve the overall quality of learning.

Baron and Orwig (1995) outlined the benefits of CAL in education as follows:

1. **Multiple sensory deliveries:** CAL in teaching basic science will provide multiple sensory channels, thereby allowing students with various learning preferences to assimilate and apply the knowledge.
2. **Increased self-expression and active learning:** CAL provide stimulating environments that encourage students' involvement in the learning process.

3. **Co-operation learning:** Introducing the new technologies into the learning environment has been shown to support the accepted student centered curriculum which encourage cooperative learning and to stimulate increased teacher/student interaction.
4. **Promoting critical thinking:** Both the structure and the use of technology could promote higher level of thinking.
5. **Enhanced communication skill:** The communication skills of students are enhanced when appropriate technologies are utilized in basic science lessons.
6. **Multicultural education:** Telecommunications, internet, teleconferencing and telecommuting make it possible to expand classroom “walls” and to link students and international interactive exchanges.
7. **Individualization:** CAL offer students broad and self paced learning by allowing them to progress at their own rate in a non threatening environment. This is vital especially in basic science programmes where individualized assignment is highly encouraged.
8. **Motivation:** Motivating students is a constant challenge to basic science lessons. Multimedia instructions could inspire students and basic science teachers by making learning exciting, relevant and rewarding.

In addition, Hadley and Sheingold (1993) observed that CAL helps students to exercise greatest independence, share their expertise and provide mutual support, more profound is the use of GSM which are now very common among learners. They make it possible for learners to listen to radio transmission which would be highly educative on issues and invent happening around them. GSM also perform different functions such as taking photographs and record event or issues which happen spontaneously. The information so obtained can become a resource material among learners in basic science.

Social Factors affecting the Effective Use of Computer Aided Learning in Basic Science

Some of the social factors that could affect students learning of basic science through the use of computer aided learning are discussed below.

Discouragement to student: Basic science teachers, many of whom are unqualified for the job they are doing (Odetoyinbo, 2004) often instruct children in a language which is foreign and difficult for most of them to understand. It is, therefore, not surprising that the children who have to suffer through this shameful process are disenchanted and apathetic and ipso facto develop a negative attitude toward basic science (Oludipe, 2011). These acts can discourage students from taking responsibility for their own learning. Furthermore, Ofoha, et al (2009) noted that the state of basic science teaching /learning is fast deteriorating in our secondary schools. This view is attested to by the abysmally low rate of enrolment of students in core science subjects like physics, chemistry and biology. Consequently, students become disenchanted and apathetic towards science. Some measures must be taken to reverse the negative attitude of our students toward basic science. It seems that we need to reappraise basic science curriculum objectives vis-à-vis the intellectual status of the average learner at the secondary school level.

Language barrier: This is another social problem which may be regarded as a pedagogical problem. Language can constitute a barrier when reading for learning and English as a medium of instruction. There are two schools of thought on the issue of readiness for learning. The older school opines that age and level of intelligence should be the determinants of the depth of knowledge that should be imparted to students at any and every stage. But the new school believes in the concept that any topic could be taught to any student at any level provided the subject matter is simplified enough to be easily digested by the students. Both concepts have their merits. It is imperative that we consider the cognitive level of the average students,

especially in the junior school when we are writing their curriculum. In addition, the teacher who will teach the content must familiarize himself with the level of development of the child and adopt the best means of conveying the ideas to be put across to the child (Ofoha et al, 2009). The more serious issue is the perennial problem of English (a second language) as a vehicle of instruction in Nigerian schools. It is quite obvious that unless a student has a good proficiency in the language of the classroom, his ability to have a meaningful learning experience in the school setting will be hampered. Some international studies (Bloom, 2009) seem to show that whatever the language, verbal ability is the key to learning. Better proficiency in classroom language is, of course, expected to lead to better learning in school. In fact, a study by Collison in Oruru (2018) suggests: *“the vernacular might be preferable as the language of science teaching since (the) findings show that process skills like conceptualization, modelling, hypothesizing might be more easily developed by students using their own language”*. The effects of the two issues discussed in the preceding pages are immense as far as the teaching/learning of basic science is concerned and thus may determine one way or the other the achievement of basic science curriculum objectives in Nigerian schools. As mentioned earlier, basic science teachers in Nigeria remain the only hope for improving science teaching in primary and secondary schools (Oludipe, 2011). Besides, he added that certain measures must be taken to improve the quality of basic science teachers. Such measures should include:

1. Better recruitment and possibility of better selection;
2. Better substantive education in teacher training institutions;
3. On the job training of younger teachers by more experienced ones; and
4. In-service and long-vacation courses to continue the education of teachers (Oludipe, 2011)

Lack of cultural acceptance: There are some communities or ethnic group or religious groups that still see the use of technology as a problem in schools. For instance, Al Amr (1998) and Saqlain, Al-Qarni, and Ghadi (2013) highlighted that the easy availability of images of women, and discussion of taboo subjects (such as dating and sexuality) has led some people to believe that the internet promotes anti-religious and anti-cultural morality. Therefore its use in teaching and learning was unaccepted.

Reduced physical interaction: In some quarters, it is believed that the use of CAL will bring about a reduction in the physical interaction of student. The impersonality, suppression of communication mechanism such as body language, and elimination of peer-to-peer learning are said to be of potential disadvantage to students' advances in communication.

Constraints Facing the Teaching of Basic Science Using Computer Aided Learning in Schools

There are several impediments to the successful use of computer aided learning in secondary schools in Nigeria. Amongst are: cost, weak infrastructure, lack of skills, lack of relevant software and limited access to the internet. They are discussed below.

Cost: The price of computer hardware and software continues to drop in most developed countries, but in developing countries, such as Nigeria, the cost of computers is several times more expensive. While a personal computer may cost less than a month's wages in the United State, the average Nigeria worker may require more than two years' income to buy one. Nigeria has over 6,000 public secondary schools. Majority are short of books, paper and pencils. Many

of the schools lack adequate infrastructure such as classrooms and only few are equipped with television or radio. Apart from the basic computers themselves, other costs associated with peripherals such as printers, monitors, paper, modem, extra disk drives are beyond the reach of most secondary schools in Nigeria. The schools cannot also afford the exorbitant internet connection fees.

Weak infrastructure: Another obstacle to CAL development in Nigeria is inadequate telecommunication facilities. Though the International Telecommunication Union (ITU) has rated Nigerian's Telecommunication Sector as the fastest growing in Africa, majority of Nigerians have no access to telephone. At the end of 1999, total private investment in telecommunication industry in the country was \$50m and there were over 700, 000 lines with 450,000 connected. The government officials and officers acquired more than half the lines connected. On the Global System of Mobile Communication (GSM), Nigeria is also ahead of most African countries with more than 2 million subscribers connected. The telecommunication sector in Nigeria has attracted more direct foreign investment hence the growth rate is faster than any other sector of the economy. Between 2001 and 2003, about \$3.8 billion new investment by foreign private investors have been recorded and as at the moment, more than 3 million landlines have been added to the existing telephone capacity. Though Nigerian's telecommunication sector is growing faster than in most African countries, the over 3 million landlines and 2 million GSM subscribers are a far cry from the ideal when such figures are meant to serve Nigeria's nearly 124 million population. Again, most of the subscribers to the Global System of Mobile Communication (GSM) and landlines owners are found mostly in urban centers. It is also on record that the connection fees for telecom facilities have reduced drastically over the years, the current rate is still too high for many Nigerians. In 1997, connection fees for telephone lines

were about \$1,500; today it is about \$148. The current rate is too high in a country where the minimum monthly wage is about \$51. To change this situation, Nigerian needs to figure out new ways of building necessary infrastructure to support ICT and CAL in the country.

