OUTDOOR CLASSROOM AND PICTORIAL ILLUSTRATION INSTRUCTIONAL STRATEGIES AS DETERMINANTS OF LEARNING OUTCOMES IN BASIC SCIENCE AMONG STUDENTS WITH HEARING IMPAIRMENT IN IBADAN

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A Thesis in the Department of Special Education,Submitted to the Faculty of Educationin Partial Fulfillment of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY

of the

UNIVERSITY OF IBADAN

FEBRUARY, 2021

ABSTRACT

Basic science is a core subject taught at the Junior Secondary School level to introduce students to the world of science and prepare them for further education in science and technology. However, Learning Outcomes (LO) of students with hearing impairment in basic science have been low due to ineffectiveness in the teaching strategies. Previous studies have focused largely on predisposing student-related factors with little attention paid to outdoor classroom and pictorial illustration instructional strategies. This study, therefore, was carried out to determine the effects of Outdoor Classroom Instructional Strategy (OCIS) and Pictorial Illustration Strategy (PIS) on the learning outcomes (achievement in and attitude to Basic Science-BS) of students with hearing impairment in Ibadan, Nigeria. It also examined moderating effects of gender and onset of hearing loss.

Dual Coding and Behavioural theories provided the framework, while the pretest-posttest control group quasi experimental design with a 3x2x2 factorial matrix was adopted. Three integrated secondary schools in Ibadan were purposively selected on an equal basis. The purposive sampling technique was used to select 30 students with hearing impairment. Schools were randomly assigned to OCIS (10), PIS (10) and control (10) groups. The treatment lasted 12 weeks. The instruments used were Basic Science Achievement Test (r=0.79), Attitude to Basic Science Scale (r=0.67) and instructional guides. Data were analysed using Analysis of covariance and Duncan post-hoc test at 0.05 level of significance.

Participant's age was 13.75 ± 2.50 years and 57.0% were males. There were significant main effects of treatment on students achievement in BS ($F_{(2;21)} = 38.86$; partial $\eta^2 = 0.78$) and attitude to BS ($F_{(2;21)}=31.74$; partial $\eta^2 = 0.75$). The participants exposed to PIS obtained the highest post-achievement mean score (43.10), followed by OCIS (36.80) and control (19.50) group. The participants exposed to PIS obtained the highest post-attitude mean score (31.00), followed by OCIS (25.80) and control (20.10) groups. There was a significant main effect of gender on achievement ($F_{(1;21)} =4.59$; partial $\eta^2 = 0.28$), but not on attitude. Male students obtained a higher post-achievement mean score (35.09) than females (31.10). There was a significantmain effect of onset of hearing loss on attitude to Basic Science ($F_{(1;21)} = -5.50$;partial $\eta^2 =0.21$), but not on achievement. Pre-lingual participants obtained a higher post attitude mean score (26.00) than post-lingual participants (24.17). The two-way and three-way interaction effects were not significant.

Outdoor classroom and pictorial illustration instructional strategies enhanced achievement of students' with hearing impairment, especially males, in Basic Science in Ibadan, Nigeria. Special educators and basic science teachers should adopt these strategies towards improving the learning outcomes of students with hearing impairment in Basic Science.

Keywords: Students with hearing impairment, Outdoor classroom strategy, Pictorial illustration strategy

Word count: 442

CERTIFICATION

I certify that this work was carried out by **Oluwatoyin Racheal Ogunwale** in the Department of Special Education, University of Ibadan

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DEDICATION

This research work is dedicated to my creator, the immortal, invisible and the only wise One and to my children Francisca, Elizabeth and Joshua.

ACKNOWLEDGEMENTS

I thank thee O God and praise your holy name for you are worthy of my praise. The Lord has made me glad to enjoy His loving kindness and faithfulness every day. Lord I am grateful.

My appreciation goes to my supervisor Professor Adebomi Oyewumi for her motherly love and time to see this work come to completion. Her encouragement arouses not only my spirit but also increases my interest in research. I pray God perfects everything that needs perfection in her family in Jesus name. Thanks to all lecturers in the Department of Special Education, Guidance and Counselling and Teacher Education- Professors: (Head of Department), O.A. Fakolade, I.A. Nwazuoke, M. Oyebola, J.A. Ademokoya, M.S. Eniola,D.O. Adeyemo. and J.O Oyundoyin, Doctors:A.F. Komolafe, G.A. Adelodun, K.U. Lazarus, O.O.Isaiah, T. A. Adewumi, E. Oyefeso, and U.S Jacob, A.O. Busari of blessed memory, J.A. Fehintola, E.A. Ukoh, A. Tella and Tolu Gbadamosi. I pray God gives you required auction to function anywhere you find yourself and you will not fall into errors in Jesus name. (Amen)

To my family, especially my parents Evangelist and Deaconess Abioye I owe acknowledgement for their unflinching love, support and care throughout my work. Mummy and Daddy Ogunwale thank you sir and ma, may the Lord bless you and cause His face to shine upon you (Amen). My siblings Tope, Taiwo, Kenny, Idowu, Alaba and Tolu I appreciate you all. Ogunwale Toye and others thanks so much for your counsel. It is well with your soul (Amen).My appreciation also goes to Tertiary education trust fund (Tetfund) for their financial support.

I equally appreciate Mrs. Oyawole, Funmilayo, Nneka, Folake Okanlawon, Bolu, Glory, Taiwo Aweda, Dr.& Mrs. Olumide Agbato, Dr. Funmilola Akinpelu, Mr. and Mrs. Babatunde Ayinla and Buade Ojebisi for their encouragement and support during the course of my study I pray God in His infinite mercies reward all them for their effort toward me.

My appreciation also goes to my Pastors at Mountain of Fire and Miracles Ministries: Pastor Moses, Pastor Ademola Oyedepo, Pastor Alaba (U.S.A) and Daddy Akinpelu I could remember vividly the day that you said “God settle Toyin” alas God really settle me. Many thanks to Dr. Pastor Ojo, Pastor and Mrs Oso, Dr. Fagunwa and Pastor Adejumobi. Thank youfor your prayers towards the succsss of this study.

To my dear friends and colleagues: Friday Azanor, Kemi Oladiran, Seun Ajagbe, Banke Abomoge and her husband Mr. Tise Abomoge. Thank you all for always checking on the progress of the study. My special appreciation goes to Drs.G.O. Salaudeen, B.A. Adebiyi, A.R. Salami,O.Y. Giwa, D.O. Aikomo,F. Quadri, Mrs.K. Quadri and M. Akande. God bless them for their support. I cannot but remember Mama Faleti, mummy Akanbi, Mrs.M.A. Abimbola, Drs. Theo AjobieweO.O. Adesina, T. Opoola, F.I. Akinsowon, G.O. Akanbi and O.A. Ademuyiwa and Late Dr.C.K. Adeyemi. I thank you for mentoring me, through your mentorship I was able to gain cherished experience which were very useful for this study.

I appreciate with love, all lecturers in the Department of Education for learners in hearing impairment especially Adediran esq, Mr Olumide Alawode, Lala Jolade, Korede Osatuyi, all lecturers in FCE (Sp.) Oyo for holding forth while I was away during the study. I will not forget the immense contributions of all the sign language interpreters especially the Director, VenerableMoses Oyawole for their professional contribution to the study during the filed work.

I am grateful to Mr. T.O. Oladele and late Dr.Mrs. A.O. Oladeleand I wish she was alive to witness the fruition and celebration of this academic feat! All the same, God knows best! May her soul rest in peace. My gratitude to all Basic Science teachers and sign language Interpreters used in schools where the research was conducted. All students with hearing impairment who took part in this research, thanks for your time and stress to participate. To the parents who consented to use their wards for this study, Principals who helped to communicate parents and permitted us to hold the research in their schools, God bless you all real good.

My deepest debt of appreciation goes to my dearest husband, Mr. Ogunwale Yemi Augustine, for his love, understanding, moral and financial support I received during the course of this study and my children of inestimable value Omolara, Francisca, Elizabeth and Joshua. I would now make myself available for you always, thanks for the understanding you showed to mummy and supporting her when she was on the field collecting data for the work. You are wonderful children and you will fulfil your destinies in Jesus name (Amen).

To the friends I could not mention God knows your effort towards me and I pray that the God Almighty rewards you accordingly in Jesus name (Amen). Please pardon me, the omission is not deliberate! Thank you all.

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CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

The world today has witnessed rapid developmental changes as a result of science and technological innovation, dynamism and resilience in a bid to ease stress and for optimal benefits of mankind. Interestingly, science education remains a major factor that determines and influences the world technological changes and dynamism through basic knowledge and skills acquired by members of the society. According to Mulemwa (2002), the reliance and sufficiency of science and technology have influence on health, transportation, agriculture as well as communication. The implication of the aforementioned is that science and technological education has, in no small measure, affected the societal process and product. Thus, science has made the world a global village. This means that for an individual to be well-grounded in science, and competent enough to face the challenges of life in his society, he or she must have gone through a science programme that is well planned, assessed and implemented.

In an attempt to foster science education, the National Policy on Education (FRN, 2007) through the 9-3-4 system of education included the Basic Science programme in the curriculum. The curriculum is a comprehensive document that accommodates the interest and abilities of different learners in vocational and technical education as well as commercial subjects. The introduction of Basic Science education into the curriculum is geared towards the preparation of young school going children to develop the attitudes that favours science education. Basic Science is a science subject taught at the lower, upper primary and junior secondary school levels. At the basic level of education in Nigeria, the Basic Science education is primarily designed to ensure that pupils and students alike gain insightful knowledge and skills about the nature, concepts and approaches to science. It is assumed that knowledge and skills gained in the science classroom will assist the students to relate with the role of scientific approaches needed for solving environmental and societal challenges. Agbo (2008) remarked that science and technology are fields that depend heavily on basic science.

In July 2006, the Universal Basic Education Commission (UBEC) endorsed full implementation of the basic science education programme through the Universal Basic Education (UBE) fund which was disbursed to every state of the federation.The education programme is regarded as a reinforcement of the 6-3-3-4 policy on education rather than a new policy in itself. The New Basic Science curriculum was approved by the National Council of Education (NCE) in December 2005. There is no doubt that the curriculum is the bedrock of any educational reform of which the Basic Science is not an exception. The focal point of basic science education as stated in the National Policy on Education is to ensure that students acquire required knowledge and adequate field and laboratory skills, as well as knowledge in basic sciences. This includes, but not limited to capability to relate scientific skills to solving personal, health and environmental difficult situations.

More so, basic science education should ensure functional positive attitude towards sciences. Laudable as the objectives of teaching basic science is, one is not sure whether these objectives are achieved as documented evidences Hancer (2006) have shown that most teachers in Primary and Junior Secondary Education in Nigeria by standards are not aware of the objectives of the Basic Science let alone implementing them. Among the resources for the implementation of basic science programme, the basic science teachers represent one of the major pillars that facilitate quality of basic science education. These science teachers undeniably play a strategic role in the development of functional disposition towards science (Onyedrian, 2010).

West African Examinations Council in (2010), Abimbola and Abidoye (2013), and Adigun (2017) observed that there is an increasing yearly enrolment in science subject but the performance of students, including those with hearing impairment continue to decline. In line with the observation of Abimbola and Abidoye (2013), Sambo, Kukwi, Eggari, and Mahmuda (2014), buttressed that between 2007 and 2012, the percentage of students who had distinctions and credit passes in basic science examination across the country has declined progressively. In addition, the Basic Education Certificate Examination (BECE) results that were released between 2014 – 2017 in Oyo State showed that 47%, 0%, 18% and 50% respectively of students with hearing impairment obtained credit passes in Basic Science. It showed that the results were fluctuating. The reasons for the fluctuation in the results obtained may be due to methodology used by the teacher. It was observed that the percentage of credit passes for Basic Science was particularly low compared to Introductory Technology and Home Economics subjects. Reasons for this, among others, are language

problems and poor attitudes towards Basic Sciences among students and teachers alike (Sambo, 2012).

The need to assess the implementation of the basic science programmes after almost eleven years of its establishment has been stressed by Ortyoyande (2006), Federal Republic of Nigeria (2007), Ajaja and Kpangbon (2007), Ajaja (2009). Generally, when a programme is assessed, some data related to the programme are collected, analysed and interpreted so that decisions regarding the programme can be made. These decisions may lead to programme improvement, programme re-planning and personnel improvement, among others. From the foregoing, it is evident that in most junior secondary schools in Nigeria, the implementation of the basic science education is yet to reach the satisfactory target. The situation in Oyo State may not be an exception. It is highly imperative for teachers to learn to make science sensible, easy to comprehend and accessible to students.Students grow in the mastery of scientific skills and concepts from their junior secondary school which they apply to their everyday activity and enhance their independence.

However, reverse is the case for students with hearing impairment in conventional classroom who for the reason of their hearing loss find it difficult to cope and comprehend what is taught in science classes/lessons through the use of conventional methods.Consequently, students with hearing impairment require specialized and effective instructional strategies to learn effectively and achieve optimally in school and later in life. Hearing is one of the distant senses nature has bestowed on human being for everyday survival. Elemukan and Umeh (2014) described a student with hearing impairment as an individual who has problems with hearing either because there is disturbance or damage in the ear, which prevents the student from hearing conversation, normal or loud speech, with or without amplification and it adversely affects educational performance.

Okuoyibo (2006) posited that learning is more effective when both ears and sight are explored but where either of them is impaired, learning becomes retarded. This is the fate of students with hearing impairment in science classroom. Modes of communication are inadequate for full learning and understanding of basic knowledge of scientific concepts. However, students sometimes may find it somewhat difficult to follow oral instructions; therefore their academic achievement especially in science is hindered. In this direction, radical change in science education is inevitable. Bajah (2010) reported that there is need to make science teaching and learning more meaningful. If instructions are not appropriately and effectively delivered, students with hearing impairment will respond poorly to their teachers. Achievement can be seen as the aftermath of an instructional programme.

Interestingly, parents and teachers are expectant of a higher level of academic performance from their children and students respectively.

To educate and meet the unique learning need of students with disabilities, instructional strategies that are suitable for their learning needs should be employed. Despite the obvious importance of educating all students to their fullest potential, students with hearing impairment are still failing in their academics. Research has shown that learning outcomes of students in basic science with hearing impairment significantly differs from those of their counterparts due to different factors (Elemukan and Umeh, 2014).Shash and Anjum (2009) concluded that basic science subjects are not easily understood by students with hearing impairment and misconception are also found about their basic science teaching and learning.Failure or success in the knowledge of Basic Science depends on ability of the students to understand the concept.

Uyotta (2008) noted that poor academic achievement in science is caused by poor instructional strategies for students with hearing impairment. If students with or without disabilities must understand the concepts, principles and retention of science knowledge for problem solving in science which requires construction of new ideas from what is already in the student mind, then careful consideration must be given to methods by which the subject matter, learners and teachers will interact. Many of the students at this level, because of the poor methods of instruction used in teaching the subject, are not benefitting much from the basic science curriculum. Afuwape and Olatoye (2004) as well as Adigun and Adedokun (2013) averred that students with hearing impairment are not exempted in this problem.

Attitude is generally an essential factor that orientates an individual towards or against a phenomenon. In other words, positive attitude towards scientific instructions attracts favourable dispositions and good grades while negative attitudes repels and may often leads to poor academic performances (Khan and Ali, 2012). According to George (2006), the development of positive attitudes towards science can motivate students' interest in science education and science-related careers. A positive attitude towards science increases independent thinking, decision making, and an enjoyment of learning (Haury and Rillero, 1994). Sobel (2004) stated that students not only gain skills in science through outside learning, but their knowledge and skills transfer to other subjects as well.

Despite a plethora of pedagogies such as direct instruction and captioned video instruction used by teachers in basic science classrooms, some students still fail to benefit maximally from such lessons and still have a negative attitude towards basic science. This can be traced to several factors among which are poor instructional techniques, poor teacher–

student relationship and lack of instructions such as total communication. When students become shy, withdrawn and unwilling to ask or answer questions in a class, a gap is created in the flow of information or classroom instruction. This barrier stands in the way of the academic achievement of students with hearing impairment academic achievement. To deal with such barrier, it is necessary to create an atmosphere of leisure and cooperation among the students so that the students can interact with one another educationally. It could be in a group or one-on-one teaching. In this type of teaching and learning, fear, shyness, and withdrawal are eliminated, leaving the students to freely interact and ask questions. This study was conceived as a result of complaints by with hearing impairment about the difficulty of learning basic science at the secondary school level. The zeal and desire to learn basic science need the application of the relationship between concrete objects and abstract ideas (Ozcan, 2008).

Educational outdoor classroom instructional strategy is an outdoor learning experience that facilitates teaching by observing real life situation which are relevant to topic of discussion (Mezieobi, Fubara and Mezieobi, 2008). The outdoor classroom is a wide range of instructional activities that occur in a varied ways outside the classroom. It is an experiential learning on the field. As noted by the House of Commons (2015), an interpretation of outdoor classroom is largely influenced by the local conditions, philosophy and culture. The concept of 'outdoor classroom' is synonymous with tourism, adventure therapy, outdoor school, adventure education, adventure recreation, experiential education, environmental education, forest or wilderness school or outdoor learning. The outdoor education focuses on teaching and learning activities that take place outside the four walls of the classroom. It relieves students of burdensomeness and foster peer-peer interaction. Hence, it is an academic activity- packed experience that is undertaken outside the confines of the classroom. This type of educational programme as reiterated by Behrendt and Franklin (2014) connect students to classroom concept and increases student interest, knowledge and motivation.

Ajala (2010) and Munoz (2009) revealed that educational trip is rarely being used in a teaching learning process due to factors such as lack of interest of host community to assist the learners in their explorative trips, inadequate preparation for the outdoor class, improper planning and problem of evaluation of learners on the field. In the view of the fact that educational trip as an instructional strategy is yet to be optimally explored in teaching basic science. In this study, it is referred to as outdoor classroom.The outdoor classroom learning has proven to be an effective science teaching strategy and it has improved students' learning

outcomes in sciences. Barker, Slingsby and Tilling (2001), Saidu, and Suleiman (2014) have reported a positive benefit of the use of outdoor instructional strategy in science teaching. Mygind (2009) found that students' social relations improved, experienced less noise, and were more satisfied spending time in the forest than in the classroom. Fagerstam's and Blom's (2012) found that the participants perceived outdoor classroom to be more stimulating, fun and relevant than their usual school environment. Several of the students claimed it was a more interesting environment and exposure to fresh air made them feel more focused and alert.

The Office of Standard in Education OFSTED's (2004) appreciated the value of the educational instruction outside the classroom because of the given depth of curriculum, students' social and interpersonal skills which are developed. However, Dillon, Rickinson, Sanders, Teamey and Benefield (2003) and Scott, Reid and Jones (2004) have both raised a concern for empirical evidences for outdoor classroom instructions and the need for a conceptual understanding of learning activities that occur in the outdoor classroom. Through play activities, Dietz (2002) and Keeler (2008) established that children are naturally drawn to the outdoors. Hence, outdoor classroom may greatly serve as a means to achieving an educational goal because of its ability to observe and relate with natural habitat, and human created characteristics in their natural environment. It is also an interesting method of teaching, the process of growth in plant, reproduction in animal and the interdependence of the ecosystem among others (University of Tennessee Extension, 2006).

It has been observed that pictures give life to words and thus Pictorial Instructional Strategy is very effective in teaching. Currently, even with the advent of the web-based technology, there is an upsurge in the use of visual images for teaching and learning. Hence, Purves, Sadava, Orlans and Heller (2011) and Madigan, Martinko and Parker (2011) stated that publishers of modern day biology textbooks have graced the text with illustrative images, often designed in interactive forms with web based links for learners. Interestingly, these quality graphic diagrams and photographic illustrations impress and motivate readers. Pictorial illustration is the use of pictures in the representation of verbal content of a reading material. Apart from written text, graphic representations in text have been said by authors to improve learning, (Hurst, 2011). Pictorial illustration strategy helps students with hearing impairment to focus on meaning, recognise words and also help them to better use their visual memory to compensate for the loss of their organ of hearing. Students with hearing impairment have greater ability and tendency to recall information better when such is presented in pictorial form. It can also improve their learning outcome in basic science.

Pictures have been extensively used as learning materials, in fact, Reid and Beveridge (2011) opined that pictures have extensively been used in teaching and learning because of their potential to stimulate attention and motivate learners as well as potential to facilitate reading. Again, the effectiveness of pictures in prose depends on the children's differing reading abilities. The question, 'would students with hearing impairment be able to read and have full comprehension of study materials when such are enhanced with pictures?' The question has been addressed from multiple theoretical and procedural perspectives, with conflicting results (Filippatou, 2010). There is a common saying that 'one picture is worth more than ten thousand words (Hibbing and Erickson, 2008). Pictures alone can provide the story or the information unsupported by the text. Where pictures are supported by text, pictures can give the same information as the text, thus, giving the reader two opportunities of gaining clear understanding (Piro, 2007).

Pictorial illustration can be used to decorate a text and to establish the emotional atmosphere of the study. They are used to make the book attractive to potential purchasers and thus help to sell the book. Furthermore, the book, which looks attractive when decorated with pictures, motivates the child-reader or the resistant-reader to start to read and to continue to read the book. Still, illustrations give or present a wide range of visual experiences to readers and thus assist them to develop and appreciate pictorial materials. It is important to clarify that a pictorial instructional strategy is a mapping between similar features of those concepts, principles and formulas. Pictorial instructional strategy creates the opportunity of the simple introduction of analogue attribute to the students and preventing a situation where the students will mentally create attribute not mentioned. In using pictorial presentation, diagrams or photographs are used and most pictorial presentations are enhanced by explanations. Thus, it is technically called to as pictorial-verbal presentation (Oladiran, 2014).

Besides, some studies have shown that certain variables such as gender is capable of influencing learning outcomes. Consistently, gender issues have been a matter of debate among educators, researchers and other stakeholders alike. Macdonald and Hara (2010); Olatundun (2008) and Adekunle (2005) reported that female students had the higher environmental knowledge and attitude means scores than their male counterparts. On the other hands, Aremu and John (2007) and Olagunju (2007) found that students' achievement scores were not impacted by gender differences. Wang and Cheng (2010) and Abiona (2008) observed no significant differences among male and female respondents who participated in their studies on environmental knowledge and attitude towards environmental education. This

review reveals that the influence of gender on learning outcomes in environmental education is still a controversial issue. Further research is, therefore, needed to investigate whether gender could influence environmental literacy of individuals.

Gender is a personal variable related to academic achievement. Literature indicated that girls are more likely to attribute their success or failure to external factors except when reference is made to ability to affirm this. Emma (2013) stressed that 15 years old girl outperformed their male counterparts around the world in science. The scholar added that girls are extremely capable in science subject than their male counterpart. Bushra, Rabia, Anum and Rukhsana (2016) in a contrary view, reported that male students with hearing impairment outperformed female students with hearing impairment maybe due to visual-spatial advantage and differences they have on sign language fluency and auditory deprivation. Fuchs and Woessmann (2008) reported a higher performance of male than females in a standardized mathematical and science test.

The attributes displayed by students with hearing impairment largely depends on degree as well as onset of hearing loss (Gudyanga Waadesanga Eliphanos and Gudyanga, 2014). Onset of hearing loss refers to time at which the loss in the organ of hearing occurs. The most important yardstick for delineating a person with hearing disability is whether the condition is prelingual (that is, congenitally acquired prior to the acquisition of speech and language) or postlingual (that is, acquired after spoken language had been developed). Time at which an individual experiences hearing loss plays an important role in language ability, acquisition and development which in turn rubs on teaching and learning of Basic Science. Therefore, Shemesh (2010) stated that those who suffer prelingual hearing loss tend to be more functionally disabled than their counterparts with post lingual hearing loss. According to Adoyo (2008), language is not a necessary ingredient for complex cognitive processes. There is a misconception that the hearing impaired are limited in cognitive development hearing mechanism not brain damage. Deafness does not affect intellectual capacity to learn. Moore (1996) added that children who are deaf and/or hard of hearing have an average intelligence when tested on performance rather than verbal texts.

A pre-lingual student with hearing impairment learning English as a second language may have difficulty in understanding concept in Basic Science because he/she might have been familiar with sign language which can affect his academic endeavour. Elemukan and Umeh (2014) averred that people who were born with hearing problems do not learn spoken language the way hearing people do. Poor readability has been characterized as one of the causative factors in the poor comprehension of the content of integrated sciences text

(Bomide, 2006 and Egbeama, 2008).In a typical science lesson, where a pupil has to learn English simultaneously with unfamiliar concepts and principles, difficulties are bound to arise.

A pre-lingual student with hearing impairment always has an experience with sign language early in life thereby, increasing his or her level of understanding language better than a post-lingual student with hearing impairment who cannot understand sign language easily due to his sudden loss of hearing. Hence, there is a great affinity between communication skills and cognitive process among children with post-lingual hearing impairment. Oyewumi (2013) revealed that students with hearing impairment regardless of onset of such condition presents some psychological maladjustment and their educational outcomes have not been parallel to those of their hearing peers because of their inability to respond to verbal stimuli within and outside the classroom. This could have effect on how students follow instruction in the classroom, their attitude to learning and how they relate with their environments. Also, learning by sight alone poses a great challenge to academic of students with hearing impairment (Mayaka, 2011). Thus, this presents a huge task for educators and researchers to find innovative strategies that will allow the participation of students with hearing impairment during a teaching-learning process to develop a positive attitude and interact with their surroundings. It is against this background that the study investigated outdoor classroom and pictorial instructional strategies as determinants of achievement in and attitude to Basic Science among students with hearing impairment in Ibadan, Nigeria.