Lack of skills: Nigeria does not only lack information infrastructure, it also lacked the human skills and knowledge to fully integrate CAL into secondary education. To integrate computer learning in secondary schools in Nigeria, the need for locally trained workers to install, maintain and support these systems cannot be over emphasized. There is acute shortage of trained personnel in application software, operating systems, network administration and local technicians to service and repair computer facilities. Those who are designated to use computers in Nigeria do not receive adequate training, at worst, do not receive any training at all (Okebukola, 1997). In Nigeria also, most secondary school teachers lack the skills to fully utilize technology in curriculum implementation hence the traditional chalk and duster approach still dominates in secondary school pedagogy. Information transfer using ICT and CAL is minimal or non-existence in secondary schools in Nigeria (Anao, 2003). Secondary school teachers in Nigeria need to be trained on educational technologies and the integration of computers into classroom teaching. According to Carlson and Firpo (2001), “teachers need effective tools, techniques, and assistance that can help them develop computer based projects and activities especially designed to raise the level of teaching in required subjects and improve student learning.

Lack of relevant software: There is no doubt that the ultimate power of technology is the content and the communication. Though, software developers and publishers in the developed countries have been trying for long to develop software and multimedia that have universal application, due to the differences in education standards and requirements, these products do not

integrate into curriculum across countries. Software that is appropriate and culturally suitable to the Nigerian education system is in short supply. There is a great discrepancy between relevant software supply and demand in developing countries like Nigeria. According to Salomon (1989), there are clear indications from many countries that the supply of relevant and appropriate software is a major bottleneck obstructing wider application of the computer. Even if Nigeria tries to approach this software famine by producing software that would suit its educational philosophies, there are two major problems to be encountered. First, the cost of producing relevant software for the country's educational system is enormous. Second, there is dearth of qualified computer software designers in the country. To overcome this, people need to be trained in instructional design.

Limited access to the Internet: In Nigeria there are few Internet providers that provide Internet gateway services to Nigerians. Such Internet providers are made up of Nigerians who are in partnership with foreign information and communication companies. Many of these companies provide poor services to customers who are often exploited and defrauded. The few reputable companies, which render reliable services, charged high fees thus limiting access to the use of the Internet. The greatest technological challenge in Nigeria is how to establish reliable cost effective Internet connectivity. In a country where only about 0.6% of the populace has home personal computers, the few reliable Internet providers who have invested huge sum of money in the business have a very small clientele. They have to charge high fees in order to recoup their investment in reasonable time. Nigeria has about 500,000 Internets subscribers. Secondary schools in Nigeria are not given adequate funds to provide furniture, requisite books, laboratories and adequate classrooms let alone being given adequate funds for high-tech equipment (computers) and Internet connectivity. Again, due to the lack of adequate electricity supply,

especially in rural areas in Nigeria, secondary schools located in those areas have no access to the Internet and are perpetually isolated and estranged from the world's information superhighway. Nigeria is lagging behind other African countries such as Uganda, Senegal and South Africa who are already helping secondary school students in those countries to become better information users. All Internet service providers in Nigeria are based in the urban areas. Hennessy and Bridley (2004) established that schools worldwide are preoccupied with technology integration over the years, he added that, yet most schools in Nigeria have not been able to utilize CAL due to the following problems:

- 1. Teachers lack ICT skills:** Most home economics teachers lack proficiency in the use of ICTs, they prefer to use obsolete materials they were taught with and are reluctant to take off sometimes to acquire ICTs skills. This will no doubt hinder the application of CAL in schools.
- 2. Erratic and unstable power supply:** The epileptic nature of power supply in Nigeria has made it difficult to initialize computer aided learning. For instance, schools that purchase some computer aided facilities are unable to operate high cost of alternative power generators. That hinders schools from utilizing such facilities to the benefit of students.
- 3. Limited access to Internet facilities:** This makes inter and intra networking exchange impossible in schools. According to Mundy and Sultan, (1999) only one of every 9,000 Africans outside South Africa have access to internet compared to 138 of the rest of the world.
- 4. Lack of Adequate funds:** Subventions sent to schools are grossly inadequate to purchase CAL equipment. Even the equipping of laboratories has remained a major problems let alone purchasing CAL materials for schools.

5. Inadequate Trained Support Staff: Lack of adequately trained educational technologists in schools has also hindered the deployment of ICT and CAL in science laboratories; such staff could complement the effort of basic science teachers with the use of CALs.

Summary of Reviewed Literature

In this chapter, efforts have been made to review as much as possible literature related to this study. This was initiated by considering the concept of computer aided learning, history of computer aided learning and definition of basic science. This was followed by discussions on computer aided learning and basic science subject and effect of computer assisted learning on basic science. The literature also highlighted the social factors affecting the effective use of computer aided learning in basic science as well as the constraints facing the teaching of basic science using computer aided learning support in schools.

The related literature reviewed indicated that several similar researches have been carried out on effect of computer aided learning on basic science but there is still a little study empirically to find answers to areas which previous researchers have not been able to satisfactorily proffer solutions and to build a strong foundation for the carrying out future researches on the study under focus. That is the gap this study intends to fill.

CHAPTER THREE

METHODOLOGY

This chapter describes the methods and procedures used to carry out the study under the following sub-headings:

- Research Design
- Population of the Study
- Sample and Sampling Technique
- Research Instrument

- Validity of the Instrument
- Reliability of the Instrument
- Method of Data Collection
- Method of Data Analysis

Research Design

The research design that was adopted for the study is a descriptive survey research design. According to Aromolaran (2004), descriptive survey is a type of study which aims at collecting data from a representative sample of the population and describing in a systematic manner the characteristics, features or facts about the given population under study. Descriptive survey research design was considered appropriate for this study because it will enable the researchers to carefully describe and interpret the behaviours, practices and trend of events that exist now and existed in the past as well as those that can have influence on the present situation concerning the use of computer assisted learning on basic science among secondary school students in Ovia North-East Local Government Area of Edo State.

Population of the Study

The population of the study consists of all 1734 JSS3 students in 29 Junior Secondary Schools in Ovia North-East Local Government Area of Edo State (Edo State Statistical Yearbook, 2022).

Sample and Sampling Technique

The sample of the study was 120 JSS3 students. Simple random sampling technique was adopted to select 12 schools from the 29 Junior Secondary Schools in the local government area.

This was done by writing the names of the schools in the area on strips of papers. Each strip was folded and 12 strips were randomly picked one after the other. Thereafter, 10 students were randomly selected from each schools earlier sampled. Therefore, the sample for this study was 120 JSS3 students.

Research Instrument

The instrument used for data collection was a structured questionnaire titled Questionnaire on Effect of Computer Aided Learning of Basic Science among Students (QECALBSS). This was made up of two sections. Section A sought information on demographical data of respondents while section B contained 22 structured questions eliciting information on the variables of the study. Section B of the questionnaire was rated using a four point rating scale of Strongly Agree (SA) - 4 points; Agree (A) - 3 points; Disagree (D) - 2 points and Strongly Disagree (SD) - 1 point.

Validity of the Instrument

The validation of the questionnaire was undertaken by the researchers' supervisor and two other experts in the Department of Curriculum and Instructional Technology (C.I.T), Faculty of Education, University of Benin, Benin City to ascertain suitability and appropriateness for the research instrument. Their suggestions and criticism was used to draft the final copy.

Reliability of the Instrument

The reliability of the instrument was determined by establishing the internal consistency coefficient using the Cronbach alpha method. This was done by administering the questionnaire to 20 Junior Secondary School Students who are not part of the sample of study in Egor Local Government Area of Edo State. The data collected was analyzed with the Statistical Package for Social Sciences (SPSS, version 22) and a reliability coefficient 'r' value of 0.84 was obtained.

Method of Data Collection

The questionnaire was personally administered by the researcher. This is to ensure that all the respondents are well guided. A brief introduction explaining the purpose of the study was explained to the respondent and the questionnaire was collected the same day.

Method of Data Analysis

The demographic data was presented in frequency tables and analyzed using percentages while research questions 1 - 4 were analyzed using mean. Decision rule: The level of acceptance or rejection of each questionnaire item related was determined based on the criterion mean rating. The criterion mean based on a four point rating scale is equal to 2.50; (that is, $4 + 3 + 2 + 1$ divided by 4). Therefore, values below 2.50 were regarded as disagreed while values above 2.50 were regarded as agreed. The means were reported at 2 decimal places to answer the research questions.

CHAPTER FOUR

DATA ANALYSIS, INTERPRETATION AND DISCUSSION OF RESULTS

The chapter presents the analysis of data collected, interpretation and discussion of result. It was divided into three main sections. Section A deals with the demographic data of the respondents, section B deals with the research questions while section C deals with the discussion of results.