1.2 Statement of the Problem

The poor performance of students with hearing impairment in Basic Science points to the fact that the teaching methods employed have not been effective. It has been observed that most Basic Science teachers use the 'chalk and talk' method in instructing students and hardly can vital abstract contents in Basic Science be effectively communicated to the students theoretically. Conventional methods of teaching have been observed to disallow full participation of students with hearing impairment during lessons which in turn do not improve their academic achievement and attitudes towards Basic Science.

Hence, several strategies have been proposed to rectify this pedagogical anomaly. Such include demonstration, or coach style, authority or lecture style, facilitator or activity style and hybrid, or blended style. The increase in poor learning outcomes of students with hearing impairment in basic science is worrisome. Due to communication difficulties

experienced by students with hearing impairment to understand vital information about nature, natural resources, living things and non-living things, learning of concepts in Basic Science is hampered. Students with hearing impairment have limited a opportunity to benefit from conventional mode of receiving academic instruction as a result of communication deficiency. This condition has a negative impact on their attitude studying basic science as a subject and more importantly development of appropriate behaviour towards the environment.

In fact, teachers of students with hearing impairment always find it difficult to express some scientific terms in sign language which has a ripple effects on their learning outcome in basic science. Studies have been conducted on science teaching to students with disabilities but there is paucity in literature on teaching science to students with hearing impairment. Therefore, there is need for science teachers to develop activities that will encourage active learning among students with hearing impairment. Hence, this study seeks to determine the effect of outdoor classroom and pictorial illustration instructionalstrategies on learning outcomes (achievement inand attitude to Basic Science) among students with hearing impairment at the Junior Secondary School level in some selected integrated schools in Ibadan. It also examines the moderating effect of gender and onset of hearing loss on the dependent variables in the study.

1.3 Purpose of the Study

This study investigatedoutdoor classroom and pictorial illustration strategies as determinants of students with hearing impairment achievement in and attitude to Basic Science.The specific purpose of the study includes to:

1. determine whether outdoor classroom and pictorial illustration strategies would have influence on learning outcome of students with hearing impairment in basic science;
2. ascertain whether gender difference would have influence on learning outcome of students with hearing impairment and
3. investigate if onset of hearing loss would have effect on learning outcome of students with hearing impairment in basic science.

1.4 Hypotheses

The following null hypotheses were formulated and be tested at 0.05 level of significance:

Ho1: There is no significant main effect of treatments (outdoor classroom and pictorial illustration) on students' with hearing impairment:

1. achievement in basic science
2. attitude to basic science

Ho2: There is no significant main effect of gender on the students':

1. achievement in basic science
2. attitude to basic science

Ho3: There is no significant main effect of onset of hearing loss on students with hearing:

1. achievement in basic science
2. attitude to basic science

Ho4: There is no significant interaction effects of treatment and gender on students':

1. achievement in basic science
2. attitude to basic science

Ho5: There is no significant interaction effects of treatment (outdoor classroom and pictorial illustration) and onset of hearing loss on students':

1. achievement in basic science
2. attitude to basic science

Ho6: There is no significant interaction effects of gender and onset of hearing loss on students':

1. achievement in basic science
2. attitude to basic science

Ho7: There is no significant interaction effects of treatment, (outdoor classroom and pictorial illustration) gender and onset of hearing loss on students':

1. achievement in basic science
2. attitude to basic science

1.5 Significance of the Study

This study is significant in that its findings would assist students with hearing impairment to develop the knowledge, skills, experiences and positive attitude which are required for becoming scientists. Moreover, since the study describes the objectives of basic science, all students who wish to become scientist would definitely benefit from findings this

study. The implementation of outdoor classroom and pictorial instructional strategies on learning outcome in this study could facilitate effective teaching and learning of basic science to students with hearing impairment. The challenges of teaching are to help students with hearing impairment develop skills which enable them to successfully cope with demands of life.

Consequently, this study would further assist special educator in developing students who are positive thinkers, successful problem solvers and lifelong learners. This would serve as a basis for professional development in special education. Special educators could receive further training on effective research-based basic science programmes to strengthen teacher capability in handling children with hearing impairment in the class. The study would serve as a guide to policy makers in organsing in-service training for stakeholders in the field of hearing impairment on appropriate strategies for teaching basic science for learners with hearing impairment. The study would enlighten parents of children with hearing impairment that their children can study sciences in spite of their disabilities. The study would serve as a knowledge-based data bank and intellectual source for future researchers and policy formulation for the government.

1.6 Scope of the Study

This study investigated outdoor classroom and pictorial instructional strategies as determinantsof learning outcomes among students with hearing impairment in Basic Science in Ibadan. However, the study comprised Junior Secondary School Two (JSS II) Basic Science students with hearing impairment in Ibadan, Oyo state. Three integrated schools were purposivelyselected from three Local Government Areas. These schools are Methodist Grammar School (Deaf unit), Bodija, HLA Grammar School, Agodi Gate Ibadan and IMG Grammar School, Sharp Corner Oke-Ado, all in Ibadan. The moderating effect of gender and onset of hearing loss were also investigated .The content covered the following from the J.S.S.2 Basic Science; living things (Habitats) adaptive features of living things in the habitats, characteristics of organisms in the same habitat, uniqueness of human being, human being as intelligent animals, chemicals (its classes, uses and hazardous nature, and changes in living things (Growth and Development)).

1.7 Operational Definition of Terms

Achievement: Accomplishment of students with hearing impairment before and after in test score items exposure to the instructional strategies.

Attitude: The combination of sense, belief and values to Basic science as measured by students' attitude to Basic Science questionnaire.

Basic Science Achievement:this refers to test scores in Basic science achievement teast based on the Basic science concepts taught using outdoor classroom, pictorial illustration and conventional instructional strategies. It was measured using Basic Science achievement test (BSAT) as instrument

Gender: This refers to male and female students with hearing impairment who participated in the study.

Learning Outcomes: This refers to the achievement and attitude of students with hearing impairment in basic science.

Onset of Hearing Loss: It is the time students with hearing impairment became deaf, either before language acquisition (Pre-lingual) or after acquisition of language (Post Lingual)

Outdoor classroom: It is the teaching activity done outside the classroom which involves field experiment and field trip.

Pictorial illustration strategy: Instructional Strategy involves pictures representation in terms of the concepts/topics used for teaching of basic science to students with hearing impairment.

Student with Hearing Impairment: These are learners with communication difficulties especially those who could not benefit from oral communication and they are in integrated/special schools.

CHAPTER TWO

LITERATURE REVIEW

2.1 Conceptual review

2.1.1 Concept of hearing impairment

Hearing loss refers to a partial or full ability of the hearing organ to perceive sound waves. It is a condition which may occur unilaterally or bilaterally in human ear which may either occur permanently or temporarily. The loss of sense of hearing may affect children's ability to develop and learn language while at adult, it may result in difficulties in reading (*Encyclopædia Britannica*, 2001; Lasak, Allen, McVay, and Lewis, 2014). According to the World Health Organisation (2015), hearing loss may result in psychological distress which includes but not limited to loneliness, aggression, tantrums and many other psychosocial dysfunctions. The condition presented by loss in hearing sensitivity may be as a result of trauma to the head or ear, infections, birth complication, genetic disorders, old age, exposure to loud noise, maternal disease, sexually transmitted infections such as rubella and syphilis or drug abuse. The loss of hearing sensitivity is usually diagnosed when it is difficult to perceive sound waves above recommended decibel of 25. Basically, hearing loss can be said to be mild, moderate, moderately-severe, severe and profound (World Health Organisation, 2015).

It is interesting to know that hearing loss as condition is preventable through immunisation, reduced exposure to loud noise, adequate pregnancy care, judicious use of drug as well as regular checking of the hearing organ by qualified professionals (WHO, 2015). While WHO (2015) suggested a reduced exposure to loud noises. Also, World Health Organisation in 2018 noted that the reduction in the use of personal audio players among young individuals will limit exposures to noise. More so early intervention and care for children will help to identify hearing loss in children and adequate attention will be made to ameliorate the difficulties posed by the condition. Although, hearing aids, manual communication, cochlea implants, lip reading and closed captioned television may help to develop the language ability of students with hearing loss.

About 360 to 538 million individuals across the globe suffer moderate to severe hearing loss (WHO, 2008) while about 108 million individuals with moderate to severe hearing loss are from the low and middle income countries. According toWHO (2013) approximately 32 million were younger than 15 years old, of these 7.5 million were younger than 5 years. In Sub-Saharan Africa the burden of hearing impairment among children, adult and elderly are enormous. According to Elzouki, (2012) about half the population of individuals with hearing loss had the experience of the condition at a younger age. However, The National Association of the Deaf (2014) stated that persons with hearing loss who use sign language as a means of communication are members of the same culture _'Deaf Culture". Hence, while amplification devices are encouraged to enhance their residual hearing, many in the deaf community see such gesture as a means of eliminating their cultural identity (Sparrow, 2005).

The occurrence of a diminished sensitivity to sound signals of the hearing predetermines hearing loss. Therefore, persons who are unable to be sensitive to auditory signals sound and speech frequencies are known as persons with hearing impairment or hard of hearing. Largely, the severity of sound insensitivity in terms of hearing loss is used to categorise persons with hearing loss. The condition of loss of sense of hearing may result from age, noise and many other factors that are resident in the society as well as in individuals. Most conditions of loss of hearing are progressive and irreversible. Although, the condition is manageable, it depends on the cause, extent of damage and degree of hearing loss. For most severe conditions of hearing loss especially when the site of lesion resides in the innermost part of the ear, a surgical procedure may be beneficial while in other situation; amplification devices such as hearing aids can be recommended. Basically, early intervention and consistent use of amplification devices are essential for enhancing the residual hearing for optimal performance for the purpose of interpersonal relationship, intellectual development and academic performances (Moss and St Laurent 2001).

While the level and severity of hearing loss differs among those living with such a condition, Stinson and Whitmire (2000) noted that communication modes and strategy also vary with respect to curriculum content and ability of students with hearing impairment. In most situations, Stinson and Whitmire (2000) opined that teachers and instructor engage the use of total and manual communication methods to disseminate information to learners with hearing impairment because of their potency over the oral approach to teaching. The oral approach which has been used as a conventional teaching strategy for the hearing students would not in any way be an appropriate instructional technique for teaching learners with hearing loss because, learners with hearing impairment are visual learners. In other words,

they learn better from what they could see and feel. Moss (1995) contends that many students with hearing loss lack access to incidental learning but they could learn incidentally when images are involved. Therefore, teachers of students who are deaf and or hard of hearing may support their teaching with colourful printed images, gestures and real images. According to Stinson and Whitmire (2000), classroom sitting arrangement is a crucial factor to be considered in order for the learners with hearing impairment to have full access to facial expression, lips, and reading have an unhindered glare of all body languages of the instructor. More so, instructors should allow for preferential sitting arrangements according to their needs of the learners while index cards and questioning techniques that will provoke the thought of learners should be encouraged.

There should be an avenue for information and announcement of school activities either in written or captioned format. Also sign language or verbal interpreting should be put into consideration for use in order to pass across various thought and provides students with notes during classroom activities. Also recommended was the inclusion of sign language tutorials in the school curriculum while various adaptations of teaching activities, materials such as textbooks, sitting arrangements, and many more, assignments and mainstreamed instructions should be adopted for teaching learners with hearing loss (Adoyo, 2008). A pull-out programme can be instituted for extral time and adaptation of instructional pacing is necessary. When necessary targeted supports are given, Reed (2008) noted that learners whose sense of hearing is non-functional can effectively function and succeed in the regular classroom. This is because the link between the special needs teachers and the general education teachers (Hegarty, 1993) need to be strengthened especially, when learners with hearing loss are stalled by a system of education that seems unsuitable for their hearing mode with barriers of attitude, lack of resources, vision and will (Hodkinson and Vickerman, 2009).

Gudyanga, et al (2014) reported that children with hearing impairment may have partial or full hearing loss on either of the ears. The hearing handicap as a result of inability to receive and express message and thought causes serious problem on the part of the students. Persons with hearing loss often suffer a devastating experience which can be very traumatic and they are manyat time absent minded (Hetu, Jones and Ghetty, 1993). Moore (1996) opined that problems of delayed speech and language experienced by most individuals who have difficulties in one or either ear experience a narrow opportunitie for social interactions and ability to enjoy satisfaction in their social relationship with peers, family and other members of the society.