Section A: Demographic Data of the Respondents

Table 1: Gender of the Respondents

Gender	Frequency	Percentage (%)
Male	62	51.7
Female	58	48.3
Total	120	100.0

Table 1 shows that out of 120 respondents, 62 (51.7%) of the respondents are male students while 58 (48.3%) are female students. Most of the respondents are males.

Table 2: Age of the Respondents

Age	Frequency	Percentage (%)
16 years and below	40	33.3
17-18 years	69	57.5
18 years and above	11	9.2
Total	120	100.0

Table 2 shows that out of 120 respondents, 40 (33.3%) were between 16 years below age bracket, 69 (57.5%) were between 17-18 years age bracket while 11 (9.2%) falls between 18 years and above. The respondents were mostly between 17-18 years age bracket.

Answers to the Research Questions

Research Question 1: What is the level of computer aided learning of basic science among secondary school students?

Table 1: Level of Computer Aided Learning of Basic Science among Students (N=120)

S/N	Items	Responses	
		Mean	Remark

1.	Computer aided learning (CAL) improves teacher's productivity	3.23	Agree
2.	CAL allow students to study at their own pace	2.82	Agree
3.	The use of ICT results in effective learning	2.47	Disagree
4.	The use of CAL enables students to achieve their academic goals	2.47	Disagree
5.	The use of CAL helps students to carry out serious assignments and studies	2.67	Agree
Criterion Mean = 2.50		Aggregate Mean = 2.73 (Agree)	

Data in table 1 showed that items 1, 2 and 5 had mean scores above the criterion mean of 2.50 and were accepted concerning the level of computer aided learning of basic science among students while items 3 and 4 had mean scores below the criterion mean of 2.50 and were rejected. In summary, with an aggregate mean score of 2.73 the respondents indicated that the level of computer aided learning of basic science among secondary school students in Ovia North-East Local Government Area of Edo State is fairly above average.

Research Question 2: What is the effect of computer aided learning on basic science among students?

Table 2: Effect of Computer Aided Learning on Basic Science among Students (N=120)

S/N	Items	Responses	
		Mean	Remark
1.	CAL will create an environment that promotes an active approach to learning	3.32	Agree
2.	Use of CAL is vital in developing creative skills of the students	3.54	Agree
3.	Use of CAL can help inculcate technical skills in the	3.42	Disagree

students		
4. Use of CAL can enhance teaching using collaborative tools or setting up groups through which learners can semi-formalize their efforts and document discussions	3.58	Disagree
Criterion Mean = 2.50	Aggregate Mean = 3.47 (Agree)	

Data in table 2 showed that all the items 1 - 4 had mean scores above the criterion mean of 2.50 and were accepted concerning the effect of computer aided learning on basic science among students. In summary, with an aggregate mean score of 3.47 the respondents indicated that computer aided learning of basic science had high and positive effect on secondary school students in Ovia North-East Local Government Area of Edo State.

Research Question 3: What are the social factors affecting the effective use of computer aided learning in basic science?

Table 3: Social Factors Affecting the Effective Use of Computer Aided Learning in Basic Science (N=120)

S/N	Items	Responses	
		Mean	Remark
1.	Discouragement of students from taking responsibility for their own learning	2.57	Agree
2.	Reduction of peer to peer physical interaction	1.30	Disagree
3.	Language barrier	2.60	Agree
4.	Cultural Acceptance	1.22	Disagree
Criterion Mean = 2.50			

Table 3 shows that items 1 and 3 had mean scores above the criterion mean of 2.50 and were accepted and regarded as social factors affecting the effective use of computer aided learning in basic science while items 2 and 4 were rejected. Respondents indicated that language barrier (mean=2.60) and Discouragement of students from taking responsibility for their own learning (mean=2.57) are the social factors affecting the effective use of computer aided learning in basic science respectively.

Research Question 4: What are the constraints facing the teaching of basic science using computer aided learning support in schools?

Table 4: Constraints Facing the Teaching of Basic Science Using Computer Aided Learning Support in Schools (N=120)

S/N	Items	Response		
		Mean	Rank	Decision
1.	Distraction from the learning process	3.00	7 th	Agree
2.	Poor Network Bandwidth	3.88	3 rd	Agree
3.	Lack of/limited ICT skills among teachers	3.20	5 th	Agree
4.	Inadequate CAL facilities in schools	3.90	1 st	Agree
5	Frequent electricity interruption	3.89	2 nd	Agree

6	Lack of maintenance culture	3.10	6 th	Agree
7	Resistance to change/ negative attitude of teachers	2.70	8 th	Agree
8	The use of obsolete hardware and software tools	2.60	9 th	Agree
9	Limited budgetary allocation to basic science education	3.40	4 th	Agree

Criterion mean = 2.50

Table 4 shows that all the listed items had mean scores above the criterion mean and were considered as constraints facing the teaching of basic science using computer aided learning support in schools. Inadequate CAL facilities in schools had the highest mean value (3.90), followed by frequent electricity interruption (3.89), poor network bandwidth (3.88), limited budgetary allocation to basic science education (3.40), lack of/limited ICT skills among teachers(3.20), lack of maintenance culture (3.10), distraction from the learning process (3.00), resistance to change/ negative attitude of teachers (2.70) while the use of obsolete hardware and software tools had the least mean value (2.60).

Discussions of Results

Finding from the research question one revealed that the level of computer aided learning of basic science among secondary school students in Ovia North-East Local Government Area of Edo State is fairly above average (mean=2.73). It was ascertained that the computer aided learning greatly improved teachers and students learning and productivity, it allows students in some way to study at their own pace, helps students to carry out serious assignments. This

finding complements the submission of Griswell (1989) who listed that computer aided learning in basic science learning improve teachers and students learning and productivity, allow students to study at their own pace, make students have time to mull over ideas, check references, refer back previous messages and take time to prepare a comment rather than having to react on ones fact, make students better prepared for getting into secondary real science education and continue with science education at higher level amongst others.

Finding from the research question two revealed that computer aided learning of basic science had high and positive effect on secondary school students in Ovia North-East Local Government Area of Edo State (mean=3.47). The respondents agreed on all the listed items. This finding is in agreement with Warschauer and Meskill (2000) who opined that these digital tools promote the socio-cognitive pedagogy for CAL by emphasizing the value of communicative and interactive instruction in authentic contexts. Nwosu (2003) added that the utilization of CAL in education could lead to cost-effectiveness in learning, bridging the gap between teachers-students' ratio, and improve the overall quality of learning.

Finding from the research question three revealed that language barrier (mean=2.60) and discouragement of students from taking responsibility for their own learning (mean=2.57) are the social factors affecting the effective use of computer aided learning in basic science respectively. This finding agrees with (Odetoyinbo, 2004) who highlighted that teachers often instruct children in a language which is foreign and difficult for most of them to understand. It is, therefore, not surprising that the children who have to suffer through this shameful process are disenchanted and apathetic and ipso facto develop a negative attitude toward basic science (Oludipe, 2011). These acts can discouragement students from taking responsibility for their own learning. Also this finding implies that unless a student has a good proficiency in the language of

the classroom, his ability to have a meaningful learning experience in the school setting will be hampered. Better proficiency in classroom language is, of course, expected to lead to better learning in school. Finding supports Collison in Oruru (2018) who suggested that: *“the vernacular might be preferable as the language of science teaching since (the) findings show that process skills like conceptualization, modelling, hypothesizing might be more easily developed by students using their own language”*.

Finding from the research question four revealed that the constraints facing the teaching of basic science using computer aided learning support in schools are inadequate CAL facilities in school (3.90), frequent electricity interruption (3.89), poor network bandwidth (3.88), limited budgetary allocation to basic science education (3.40), lack of/limited ICT skills among teachers(3.20), lack of maintenance culture (3.10), distraction from the learning process (3.00), resistance to change/ negative attitude of teachers (2.70) and the use of obsolete hardware and software tools (2.60) respectively. This finding indicated the mere availability of technology does not guarantee its effective use and integration in education. Yet the material availability of the technology and access to it are prerequisites for its incorporation into classroom activities. Teacher’s attitudes towards technology and their skills in using it are also crucial in determining instructional choices for normalising CAL (Kreijns, Van Acker, Vermeulen, & Van Buuren 2013; Elsaadani 2013). This finding is in tandem with Zaid (2011) and Oyaid (2009) who stated that the provision of resources, motivation and training issues are among the key challenges still faced by introducing CAL in schools.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

In this chapter, the researcher presents the summary of the study, conclusion, recommendations as well as suggestions for further research.