2.1.2 Attitude of Students with Hearing impairment to Basic Science

Attitude is one of the major determining factors that shape human identity. It is a major component that influences peoples' dispositions of hate, dislike, agreeing and disagreeing, persuasion and argument, love and favouritism, and many other attitudinal dispositions. As stated by Rubinstein (1986), attitude which though, is not constant is predisposition and inclination that influences behaviour of an individual which can be assessed as either negative or positive (Fishbein and Ajzen, 1975). According to Aiken (1970), based on stimulus either positive or negative, concepts or situation, attitude is a predisposition that is learnt by an individual which as well moderate the intensity of a particular feeling or stability. In terms of basic science, Orhum (2007) described attitude as a measure of aggregated disposition towards basic scientific activities, its usefulness to individual and the society at large. Attitude is a response to some stimuli which has been mostly associated with actual practices associated with emotional responses (Anastasi, 1990). Whether exhibited as favourable or unfavourable, attitude of an individual is expressed in feelings, inclinations or beliefs to act towards a phenomenon (Zimbardo and Leippe, 1991). Greenwald McGhee and Schwarts (2002) revered that an individual action is easy to predict attitude the attitude is understood because attitude as a concept involves evaluation. When association between an object and its evaluative process is strong, then the attitude may become more accessible. McGhee and Schwarts (2002) were of the opinion that attitude is needed for an individual to be potent only if it is a potent action.

Over the years, academic achievements of students at all levels of education have been impacted on by attitude towards various subjects. Either negative or positive, attitude of students have developed different dispositions towards various subjects. Hence, this disposition affects basic science (Greenwald, McGhee and Schwartz, 2002) Javis and Pell observed (2005)that students' perception of sciences was changed positively after they were exposed to space science and visited a science centre. A positive disposition towards basic science is a reflection of good emotional feelings towards a subject while a negative attitude may negatively influence the performance in different subjects. Positive disposition towards basic science influence students' behaviour and thus tend to enjoy better performance in their academics, and desirable willingness to learn from science instruction. It is quite unfortunate that while positive attitude enhances academic achievement, a negative attitude results in a problem of repeated failures in basic science (Nicolaidou and Philippou, 2003).Adigun (2014) asserted that the condition of Basic Science teaching and learning for students with special needs is very discouraging in most developing nations of the world like Nigeria.

Salend (2001) reported that students' performance in Science in public examinations has been consistently low. Al-Methen and Wilkinson (1992) revealed that lack of confidence in knowledge acquired during science instructions have significantly led to the dismal failure in Basic Sciences. Iqbal and Sharif (2006) opined that the traditional science curriculum and teaching method are the main reasons for poor science concept of students with hearing impairment.

Students, when exposed to basic science, tend to have positive attitude at first to the subject but such positive attitude may be reduced as time goes on or changed drastically to negative attitude as they continue in teaching-learning process (Kogce, Yildiz, Aydin and Altindag, 2009). Soyibo and Ishola(1986) mentioned some general characteristics of attitude as a predisposition to respond, that is readiness to behaviour rather than actual behaviour toward an attitude object, amendable to change that is the alteration of attitude especially that which is strongly held, requires substantial press. It produces consistency among its various manifestations, in an individual's behaviour toward an attitude object,a phenomenon that has intensity and a directional quality ,a results from experience and therefore is learned, that is, acquired through experiences that have profound affective component and more than different forms of learning are transmitted through the process of imitation, modelling and identification within the peer group and remains latent until associated signs or objects evoke it to influence the behaviour of the individual towards the stimulus sign or object.

Neathery (1997) also found that science achievement correlates with a positive attitude toward science. Research suggests that attitude and achievement are closely linked. However, the precise relationship between them has been the subject of considerable debate. Studies have consistently shown that positive attitudes correspond with increased achievement in a wide range of science subjects (Nwagbo, 2006). Research findings of Eccles (2007) and Krogh (2005) have shown that attitude and achievement have a close affinity. However, the point of intersection between both has been a subject of discussion. Basically, achievement in sciences is greatly influenced by students' disposition as well as strategy used by instructors in dissemination of scientific instructions. Therefore, understanding the attitudes of students with hearing impairment is very important in supporting the achievement and interest towards developing a sustainable environment. Studies such as Dhindsa and Chung (2003) have previously investigated students' attitude towards several aspects of sciences.In this study, students with hearing impairment were not considered. This can partly camouflage the attitude of students with hearing impairment

because science is not viewed a homogenous subject.There is a need to beam research lights on basic science in relation to students with hearing impairment.

Based on the foregoing, attitude can be seen as having three components according to Multi component model of Attitude (Maio, Maio and Haddock, 2010). This involves cognitive (thoughts, beliefs, attributes), affective (emotions and feelings) as well as behavioural information (experiences, past events, or action tendency). The affective involves feelings of like/dislike, love/hate, sympathetic nervous system responses and verbal statements of affect. The cognitive involves perceptual responses, beliefs about or factual knowledge of the object and verbal statements of cognition, verbal statements concerning overt actions, action tendencies, verbal statements concerning behaviour (Anyanwu, 1993). These three components are related and hence exert a mutual influence on attitude. Students' attitudes towards science education have been largely influenced by several factors which have consistently played a vital role. These factors include but not limited to those factors that are inherent or have an association with the learners themselves. These students' specific factors may include achievement scores (Kogce etal., 2009), science anxiety, motivation of the extrinsic level, self-concept and students' perception of self (Tahar, Ismail, Zamani and Adnan, 2010) and school experiences (Klein, 2004). Aside from factors that are inherent or have an association with the learners, other factors are those that are inherent in the school vis-à-vis teachers and the teaching prowess. The school could influence how, why and what teachers teach as well as attitude of learners towards teaching, classroom management, content management, teachers personality, opinion of learners and attitude towards basic science (Yilmaz, Altun and Olkun, 2010),teachers pedagogy, reinforcement (Papanastasiou, 2000), teachers' beliefs (Cater and Norwood, 2010) and attitude toward basic science (Ford, 1994).

Also, societal, home and environmental factors could impact the students' attitude towards the basic science. Tobias (1993) and Kogce etal (2009) posted that other causes might be responsible for students' attitude towards basic sciences which could as well include parents' educational background, parents' occupation and expectation. Through the influence of perception, attitude towards learning can be influenced and thus could results to seeing a students coming out with a pleasant grades or even into grades that may fall below expectation. The affective and cognitive processes are inter-related phenomenon that is directed by organic interaction (Onwuka, 1981). It thus affects the way people think. In support of (Onwuka, 1981), Bruner (1960) was of the opinion that required positive attitude towards learning activities and sciences in particular exposes learners to better academic

gains.The inclusion and promotion of more efficient and effective teaching strategies for teaching and learning sciences-related concepts as well as the need to enhance positive attitude towards science education have been projected by Henderson, Fisher and Fraser (2009). According to the researchers, the need for utilization of effective teaching strategies and attempts to develop positive attitude towards teaching and learning of science are measure up to enhance better science achievement which could be obtained by maintaining positive learning in a more student centred learning environment with greater reflection of positive teacher-student and student-student interactions (Scott, 2008). As noted by Achor (2008), instructional strategies that arouse students' interest, that are activity-oriented and learner-centred are effective in teaching basic science. Examples of such instructional strategies are outdoor classroom and pictorial illustration.

2.1.3 Concept of Outdoor Classroom Instructional Strategy

Outdoor classroom is an enquiry based learning which benefits students in multiple ways. Positive attitude, investment in the environment and community and achievement not only in science but in other curricular areas have been noted through inquiry-based science (Yager and Akcay, 2009). Inquiry-learning can take place in a schoolyard, a classroom, a school/community garden, or a local park. Outdoor classroom has been utilized to help students care about their local environments, building stewardship for the area in which they live (Lakin, 2006). Positive attitudes and increased student engagement have been observed when inquiry learning is utilized (Elliot and Page, 2010; Lakin, 2006). Educating students with hearing impairment outside the four walls of the classroom is an essential component of the school learning and teaching techniques. It is a strategy that affords learners the opportunity for fresh breeze and ultimately an opportunity for instructors and learners to relate with each other than. The outdoor teaching strategy comprise of the field trips in biology where learners are instructed to search and observe organisms found in the school garden or visiting a botanical or the zoological garden or the museum. The outdoor strategy is currently enjoying a wide acceptance because if its benefits over other teaching strategies used in teaching sciences.

The concept of outdoor strategy enhances the teaching of arts and history, geography and other science subjects (The Education and Skills Committee of the House of Commons of the United Kingdom, 2008). Aside for the benefit of the outdoor to students and teachers, the community as well also derives a sense of belonging with those who engaged in the outdoor teaching and learning processes. In other words, a bond is created with adequate

connection with and understanding of every aspect of the project done by the school. It makes both the school and the community to be conscious of the environment and therefore take control of it for sustainable development (Kudryavtsev, Krasny, Stedman and Richard 2012). The outdoor strategy is aimed at ensuring that learners (learners with hearing impairment inclusive) are equipped with ability to have social and personal development with a reduced adversities and ability to have a deeper connection with nature.

The educational strategy that uses the outdoor type encompasses the specific domains of the natural environment, self and that of others. While the emphasis of these domains have relative emphasis that varies from each others depending on the programme it's being used for, the outdoor strategy is designed to teach some survival skills that can drastically reduce recidivism but enhance the development of leadership skills, improved problem solving skills, boost team spirit, increased connectivity with the natural environment and promotion of spirituality (Kudryavtsev ,Stedman and Richard, 2012).The works of Ajala (2010) indicated that educational trips provide opportunity for real and first hand experience, motivates and arouse the interest of learners, make learning real and permanent, give students first-hand information about the needs of the community, provide an avenue for exploration and foster positive interaction between the school and the community. It involves different forms of activities by students, teachers, and by extension community members. Such activities include discussing critical environmental issues and problems, visiting sites such as markets, forests, dumpsites and riversides.

There is an increase in the awareness and need to include outdoor teaching strategies in instructional activities because of its proven benefits to students. Outdoor classroom has raised curiosity about arts and history develops social skills and enhances attitude and achievement in sciences and geography (Nixon, 2007). The outdoor classroom activities have effectively engaged all sense organs needed for scientific investigation and exploration. The outdoor classroom has effectively brought closer to learners a first-hand experience of a real world and constructive knowledge about approaches to scientific (Dietz, 2002) and learning experiences. Therefore, Dietz (2002) advocated outdoor classroom strategy because of its ability to stimulate the brain and activate it for perception in actual contact with phenomena of interest. With the availability of learning materials on the internet, some teachers and students may question why educational trips are needed anymore. Educational trips can be troublesome and difficult to organise and supervise. However, it provide learning opportunities that cannot be experienced in the classroom as discovered by some researchers.According to American Institutes for Research (2005), active participation in

outdoor instruction for students with disabilities enhances their social performances and emotional wellbeing. It is a strategy that gives full support to education of children and it provides an opportunity for students to spend time and relate with the natural environment. Outdoor classroom opens them up to the world outside made them excited about learning (discovering) after the students attend outdoor classroom.

1. Academic Impacts

According to American Institutes for Research (2005), outdoor classroom strategy presents an avenue for instructor to expose their learners to an extensive hands-on experience of science instructions with a solid foundation to support later instructions in the classroom. This strategy assists learners to have connection between the classroom and their real world while it motivates learners. Others include the following:

- a very good science experience for learners to explore the beauty of nature in different habitat. In fact, it as well affords learners the opportunity to see beyond printed text and assessment or evaluation.
- it provides opportunity for learners to develop language skills with reinforced vocabularies for students with hearing loss.
- when students engage in outdoor teaching, they have the ability to engage in both physical and mental work which gives them opportunity to shine.
- Based on the learning styles, students are exposed to opportunities that help to expose learning styles that suite each and everyone and thus tend to improve in the academic or learning outcomes most especially when practical skills are involved. Many students are auditory/verbal or kinaesthetic learners.

Students' new environment; interest; the nature of curriculum; the less prescriptive nature of school type and hands-on strategies with a range of opportunities for variants of programmes have been identified as that support students' learning.

2. Social-Emotional Impacts

Though, there are many benefits of engaging in academic activities but an outdoor classroom enhances emotional development as well as social connectedness. Outdoor teaching help to develop students' self-esteem reduces anti-social behaviour exhibited by students and also promote academic relationship between students and students.

1. *Self-esteem:* By boosting learners' confidence and independence, outdoor teaching strategies facilitate the enhancement of students' self-esteem and it provides an avenue for the students to high performance in the academic activities.
2. *Relationships among Peers:* one of the major benefits of the outdoor instruction is its ability to encourage socialization and the potential of learning together, boot self confidence and gives students the privilege to establish positive relationship with others within and outside the school settings while it as well expose students to various social gatherings where they can efficiently learn new concepts and ideas while they build strong emotions.
3. *Behaviour and Discipline:* The behaviour of some students may be impacted positively during the outdoor classroom strategy because the strategy emphasis on mutual respect for all both amongst the students as well as amongst teachers and students. The outdoor teaching strategy enables teachers to efficiently interact individually with their learners. In fact, the strategy allows for a close monitoring of learners based on its small size nature and then help to instil desirable behaviours in learners. Responsibilities and respects are the hallmark of the outdoor classroom instructions (Kudryavtsev, et al 2012).