Summary

This study investigated the effect of computer assisted learning of basic science among secondary school students in Ovia North-East Local Government Area of Edo State. Four (4) research questions were raised to guide the study. The study adopted the descriptive survey research design. The population of the study comprised 1734 JSS3 students in 29 Junior Secondary Schools in Ovia North-East Local Government Area of Edo State. Simple random sampling technique was used to select 120 JSS3 students as sample for the study. The instrument used for data collection was a structured questionnaire titled Questionnaire on Effect of Computer Aided Learning of Basic Science among Students (QECALBSS). It was validated by the researchers' supervisor and two experts in Department of Curriculum and Instructional Technology, Faculty of Education, University of Benin, Benin City. Its reliability was established at 0.84 using Cronbach Alpha method. The data collected for the study was analyzed using frequency tables, simple percentages and mean.

The findings revealed that:

1. The level of computer aided learning of basic science among secondary school students in Ovia North-East Local Government Area of Edo State was fairly above average (mean=2.73).
2. Computer aided learning of basic science had high and positive effect on secondary school students in Ovia North-East Local Government Area of Edo State (mean=3.47).
3. The social factors affecting the effective use of computer aided learning in basic science are language barrier (mean=2.60) and discouragement of students from taking responsibility for their own learning (mean=2.57) respectively.
4. The constraints facing the teaching of basic science using computer aided learning support in schools are inadequate CAL facilities in school (3.90), frequent electricity

interruption (3.89), poor network bandwidth (3.88), limited budgetary allocation to basic science education (3.40), lack of/limited ICT skills among teachers(3.20), lack of maintenance culture (3.10), distraction from the learning process (3.00), resistance to change/ negative attitude of teachers (2.70) and the use of obsolete hardware and software tools (2.60) respectively.

Conclusion

Based on the foregoing evidence, it was concluded that the level of application of CAL in teaching basic science in schools had a moderate influence on students. Though CAL effect was high and positive on students learning, the use was highly hindered by some social factors and implementation constraints. Significant among them are inadequacy of CAL facilities in school and frequent electricity interruption. The study has found that the relevance of CAL in augmenting teaching of Basic Science cannot be over-emphasized when their use intersects with and supports specific scientific ideas and skill thereby promoting independent learning by allowing students to collect, review and revise data. To effectively address the state of CAL in schools, it is crucial for all education stakeholders to collaborate and come up with a more multidimensional approach in providing adequate and up-to-date CAL facilities in schools while ensuring all obstacles at accessing and utilizing these resources were handled effectively in order to deliver effective and efficient learning and meeting Basic Science education goals.

Recommendations

Based on the findings of the study, the researcher recommends that:

1. The government should invest heavily to provide adequate number of computers in schools and also enhance internet connection in the schools to ensure easy access to teaching and learning materials of Basic Science using CAL.

2. Electrification should be diversified in the rural areas to enhance the use of computers; alternative sources of energy can be procured and used in schools especially in the remote places where it is very expensive to provide adequate electricity. Power back up can help solve the problem power interruption.
3. The government should develop pre-service and in-service staff training programmes that are tailored to the school programmes to keep teachers up to date with the technological changes which will promote proper integration of computer aided learning in teaching and learning. Those teachers that are not ICT compliant should be encourage to study further in order to meet up with the new demand.
4. Teachers should be encouraged to use ICT in teaching Basic Science since this strategy provides students with the opportunity of engaging in series of activities and encourages participatory learning and retention of scientific concepts.
5. Curriculum improvement effort should be encouraged by government to ensure successful integration of ICT into teaching/learning processes at junior secondary school level.

Suggestions for Further Studies

The researcher suggested that:

1. A similar study can be carried out in all the senatorial districts of Edo State.
2. A study could be carried out to determine the cost benefit analysis of adequate funding of using computer aided learning in secondary schools.

3. A comparative study can be carried out on the extent of use of computer aided learning for teaching Basic Science in public and private Junior Secondary Schools.
4. Replications of this investigation will need to be carried out five or six years from now to establish exactly what changes will have taken in the use of Computer aided learning.

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APPENDIX I

UNIVERSITY OF BENIN, BENIN CITY

FACULTY OF EDUCATION

DEPARTMENT OF CURRICULUM AND INSTRUCTIONAL TECHNOLOGY

Dear Respondent,

I am a final year student of the above named institution and department. This questionnaire is meant for a research work to investigate **the effect of computer aided learning of basic science among secondary school students in Ovia North L. G. A. of Edo State**. Your response will assist in meeting the aim of the research. While I ask for your response to the items on the questionnaire, I promise that information supplied will be kept confidential, and will be used for the purpose of the research only.

Thank you.

Ukpegharovwe, O. Progress

Researcher

QUESTIONNAIRE ON EFFECT OF COMPUTER AIDED LEARNING OF BASIC SCIENCE AMONG STUDENTS (QECALBSS)

Section A: Demographic Data

Please indicate your answers by ticking in the appropriate boxes (✓)

Gender: Male () Female ()

Age: Less than 16 years () 17-18 years () 18 years and above ()

Section B

Instruction: Tick (✓) any response that corresponds with your opinion in the appropriate boxes below. **Key:** SA =Strongly Agree; A= Agree; D= Disagree; SD = Strongly Disagree

S/N	Items	SA	A	D	SD
-----	-------	----	---	---	----

A.	What is the level of computer aided learning in the teaching of basic science among secondary school students?				
1.	Computer aided learning (CAL) improves teacher's productivity				
2.	CAL allow students to study at their own pace				
3.	The use of ICT results in effective learning				
4.	The use of CAL enables students to achieve their academic goals				
5.	The use of CAL helps students to carry out serious assignments and studies				
B.	What is the effect of computer aided learning on basic science among students?				
6.	CAL will create an environment that promotes an active approach to learning				
7.	Use of CAL is vital in developing creative skills of the students				
8.	Use of CAL can help inculcate technical skills in the students				
9.	Use of CAL can enhance teaching using collaborative tools or setting up groups through which learners can semi-formalize their efforts and document discussions				
C.	What are the social factors affecting the effective use of computer aided learning in basic science?				
10.	Discouragement of students from taking responsibility for their own learning				
11.	Reduction of peer to peer physical interaction				
12.	Language barrier				
13.	Cultural Acceptance.				
D.	What are the constraints facing the teaching of Basic Science using computer aided learning support in schools?				
14.	Distraction from the learning process				
15.	Poor Network Bandwidth				
16.	Lack of/limited ICT skills among teachers				
17.	Inadequate ICT facilities in schools				
18.	Frequent electricity interruption				
19.	Lack of maintenance culture				
20.	Resistance to change/ negative attitude of teachers				
21.	The use of obsolete hardware and software tools				
22.	Limited budgetary allocation to basic science education				

APPENDIX II

Reliability Result

```

SAVE OUTFILE='C:\Users\accer\Documents\Progress \ Progress reliability.sav'
/COMPRESSED.
RELIABILITY
/VARIABLES=A1 A2 A3 A4 A5 B6 B7 B8 B9 C10 C11 C12 C13 D14 D15 D16 D17 D18 D19 D20 D21 D22
/SCALE('ALL VARIABLES') ALL
/MODEL=ALPHA.

```

Reliability

Notes

Output Created		5-FEB-2023 05:49:52
Comments		
Input	Data	C:\Users\accer\Documents\ Progress \ Progress reliability.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data	20
	File	
	Matrix Input	
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the procedure.
Syntax		RELIABILITY /VARIABLES= A1 A2 A3 A4 A5 B6 B7 B8 B9 C10 C11 C12 C13 D14 D15 D16 D17 D18 D19 D20 D21 D22 /SCALE('ALL VARIABLES') ALL /MODEL=ALPHA.
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.06

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded ^a	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.842	22