The outdoor teaching strategy also encourages equality between student with hearing impairment and their hearing peers. It eradicates the issue of labelling and encourage social inclusion both within and outside the classroom setting. It is a strategy that promotes discipline, determination, motivation and structure for equal opportunity for every member of the class.The EcoSchools Toolkit (2013) asserted that participation of students in outdoor classroom requires alternative management other than that is required for the indoor classroom settings while appropriate behaviour of students who have had a prior experience with outdoor learning can be modified.

1. In order to develop cooperative attitude among the learners, instructors should discuss with the learners some ground rules to follow during the outdoor sessions. When this is done, the rules should be placed in a conspicuous place for it to be accessible to all learners. Each ground rule should be clarified and displayed on the bulletin board or the clipboard in a shorter but understandable version.
2. Concerns about anticipated issues should be addressed and fears of exclusion should be addressed.

3. School playground should be a site for direct learning rather than engaging the students in a learning situation whose location may not do the needful to teaching students with hearing impairment.
4. For a direct experience of outdoor teaching, the school playground may better serve the purpose as a site for the outdoor strategies.
5. For rapid behaviour change, the outdoor teaching may be a faster approach because students can learn better in this medium as an extension of the classroom.
6. Teachers should use the outdoor strategy to ensure that students stay on task while giving support to each other.
7. Various ways by which learners can give helping hands to each other and when they can call for assistance in their tasks should be itemised.

2.1.4 Pictorial Illustration Instructional Strategy

Teachers have consistently striven to improve their efficiencies and improve the performance of students alike. This is done through the use of essential tools and instructional materials needed by students for effective teaching and learning of school subjects which make learning more practical, realistic, interesting and appealing. The use of instructional materials in teaching-learning process facilitate active participation in the teaching process by students during classroom sessions. More importantly, the use of instructional tools help to build students' self actualization and self-confidence while it as well provides students with the opportunity of rapid skill acquisition, knowledge and development. Instructional materials also known as teaching aids are regarded as materials and equipment used for demonstration and practical in the classroom by teachers for students to learn and perform better in the school subjects (Ibeneme, 2000). In a similar vein, Ikerionwu (2000) noted that instructional materials are devices, materials or facilities that aid the presentation of the teachers to their learners in a logical manner.

As stated by Mayer (2006), pictures represent both words inform of spoken text and spoken text as well as pictures inform of photos, videos, animations and illustrations. Mayer (2006) was of the opinion that when images are supplemented with text, learners tend to have a good grasp of learnt materials. He further reiterated that based on the cognitive theory, images can contribute positively to the learning experiences of learners when such images are used in a way that is consistent with appropriate teaching techniques. There is currently new dimension to teaching and learning experiences that currently create new challenged and opportunities for teaching, learning and assessment of same when digital images of high

qualities are used. Based on the present visually-oriented community, textual information is no more a dominant mode of instruction and information (Duygulu, Freitas, and Forsyth, 2006).

Since time immemorial, presentation of pictures has served as a tool for expression of public ideas, culture and traditions that thrive as iconic gestures with or without specialized trainings. However, the present day society has strategies to transmit a larger amount of information and pictures as road signs, illustration in textbooks, audio visual broadcast, drawings and maps among others. Pictorial presentations have a deep root in the human mind with the visual cortex human beings manages visual information which is presented in the brain particularly when the perceptual processing is at the lower level (Pylyshyn, 2006).According to Carney and Levin (2005) in Fang (2006), the benefits of pictures to the literacy development of students and behaviour of learners outweighs any potential disadvantages of using picture in the teaching processes. Based on the benefits, Fang (2006) itemized six roles played by picture among texts: This includes the ability to help to establish settings; character development; ability to effectively develop a plot; it supports text coherence; and it as well reinforces a text. More so, pictures in text promote creativity, motivate readers, foster aesthetic appreciation and serves as mental scaffolds with a greater ability to promote language and literacy of students (Fang, 2006).

According to Roberts (2008), instructional charts represent pictorial and graphical representations of ideas, phenomena, concepts or materials which are used for instructional purposes with the sole aim and focus on the learners' minds regarding what is learnt. Instructional chart does not only focus on learners' mind, its impact is as well felt on how it aids the memory and recall ability of learners. There is great potential exhibited by learners when their education is facilitated with visual aids such as pictures, posters, charts than when their teaching-learning activities are done in abstract or they are subjected to imaginative teaching process. Charts and other visial images when they are properly harnessed, utilized or manipulated by teachers have the capability to arouse learners' curiosities, stimulate interest and enable students to have a broad view of concepts. Concepts and ideas are better understood by students if they have visual representations of those concepts or ideas (Schnotz, 2006). Students can use images to communicate concepts or ideas; to create a visual record of classroom/athletic events, field trips, experiment, or their work for sharing with peers and parents on websites, blogs, or digital newsletter. This method can enhance audience engagement with their presentation by embedding images. The teachers can also use

images as graphs or charts for presenting empirical data in all disciplines involving data analysis.

2.1.5 Academic achievement of Students with Hearing Impairment in Basic Science

Academic achievement is the performance and outcome of learning activieties in which students engages in. It is the extent students with hearing impairment can go in order to ensure that their educational goal is realised. The end of the term examination or the formative assessment scores are used to measure the level of achievement, however, there is yet to be a consensus on the best modalities or rules of engagement to assessing the academic achievement of these learners with hearing impairment. More so, the aspect of knowledge to be measure in order to determine the academic achievement is currently under discussion measure researchers.

Students with hearing impairment often experience difficulties in the science educational environment with lack of visual materials to which they are exposed such as textbooks, class, outlines, maps, laboratory experiments, field trips among others. Careful considerations are not given to students with hearing impairment in terms of subject matter and materials employed by the teacher. The pool achievement of students in science subjects is very discouraging. Sciences as school subjects have been regarded as difficult subjects by learners with hearing impairment due to there nature and requirements in both the concrete and abstract concepts. This is largely due to the fact that traditional science teaching has over the years depended mostly on verbal instruction only in teaching children with hearing impairment. The principle of learning science is based on the fact that science concepts learnt must be retained for problem solving and reflective thinking. This requires constructing and relating new ideas from already existing knowledge in the child's mind. However, this has been found lacking in most instructional strategies employed by teachers in the classroom. In addition, teachers of hearingimpaired pupils do not give careful considerations to the methods by which subject matter, learner and teacher interacts. Similarly, science as a subject involves experiments and observations which require vision thereby a need for an effective pictorial instructional strategy and the appropriate instructional materials for teaching primary science to students with hearing impairment are therefore necessary (Lasak et al, 2014).

Rawlings (2009) added that knowledge gained from science education can be utilized in understanding new concepts, take well-informed decision and pursue new interest. Basic science education helps in broadening curiosity and develops certain scientific ways of

thinking such as being open-minded, not jumping into conclusions and ability to think critically. The effectiveness of the quality of science programme needs to be known (Onwuegbuna, 2005). Mustapha (2001) further maintained that educational programmes are assessed to determine the extent to which the purposes for such programmes are being achieved.Egunjobi and Sangodoyin, (2013) highlighted some advantages of learning science, which includes enhancement of observational abilities, critical thinking as well as facilitation of understanding of the world.

However, reverse is the case. It is not the same for students with hearing impairment in conventional classroom in the study of basic science and contributing their own quota to creating new ideas and innovations that will indeed be of benefit to them as individuals and contribute to national development because of inadequate learning experiences due to hearing loss.Muraina (2015) pointed out that academic achievement of students irrespective of their ability or disability especially at the secondary school level is not only for effectiveness of the teaching and learning but that of determinant of the future of youths.

Vigne and Ryan (2008) reported that students with hearing impairment face communication barrier, during instructional processes in the classroom, when concepts seem unclear and students with hearing impairment find it difficult to comprehend concepts, it is imperative for sign language interpreters to get and isolate technical terms used during classroom instruction and use all means to ensure that students with hearing impairment in such classrooms clearly iunderstand the concept under discussion. The process described when used by sign language interpreters is called Conceptual Sign Language (CSL). Unfortunately, (CSL) is rarely employed by sign language interpreters. Due to its time-consuming nature, it can cause a significant delay and slow down the flow of the instructor. Therefore, it is highly imperative for both the students with hearing impairment, sign language interpreters as well as the instructors to communicate briefly about the concept in order for the students with hearing impairment to clearly understand. Ultimately, students themselves are responsible for the acquisition of needed educational materials such as books and some visual aids.According to Al-Methen and Wikinson, (1992) academic problems experienced by students are a product of impaired self-conceot, maladjustment, anxiety, school and home environmental inadequacies, unresponsive curricula, and pressures from peers.

As noted by Gaustad and Kluwin (2009); Kluwin and Stinson (2013), students with hearing impairment differ in their various communication modes. In other words, onset of hearing loss may largely influence their communication approaches. While some may require

the use of assistive listening devices, others may prefer the use of sign language interpreters than relying on speech reading in the classroom; others prefer to express and receive communication through signing. The issue of academic achievement among students with hearing impairment is very important; if learning are not effective students learning outcome will be negative. Moores (2011) averred that academic progress is directly related to an accessible and especially constructed curricula wrapped in communicational element and instructional delivery by specialists that can effectively address the academic and educational needs of students with hearing impairment. This kind of academic progress can be accessed in an environment with provision of relevant committed personnel which are lacking in most schools. Mckee (2012) added that success or failure in either reading or knowledge of English in school subjects (Basic Science inclusive) can drastically affect academic outcome. It will inhibit the child's ability to advance in academic work.

Some measures have to be put into consideration, for a child with hearing impairment to be able to learn Science and get good grades. One of the good things that assist them learns science properly is providing them good environment to facilitate their learning. These could include early diagnosis and intervention, school environments that have facilities like interpreters, committed tutors, note takers, good homes that does not inhibit them, and of course modern technologies like using computer software and projectors to educate them. This is to provide them early, a highly stimulating and enriched learning environment, that can assist them acquire language early in life. Good learning environment where all the facilities the hearing impaired need to learn better is sine quo nan for their success in school at all times coupled with good school/home relationships (McGhee et al, 2002).

Moores (2011) opined that in order to ensure and record significant progress in the academic of students with hearing impairment, there is need for a well-structured curriculum which is uniquely designed and well communicated to students in language that they will understand. This kind of academic progress can be accessed in an inclusive education setting with provision of relevant committed personnel who are not quite available in most of our regular schools. Buckle and Bird in Elemukan and Umeh (2014) are of the opinion that social inclusion and engagement allow for proper psychological adjustment with significant influence of such development on language, speech and literacy skills among children with hearing impairment. Therefore, inclusion practices further promote the learning outcome of learners with hearing impairment. The academic achievement or performance of students with hearing impairment can be viewed from the perceptive of how many of the students did well in a given test or to be viewed from the perspective of level of mastery or objective

attainments (Reid, 2005). Academic achievement of students with hearing impairment academic achievement can be determined by looking at End-of-Term or End-of-session assessments. Annual student with hearing impairment academic achievement is a good indicator of grown student with hearing impairment growth over time and it can pinpoint a student strengths and weaknesses.

2.1.6 Onset of Hearing Loss

Onset of hearing is a term used to describe the actual loss time when an individual suffers the ability of sound perception (Adigun, 2017). Shemesh (2010) stated that hearing disability can exist either before or after the acquisition of speech and language. According to Shemesh (2010), onset of loss of hearing sensitivity can therefore be preligual (loss of hearing prior to acquisition of language) and post-lingual (occurrence of hearing loss after the sufferer of hearing disability has developed spoken language abilities). Those with prelingual hearing loss, are a group of persons who sustain loss in the hearing sensitivity before the acquisition of speech and language as done by their hearing peers. Unlike those without the development of speech and language skills before they were diagnosed of hearing loss, those with postlingual hearing loss have actually acquired language skills before sustaining hearing loss. In their words, individuals with post-lingual form of hearing loss have been able to use speech and language for academic and social purposes (Mba, 1995 and Adigun, 2014).

The population of children with hearing loss has been estimated to be every three in a thousand and there is a projection of increase in the number of persons who will sustain hearing loss before the expiration of basic education. In fact, White (2010) stated that the prevalence of hearing loss among primary school children may rise from every three in a thousand to about every ten in a thousand while a transient and/or permanent hearing loss in any or both ears may affect about fourteen per cent or one in every seven school children. This implies that there will be many school children with significant hearing difficulties that will interfere with their learning and academic tasks. Deafness according to Elzouki (2012), refers to a condition with a sufficient degree of loss in the sense of hearing that therefore requires the use of assistive listening devices before one can understand speech. Acquired deafness is the loss of hearing that was not present at birth but develops sometimes during a person's life (Ogundiran and Olasosun,

2013).According to Hindley and Kitson (2000) this is the type of deafness that occurs after the acquisition of speech. Here, the auditory system has already been programmed for language and spoken communication. While congenital deafness is the type of deafness that is present at birth. In this type of deafness, the auditory system has not been programmed for language and communication.

It has been observed that losing hearing early in life (either before birth or before speech could be acquired) is more fraught with more damaging effects in terms of pragmatic skill that would be when one has acquired the language skills before experiencing hearing loss. As noted by Adigun (2014), the impact of hearing loss in early stage of life is detrimental to socialization process, personality development, academic progression, communication process and can affect socioeconomic independence. However, though, those individuals who sustain postlingual hearing loss also have some academic difficulties to contend with, but, communication and interpersonal skill it seems not to be difficult for such individuals to manage as they may relatively function better that their peers with prelingual hearing loss but their academic performance is also challenged (Ademokoya, 2006). As stated by Hallahan and Kauffman, (1994), persons with post lingual hearing loss may have academic challenges that fell below what their peers with hearing loss could have, those with prelingual hearing loss still fall short below in learning inputs and outputs when compare with those with post lingual impairment.

Due to the conditions presented by hearing loss, persons with thiscondition, either prelingual or postlingual deafness have their academicoutcome affected in varied ways depending on other potential factors.According to Oyewumi(2013), students with hearing loss have language deprivation that has potentials to influence their reading abilities. Their vocabulary strengths are weak and have few words that are relatively low for their age grades.Thus, because of language deprivation, Oyewumi (2013) further remarked that individuals with hearing impairment relay on visual cues for knowledge and understanding of spoken words. In other words, they are visual learners who receive instruction through images, pictures, or by examination of real objects.Hence, for these students with hearing impairment to function efficiently inlearning activities, there may be need for adaptation of curriculum, need forinstructional aids and sometime amplification systems that

will facilitate the effective learning outcomes. Thus, instructing the two in classroom required diverse strategies that are innovative and participatory.

2.2 Theoretical Review

2.2.1 Paivios Coding theory

The Paivios coding theory by Allan Paivio(1971) was based on the theory of cognition. As indicated by Reed, Evely, Cundili, Fazey, Glass, Laing, Newig, Parrish Prell, Raymond and Stringer (2010), the idea of the theory was its impact on mental image formation which involves visual imagery and verbal association. The visual imagery and verbal association is termed a dual-coding theory by Sternberg (2003).Obviously,Sternberg (2003) noted that the Paivios coding theory is used to represent information via both the verbal and visual mode with distinct operation is the mind of man with an ability to create separate idea and information. Hence, information retrieval, information stored and those which can be acted upon are based on the mental codes formulated via both the verbal and visual representation. For instance, the stimulus 'dog' can both be recalled individually or simultaneously as either an animate object or word. In any case, when the word or the image is recalled, individually the other object can be retrieved at a short time interval.This describes the ability to remember concepts or stimulus.However, while dual-coding theory can enhance recalling ability of both words and images. It fails to take to take into consideration other factors that could possibly influence or mediate between words or images. As noted by Pylyshyn (1973) and Reed (2010) dual-coding theory only focused on prompts given to an individual in terms of how they are able to remember or discover items or phenomena.

2.2.1.1 Types of codes

Analogue codes: These are codes that describe what mental images represent. It is a code that facilitates a retain of perceptual concepts. With analogue codes, the formed images in the mind are very similar or near exact to the physical stimuli (Sternberg, 2003).

Symbolic codes: The Symbolic codes are not used to represent concepts perceptually but rather it is used to represent phenomenon arbitrarily and sometimes

conceptually. Symbolic codes associate contrasted phenomenon in ordering words, information represented in the mind is in form of arbitrary symbols where each symbol can represent many other things apart from itself.

2.2.1.2 Support Provided by Paivios Coding Theory

The followings are support provided by Paivios Coding Theory

(1) Psychology support

Pylyshyn(1973) stated that for easy remembrance, words and images are essential.Meanwhile, ability to recall verbal information is enhanced when such information is captured in the mind with appropriate mental images. Likewise visual images can be better retrived in the memory when such is accompanied with required verbal information or when such visual image is paired with required verbal information or imagination (Anderson and Bower, 1973). The Paivios coding theory in terms of psychological support has been attributed to multimedia presentations because it requires verbal working memory and spatial working memory. As stated by Brunye, Taylor, and Rapp (2008), individuals who can dually code information have better recalling potentials. In a study when Paivio asked some participants about their recalling ability, Paivio noted that though a rapid sequence of both words and pictures were shown to them but participants were able to recall the sequence of words in no particular order that they do for pictures. The finding was in tandem with earlier hypotheses that while verbal and visual information is processed differently in the mind, there is more potency to recall verbal information than visual information even when a particular sequential order is required (Paivio, 1969). In support to the two systems of working memory, Lee Brooks in an experiment provided an additional support where participants were made to perform either a visual or verbal task. Participants who participated in the visual task were encouraged to observed pictures and answer some questions. Same goes for the participants who were exposed to verbal task; they were made to listen and answer some questions as well. The participants according to Lee Brook were encouraged to answer the questions either with visual indications, verbally or manually.While manipulating visual task, Brooks spotted interference between visual task and visual perceptions. Also same occurs between verbal statements and responses when verbal statements were manually manipulated. According to Sternberg (2003), the idea stated

in the study of Brooks gave credence to two code ideas which are used to mentally represent information.

In proposing the 'working memory' Alan Baddeley recognised the two-part processing system of the phonological loop and visuospatial sketchpadwhich was an essential phenomenon in the theory of Paivio. According to thePaivio Dual-code theory, the ability to encode written information through a phonological imput by recognising the words and alphabet contends with thedual route theory and complements dual-coding. Therefore, the work ofPaivio has implication for visual mnemonics, generation of idea, interface design, literacy and human factors in the development of teaching-learning materials, computational sciences as well as cognitive modelling (Just et al., 2004, Sun, 2007).

(2) Cognitive neuroscience support

The region involved in the visual imagery and perception has been identified by researchers using two different strategies. Using the cerebral blood flow, researchers have been able to isolate the quantity of blood and oxygen supplied to a specific region of the brain with an blood which provides a measure of activities that occurs in the brain. During a given stimulus, the electrical activities that occur in the brain can be measured or accessed by using related potentials. Various methods used by researchers to access the brain activities that occur when potentials are exerted have supported the dual-coding theory. As noted by McGhee et al (2002), studies conducted using the functional magnetic resonance imaging (fMRI) and the Position Emission Tomography (PET) have revealed an increased brain activation to process information that is abstract when paired with visual cues and an improved memory for spoken words and sentences when support with visual images, whether imagined or real.

2.2.1.3 Relevance of Paivios Coding theory to the Study

Based on the Paivios theory, students who are deaf have shown superiority in the ability to recall word order when such is presented to them in signed language than how they are able to recall pictures or images. This is probably because they have sign language as their first language which they are usually used to as a means of communication while pictures and images rarely feature in their

daily conversation. This assertion is in tandem with the hypothesis of Paivios which states that visual and verbal information is processed differently with the domain responsible for verbal information being superior to the domain responsible for images when there is need for recall in sequential orders (Sternberg, 2003)

2.2.2 Behavioural Learning Theory

A fundamental systemic approach to better comprehend the behaviour of both animals and human is known as the behaviourism. This approach is understood as an impulse or reaction to an environmental stimuli or consequence.The approach dwells on the theory that the reaction of human or animal as a result of previous experiences or reinforcement.Ultimately, reinforcement either positive or negative coupled with the individuals present state of emotion and controlling stimuli can have a long lasting effect on the behaviour of an organism. Behaviourism as a concept is a derivative of the Edward Thorndike experiment that presented the law of cause of effect relationship which is stimulated by reinforcement (Dillenburger and Keenan, 2009). While some behaviourist focus on the impact of inheritance which basically dwells on the environmental role in determining a behaviour, behaviour itself is a combination of elements derived from psychological theories, philosophy and methodology which emerged in the late 1990s in a reaction to various fields of psychology that had previously presented difficulties in predictions of variables that can be experimentally tested. In order to measure events and behaviours with an in-depth knowledge which is against methods that are introspective, Watson, J. B came up with a methodological behaviourism in the mid 20^{th} century.

It was not until the 1930s that B. F. Skinner suggested that private events – including thoughts and feelings - should be subjected to the same controlling variables as observable behaviour which became the basis for his philosophy called radical behaviourism (Dillenburger, Karola and Keenan, 2009). While Watson and Ivan Pavlov investigated the stimulus-response procedures of classical conditioning, Skinner assessed the controlling nature of consequences and the antecedents (or discriminative stimuli) that signal it to strengthen or weaken a given behaviour; the technique became known as operant conditioning.

According to Palmer (2006), the applied behavioural analysis of the radicalbehaviourism has been applied in various forms and setting to manage andcorrect behaviours. For instance, the concepts have been applied in themanagement of organisational behaviour, management of mental health disordersand drug abuse.Although, there has been arguments over the cognitivepsychological school of thoughts and behaviourisms but the two concepts havealways complemented and demonstrated efficacy for one another in cognitivebehavioural therapies used in managing psychopathologies such as anxiety,moodswings, depression and PTSD

General Assumptions of Behaviourist Theorist .

Behaviours exhibited by various animal species are learnt through equal applications of learning principles.When the study focuses on responses and stimuli, then, learning processes can be examined objectively.Internal cognitive processes arelargely excluded from scientific study.Learning is a relative permanent change inbehaviour.When organisms are given birth to, they are as blank as a slate.Events inthe environment facilitate learning.Theories that tend to be parsimonious are the mostuseful theories (Dillenburger and Keenan 2009).

General Educational Implications of Behaviourism to this Study

Emphasis on behaviour: This recommends that learners should not be passiveintheclassroom. In other words, they should actively participate in classroomactivities.More so, the theory assumes that people are better learners whenthey are activelyexhibiting a particular behaviour. For instructors to be surethat learners haveimbibed certain behaviours, students learning needs to bemeasured in order todetermine if learning has actually taken place.

Drill and practice: This states that habits are strengthened by a repetition ofbehaviour through a stimulus-response-habit

Breaking habits: The exhaustion method is one of the ways to make anindividualstop exhibiting an undesirable characteristics or traits. In otherwords, stimulus shouldbe promptly introduced in order to break the chain of a habit. Also, the stimulus-response can be initiated intermittently or faintly so that the habitual traits can beexpunged gradually (Dillenburger and Keenan 2009)

Rewards: This refers to an essential phenomenon in the correction of a trait,character or habit. Over the year emphasis has be laid on the relevance of reward by psychologists with an impact of learning.

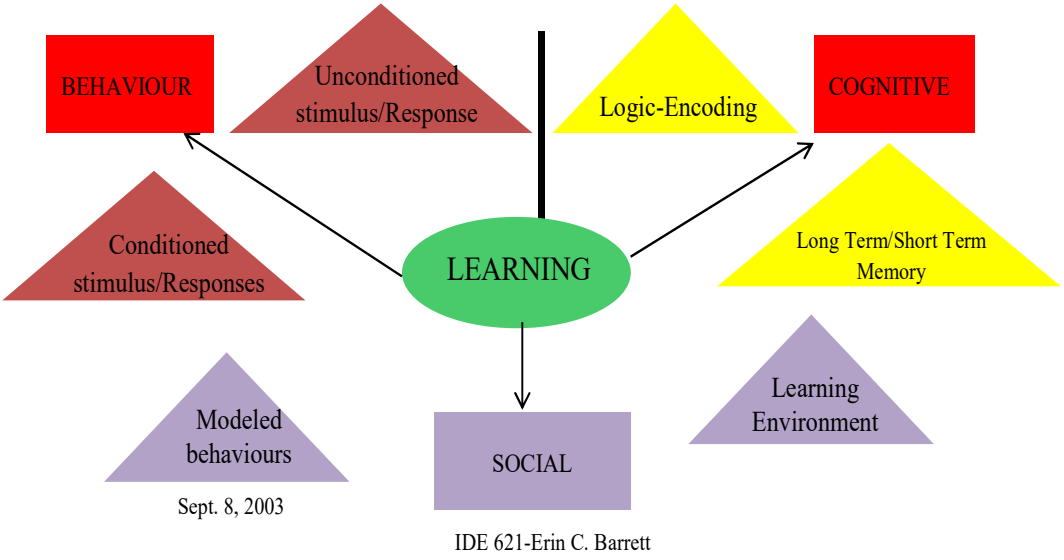


Fig2.1: Behavioural Theory

Source:http://erincunia.com/portfolio/MSportfolio/ide621/ide621f03production/images/firstconceptmap.gif

2.3 Empirical Review

2.3.1 Effect of Hearing Loss on Academic achievement of Students with Hearing Impairment

The relationship between hearing loss and poor academic outcome of students with hearing loss has been established by various studies across the globe. Although, many of such studies have identified early intervention as strategies that could prevent a detrimental effect of hearing loss on scholastic outcome (Ching, Dillon, Marnane, Hou, Day and Seeto, 2013). The aforementioned was reiterated by Yanbay, Hickson, Scarinci, Constantinescu and Dettman (2014) who noted similar characteristics among children who are fitted with hearing aids and cochlea implant technology. In their study among Australian parents and teachers, Yanbay, Hickson, Scarinci, Constantinescu and Dettman (2014) observed an enhanced academic outcome, improve communication and social integration among of children who were implanted with cochlea implant technology. Fitzpatrick, Olds, Gaboury, McCrae, Schramm and Durieux-Smith (2012) expressed that children with hearing difficulties who are fitted with assistive listening devices have a greater tendency to function at their optimal capacities. However, the researchers still noted that despite the application of the assistive devices, many children with hearing loss still have difficulties to fully participate in classroom activities and social interaction. Some parents still felt their children are at disadvantage and therefore support manual communication as a form of a back-up when the child is not wearing the assistive devices (Punch and Hyde, 2011).

In order to enhance the learning outcome of children with hearing loss, Adoyo (2008) called for the concerted effort by the parents, teachers and other professionals alike to understand and accept the persons with hearing impairment as members of the society and not to mistake their weakness as for helplessness. Studies of Chimedza and Peter (2001) pointed out that low academic outcome is experienced my many children with hearing loss but such difficulties in academic performance has nothing to do with loss in the sense of hearing except if there is a comorbid brain injury or disorder (Gudyanga, Wadesango, Eliphenos and Gudyanga, 2018). Although, the frustration, anger, mistrust, isolation, dejection experienced by children with hearing loss may compound their academic problem and negatively impact their learning outcomes.

Hearing loss, irrespective of degree of loss or type have a detrimental effect on the academic performance of students (Lisa, 2018). The conditions presented by the loss in sound perception do not only affect social relationships but its impact is felt on learning outcome, hence, all learnesr with hearing loss, whether unilateral or bilateral are at risk of academic failure because of the loss in the sense of hearing. The aforementioned signifies that sense of hearing is important to the development of speech and language, learning and social relationships. However, a delay in speech and language development may greatly impact on the positive social inclusion, language development and ultimately low academic performance with a greater effect on the persons with hearing loss who never receive early intervention or exposed early to manual communication methods.

For example, a study conducted among 85 students who are deaf and/or hard of hearing by Iva and Ronnie (2016) when the duo try to find out the cognitive skills and academic achievement of the deaf reported that students who used the America Sign Language at a proficient level outperformed in mathematics, reading comprehension and their national standardized measures their counterparts who were less proficient in sign language. The finding of Iva and Ronnie (2016) was in conformity with that of Qi and Mitchell (2012) who reported an overall low/depressed academic performance among students with hearing impairment than their hearing colleagues. Similarly, to Pagliaro (2010) who discovered that academic achievement of deaf students in sciences is very much lower than others without any loss in their sound perceiving abilities.

Mohd and Amran (2009) in a study among 257 students with hearing impairment found that academic performance of the 257 students with varying degrees of hearing loss were poor when compare with their colleagues without hearing loss. Of note Mohd and Amran (2009) stated categorically that the state of one's hearing impact negatively the scholarstic outcome of an individual while Mitchell (2008) found a difference in the mathematical knowledge of both fifth and sixth grades. Mitchell (2008) attributed the slight differences in the observed performance to the level of hearing and early intervention programmes received. In relation to what Mitchell (2008) observed, Marschark, Shover, Nagle and Newman in a 2015 study affirmed the position of Mitchell when Marschark and colleagues examined the mathematics and reading comprehension abilities of deaf and hard of hearing students in the secondary schools. In the said study, Marschark

and colleagues (2015) reiterated that deaf students performed better in mathematics test than they did in reading comprehension.

2.3.2 Outdoor Classroom Instructional Strategy and Academic Achievement of Students with Hearing Impairment

Students' without hearing loss have benefited from various instructional strategies and thus outcomes of such strategies have enhanced their capacity to engage and transfer skills to appropriate use. Nadelson and Jordan (2012) acknowledged the benefit of such instructional strategies and thus advocate for adaption of such instructional strategies to educate students generally, transferring of knowledge and recall knowledge is one of the benefit.. In relation to the observation of Nadelson and Jordan (2012) stated that captioned video and direct instruction have been found to enhance learning outcomes of students with hearing impairment. In a similar vein, Churckovich and Oughtred (2002) during a study that examined the differential effect of face-to-face and online medium instruction on the use of the library noted that students who were taught using the face-to-face instructional strategies performed better in a posttest analysis and even had better skills in library use and were more confident that the group who were exposed to the online tutorial instructional strategy.

Unlike Churckovich and Oughtred (2002), SEER (2000) study was conducted among secondary school students from eleven environmentally focused curriculum Californian schools. SEER in his study in year 2000 determined the efficacy of teaching using fieldwork and traditional methods of teaching. The study of SEER stated that students who were exposed to fieldwork had higher scores in attendance rate, higher grade average in mathematics, sciences and in reading than their colleagues who were taught using the traditional method. The finding from the study of SEER (2000) corroborates the fact that outdoor learning experiences have ability to enhance positive attitude and cognitive skills of learners than when taught only with classroom based learning strategies (Eaton, 2000).

Saidu (2014) reported that outdoor classroom teaching strategy had a significant difference on performance of students which mean outdoor teaching found to influence the academic performance of students who are low achievers. Adesoji (2008) result also supported Saidu (2014) result.Oyovwi (2020) published his study on outdoor school activities

in Delta State, Nigeria which was a quasi-experimental design found out that there was significant difference in mean achievement scores based on the findings he recommends that science teacher adopt outdoor science activities.Usman (2010) studied effects of indoor and outdoor instructional methods on Academic achievement of Junior Secondary School Integrated Science Students in Zaria found that student performed well in outdoor classroom than indoor classroom.

Among some students who were between 11 and 12 years of age in a Finland study which was conducted in 2000, Palmberg and Kuru compared various learning activities such as field trips, camping, adventures and hiking activities. In the study, Palmberg and Kuru (2000) noted that outdoor education experience cannot be compares with indoor learning activities based on the experiences gained, learning outcomes as well as how students could be empathic about nature. It was clearly recorded by Dietz (2002) that outdoor learning activities can increase students' comprehension and recall abilities of students in sciences subjects. In the study, four Kindergarten classrooms were selected from school in Louisiana and the pupils were divided into three treatment groups and they received three different lessons on trees while Dietz (2002) made other group to receive their instruction on tree from the classrooms with opportunities to interact with picture and realia. After several periods of treatment, the group exposed to outdoor classroom instructions performed better than their colleagues who were in the classroom.

2.3.3 Outdoor Classroom Instructional Strategy and Attitude of Students with Hearing Impairment to Basic Science

Naldeson and Jordan (2012) study revealed that teaching out of classroom are more effective because they enhance learning and facilitate knowledge transfer, thereby influencing students learning attitudes, interest and motivation. Mygind (2009) conducted a survey on this subject about third graders that had 20% of their education in the forest, researching how they experienced the classroom and the outdoor setting. The research material was gathered with questionnaires, where the students could choose between different statements concerning their experiences of outdoor teaching. The survey showed that students' social relations improved, the students experienced less noise, and were more satisfied spending time in the forest than in the classroom. Fagerstam's and Blom's (2013) study of high school pupils' attitudes towards learning Biology and Mathematics outdoors in comparison to indoor

learning. Participants in the study mentioned variation as a reason for why they liked outdoor teaching. It was also perceived by many as more stimulating, fun and relevant than their usual school environment. Several of the students claimed it was a more interesting environment and exposure to fresh air made them feel more focused and alert. They also gave negative responses regarding outdoor education: for example, they had problems concentrating, hearing what the teacher said and reported that it was noisier and that the weather could be cold and wet.

The comparative study conducted by Fagerstam and Bloom (2013). This study shows that students who were taught more outdoors in Biology experienced a more contextualized learning experience as active participants, than the students who had less education outdoors. When asked about the lessons after five months, the students who had more outdoor classes talked about themselves performing science, while the students who were taught indoors seldom explained how they worked with different content areas and mostly talked about what the teacher did .In Erick's (2013) narrative study of a third- grade teacher of science, and one of her classes on their daily activities and practice of outdoor education, the students in the study performed better on high stake tests than other third grade classes in science, thus providing further evidence for the usefulness of outdoor education.

Some previous experiments on the implication of outdoor educational strategies have been found to be statistically significant with learning outcomes in environmental behaviour of students at different times. One of such studies conducted by Dianne in 2011 among the upper elementary students concerning their understanding and knowledge about woodlands and associated environmental problems. Dianne (2011) used an outdoor educational strategy to teach seventy 5^{th} grade students environmental concepts two months prior to when they were post-tested in order to determine their attitude while eighty-five 6^{th} graders were taught the same content given to the 5^{th} graders one year before being post-tested. After post-test, Dianne (2011) noted a change in sensory and awareness of organisms' natural environment due to their exposure to the outdoor teaching strategy. Although, no control measure was taken for students' history and effect of maturation on their knowledge about various environmental concepts studied but the treatment generally resulted in a more positive students' disposition and orientation towards the use and abuse of the wild.

In 2005 among 150 students (75 males and 75 females) who were between grade level 10 and 12 as well as 200 students (100 males and 100 females) who were randomly selected from grade level 4 and 9 respectively were all exposed to a project designed strategy by DeLuca, Kiser and Frazer (2005). In the study DeLuca, Kiser and Frazer (2005) strategically used the project designed strategy to determine the effectiveness of the said strategy on the awareness of environmental issues among the randomly selected students. DeLuca, Kiser and Frazer (2005) presented the participants with the environmental knowledge and attitude test after a period of instruction. The findings derived by DeLuca, Kiser and Frazer (2005) revealed a statistical significant difference in the knowledge and attitude of learners in environmental concept. Although, the statistical difference in the study favoured the experimental groups. A similar study in 2006 by Davis, Doran, and Farr among 14,786 YCC campers who were randomly sampled from 194 camps supported effectiveness of educational outdoor when they were assessed about environmental awareness by completing an eleven domain-questionnaire before and after their camping experiences. Out of the eleven domain examined by the questionnaire, only six were statistically significant in relation to the attitude of the campers towards environmental awareness.

In another study, Olatundun (2008) analysed examined the impact of outdoor educational activities in selected primary schools in Ibadan, Nigeria. Olatundun (2008) was curious about students' environmental knowledge and attitude and thus simultaneously exposed experimental pupils into outdoor educational activities and control group into convectional teaching methods of nine weeks. The result showed a higher adjusted environmental knowledge mean score ($x = 19.59$; $SD = 1.78$) among pupils who were exposed to outdoor educational activities than that of their counterparts who were taught with the conventional teaching method ($x = 16.02$; $SD = 1.78$). Ignatiuk (1978) stated that there was a positive relationship students' attitudes toward science and environmental concepts who were taught using the educational outdoor activities.

During a biology field work, Ignatiuk (1978) used the Biological Sciences Curriculum Study (BSCS) test, Green Version, to determine the attitude of learners in the eleventh grade towards science and environmental concepts in biology. He thereafter a pretest and posttest found a significant difference in the attitude of the learners after a 15-week treatment period. Dyment (2005) knew the importance of

a green field to the environment. Hence, from her study among the elementary, middle and high schools in the Toronto District School Board regarding the impact of green school ground, Dyment found that learners in the Toronto District were enthusiastic about learning engagements that is done on green school grounds as compared to teaching indoors. According to the report of Dyment (2005), 70% of the respondents noted that they were more motivated to learning on the green field than staying in the classroom.

Blair (2009) in a review of previous studies examined both quantitative and qualitative studies which have investigated the impact of school garden on the learning behaviour of children across different educational level. Blair (2009) found that 9 studies out 12 quantitative studies have previously found a positive significant influence on school gardens to different behavioural measures in those studies which include but not limited to learners' academic achievement and food consumption behaviour. While among the seven qualitative studies reviewed by Blair, all the studies found a number of common reports in those qualitative studies. The qualitative studies have reported that school garden motivates learners and it improves students' attitude towards schooling, enhanced students bonding, team spirit and learning opportunities.

Falk and Balling(1982) reported a study conducted by the Smithsonian Institution's Chesapeake Bay Center for Environmental Studies which indicated how children learn a great deal from a well structured outdoor education programme. The programme designed by the centre noted that the educational design must be well planned to include field work and pre-planned filed trip orientation. Falk and Balling (1982) noted that classroom teachers who have earlier attended a targeted workshop were able to give effective pre-trip orientation to students who were slated to visit a zoo. Although, the zoo resource person also gave pre-visit orientation and some other zoo-generated printed materials but these material were found to be less useful to learners because they have been properly briefed by their teachers and zoo resource persons.In a related study by Mackenzie and White (1981) which was conducted among some junior high school students in Australia.

Mackenzie and White (1981) determined the exert effect of educational outdoor activities and the traditional method of teaching on some basic geaography course among participants who were divided into three groups, one of the groups were exposed to excursion in order for them to observed and experience phenomena

in their natural environment, another group were exposed to the traditional "passive" excursion approach of teaching while the third group was exposed to traditional teaching without excursion.Amongst the three groups, the researchers observed that students who had the excursion opportunities performed better that those without outdoor educational activities in a test of geography knowledge.In an 8-week session where Chowdbury (2008) recruited 58 campers in order to determine their knowledge of environmental issues and to examine the moderating effects of locus of control as well as attitude towards environmental issues, the 58 campers in the study of Chowdbury (2008) were pretested and posttested on their knowledge on environmental issues to determine the extent of changes in the knowledge after being exposed to some form of trainings. The study thereafter found a significant positive relationship between locus of control and knowledge in environmental issues.Chowdbury(2008) also found a positive significant changes in the environmental knowledge and attitude but such a finding was absent in locus of control.

Two of the three domains of education were examined by Flexer and Borun (2004).These were the affective and the cognitive domains when the researchers exposed the 5^{th} and 6^{th} graders to visit a participatory science museum. In other to determine the impact of the visit on both the 5^{th} and 6^{th} graders, Flexer and Borun (2004) further assigned the learners into four experimental conditions which were (control, exhibit only, lesson only and exhibit followed by lesson) as well as verbal and visual assessments.

After the visitation and assessments, the researcher observed that learners who visited the simple machines section of the museum had a higher score when examined than the control group but they had a relatively lower achievement scores than those group of students who had some sessions of instruction in the museum.Flexer and Borun (2004) stated that students performed better in the visual and verbal tests but the researchers were unable to conclude the report on the cognitive advantage of benefitting from exhibit experience before the treatments but the students exhibited better strength in the affective domain of sciences.In other words, students enjoyed and found interesting the exhibit approach towards sciences than a classroom lesson.Based on their observation, Flexer and Borun(2004) concluded that visit to a science museum and provision of an exhibit could

make student to be more enthusiastic about learning sciences, motivate them to learning sciences and could be used as part of science instructions.

Alto(2005) sought to test the impact of the outdoor educational programme when he engaged some students in a week long outdoor education programme and found that there was about twenty-seven per cent increase in the knowledge gained and mastery of science concept taught while his study was able to enhance conflict resolution skills, enhanced self-esteem and cooperation among the participants.Alto (2005) also noted that there was increased behaviour to learn and students gained some problem-solving skills.The philosophy of field approach to teaching sciences was exploredby Klute(2002) when he assessed the knowledge and attitude of a general education classroom in the introductory level geological sciences.In the study, Klute (2002) observed a positive attitude towards learning when students were exposed to the field-oriented approach.In fact, participants in the study of Klute(2002) showed an increase in the affective domain of participants and they equally attached more importance to geological science instructions given during the field-oriented approach than those participants in the control group who were instructed using the traditional method of teaching.

Childhood nature experiences and adult environmental attitudes as well as their behaviours have been a subject of discussion in various fora. While some studies have beamed their searchlight on other variables regarding childhood behaviour, Wells and Lekies (2006) chose a survey research design to examine the relationship between childhood nature experiences and adult environmental attitudes and behaviours. The researcher through their study used a telephone survey technique to gather data from about 2000 individuals who were between the ages of 18-90 years in some urban areas in the United States of America. During the telephone interview, respondents were asked some questions that pertain to their childhood experiences and their present environmental attitudes and behaviours as adults.

Wells and Lekies (2006) in their study controlled some socio-demograhic variables such as age and gender of the respondents while other variables were analysed using structural equation modelling. Results obtained by Wells and Lekies (2006) revealed a positive significant impact of childhood activities such as camping, playing in the woods, hiking on the attitude and behaviours of adults who were interviewed. In other words, Wells and Lekies (2006) stated that adults who had close relationship with nature or the wild as children tend to have pro-

environmental attitudes and behaviours. In comparison, adults who had closed association with 'domesticated plant' (picking flowers in the neighbourhoods, or planting seed in the garden) had less positive environmental attitude and behaviours towards the environment that those adults who had close interaction with wild as children.

Wells and Lekies (2006) assessed the relationship between the relative impacts of childhood with nature with evidence of long-term effects of childhood experiences. This study further provided evidence that childhood experiences with the natural habitat particularly the wild have a lasting effect of their attitude towards the environment in latter life. According to the results of the MEAP, the service-learning grade 5 students performed and had better scores better in both sciences and social studies that their peers who did not participate in the MEAP programme (Billig, Meyer and Hofschire, 2003). Significantly, age had a significant difference in the study; three students who were much older performed and had a better engagement.Some variables such as quality of some aspects of the programme, indicators as well as teachers and students rating of the service-learning experiences were manipulated to serve as moderators for service learning.

Unlike the MEAP programme, Billig and Salazar (2005), the sixth-graders were used in the experiment of the Philadelphia Need in Deed Initiative Study which engaged the Terra Nova to access the language and science achievement of those who participated in the service-learning approach.The study revealed that the sixth graders had a significantly higher score using the Terra Nova. However, same higher statistically significant score were not obtained for those who were below the sixth grade form (Billig and Salazar, 2005). While MEAP and the Philadelphia Need in Deed Initiative Study 5^{th} and 6^{th} graders respectively, a study of service-learning in Michigan among 3, 5, 8 and 10 graders by the Smartworks incorporated reported that students who participated in the study revealed that about 2/3 of the participants understood what they were taught and had better performance scores and improvement in their academic outcomes.

Ethics is one of the major factors discussed in service-learning participation studies which have explicitly described students' readiness to accept what is right coupled with the development of moral values and judgments, willingness and readiness to intervene for justice's sake, they also develop a sense of direction. Based on the observation of Furco (2002), there was a better and positive rating by

participants who participated in either the service-learning or the service itself. In other words, there was a significant difference in the performance of those who participated in the study based on the two strategies used. In 2001, while comparing learners who has ethical components and those on the service-learning programmes to other learners who engaged community services especially those who have never been involved in services or have any ethical components, Leming (2001) studied the reflections of service-learning with elements of ethical components on political-moral awareness, social relatedness and students agency. In the study Leming observed that learners in other programmes performed lower and scored lower in their performances in ethical measures than their peers with ethical components in the service learning programmes. However, students who were exposed to various models of conditions had a better performance than those where not placed on any conditions of treatment on measures of anticipated future participation, social responsibilities in community related affairs. Interestingly, Leming (2001) found on significant differences in the self-esteem levels of the entire participants. As often stated in the measures and standard of the National Assessment of Educational progress, citizenship and civics require knowledge acquisition, virtues, dispositions and skills.

In the area of citizenship and civic engagement, service-learning is progressing at an exponential rate particularly in the face of recurrent call for increased civic education. In a 2005 of the Carnegic Corporation Study of High School Civic engagement, Billig and Salazar noted that based on enjoyment of school and schooling, participants who were part of the service-learning groups had higher scores when compared with those in other groups. In fact, those in the service-learning groups reported higher tendencies to vote and engage in political circumstances. Based on the report of the study of Billig and Salazar (2005), there was a significantly higher association between students' disposition, skills and civic knowledge with students' decision making, characteristics of their teachers,, service-learning experiences, time spent in the service-learning programme, active teaching strategies and experiences using the service-learning. A result of a study of 761 students from 35 classrooms, half of them participated in the service-learning while half did not have opportunity to participate in the service-learning Based on the Colorado Learn and Serve progamme revealed that students who were in the service-learning programmes statistically showed a significant difference in

connection to school, community and civic responsibilities than the non-participants in the service-learning (Billig, and Salazar, 2005; Kim and Billig, 2003).

2.3.4 Pictorial Illustration Strategy and Academic Achievement of Students with Hearing Impairment in Science

In a study conducted by Ekeke(2007), It was revealed that learning strategy improved content learning and Thorborn and Allison (2010) confirmed the fact that learner-centred strategies learnt and properly implemented by teachers improve academic achievement. The full engagement of all body senses is very important of effective teaching and learning to take place. According to Bilbao (2006), while the sense of hearing is important, the application of sense of sight cannot be underestimated in effective learning and subsequent academic outcomes. Bilbao (2006) asserted that hearing academic instructions alone can only account for about eleven per cent of learning while about eighty-nine per cent of learning is facilitated by the sense of sight. Bilbao (2006) further stated that learning by sense of hearing alone can only facilitate retention of learnt information for just for about 72 hours after which the percentage of recalling ability begins to decline whereas when learning is facilitated by both sense of sight and hearing, about ninety per cent of learnt concept can be recalled even after three days.

A study conducted by Oladiran (2014) showed that outdoor classroom and pictorial instructional strategies are more effective for the dissemination of teaching-learning content during biology classes in the secondary schools than the conventional method. It could be concluded that outdoor classroom and pictorial instructional strategies facilitate academic achievement particularly in knowledge and attitude to biology than the conventional method.The teaching through traditional teaching or lecture format has over the years found not to be able sufficient for teaching the deaf who primarily learn mainly through the sense of siight and even better when instructional model encompasses the use of multimedia approaches. It should be noted that multimedia approach to learning efficiently enhances factual recall of learnt concepts (Lang, 2005). According to Kelly and Mousley (1998), multimedia invasion in the teaching and learning processes is combined with perfect interpretation through sign language, questioning techniques, and structured

lecture materials are important for the expected changes in academic performances of the students with hearing loss.

Kelly and Mousley (1998) stated that in order to eliminate the challenges faced in teaching students with hearing loss, visualisation should be used because it has proven to help facilitate creating thinking, increased potency in problem solving and being perfect observer and analyst with greater problem solving abilities. Students with hearing loss should be gradually put into learning of new concept especially in mathematics. For instance, in word problems, teachers should endeavour to use all available materials to ensure proper understanding of the questions. This can be done using pantomine, dramatisation, drawing; pictorial illustrations as this can help students move from a known concept to unknown concepts and then translating action into mathematical sentences. NCTM (2000) and Pagliaro (1998) both reiterated that technological application can as well enhance engagement and ownership of abstract ideas. Simple machines such as calculators and other hand-held devices such as phones, ipads, and many others can be used to solve mathematical problems as quickly as possible and it could also allow for modelling.

Pagliaro (1998), in his study among freshmen at the West Lafayette campus of Purdue University, engaged the freshmen of the computer engineering to Computer Graphics Technology course using the freehand sketching and computer-aided design (CAD) as a means of conveying instructions during the spring semester of 2006. Using the extreme or deviant case sampling techniques to select the participants, Pagliaro (1998) also used the Vandenberg Mental Rotations Test (1971) to determine the spatial ability of the participants. With 20 participants out of whom only 8 of them participated in the focus group discussions, 12 other students' participants had the opportunity to partake in the in-depth interviews. The instructional strategy employed by Pagliaro assisted the participants to be able to create from multi-view drawings some other pictorial drawings. This strategy employed by Pagliaro (1998) gave rise to the unique findings due to the think- aloud task and in relation to their research question. Based on triangulation process, Pagliaro corroborated the finding in his study with other findings from focus group discussions, interviews, and observations before conclusions. Although, the study of Pagliaro had several data sources but one of them was obtained from engineering drawings problems which the students who participated in the study solved during interview.

While trying to solve the puzzle, participants were encouraged to use the think-aloud strategy. This process, that is, the think-aloud affords the participants to speak out what they are thinking as it has been done in some behavioural task (Lodge, Tripp, and Harte, 2000; Nielson, Clemmensen, and Yssing, 2002). While the interview was going on, the researcher recorded the narratives, observed the participants and write supplementary notes. The recorded sessions were late transcribed and alongside other data derived from other sources, a qualitatively analysis was done. The researcher allowed the participants to solve three engineering problems within an hour and thirty minutes. Accordingly, the participants were required to create from a pictorial illustration multi-views and also to create isometric pictorials from the multi-views. Pagliaro (1998) noted that a large number of the participants, that both the high and low spatial ability learners were able to solve the problems except for some minor errors due to incorrect line or situations where the participants forget some details. However, the low spatial ability participants were not able to resolve problems related to isometric pictorials.

In 1995, Fillipattou in a study among 162 children with dyslexia who were between ages 7 and 8. Fillipattou (1995) identified those who were below average, average and above average in word reading attainment after being assessed at independent, instructional and at different frustration levels. The children with dyslexia in the study of Fillipattou were randomly assigned into various experimental conditions of a combination of pictures. The result of the study was that pictures of different types and titles enhanced the reading accuracy and comprehension. While non-intergrative pictures and titles enhanced reading accuracy of below average readers, the non-intergrative pictures also facilitated comprehension of below average readers at different frustration levels. Unlike the non-intergrative pictures, the intergrative pictures according to Fillipattous' study aided the reading accuracy of average readers at all frustration levels. More so, among average readers, the titles, pictures or verbal aid had no significant impact on their reading accuracy even at all frustration levels. However, the non-intergrative pictures aided inferential comprehension of above average readers at all frustration levels. Fillipattou noted that among children with dsylexia titles were found to interfer with reading accuracy and the use of contextual information while it also helped dyslexic children to answer more questions successfully while they accurately read at different levels of frustrations.

Although, the use of pictures in the study of Fillipattou (1995) enhanced reading performance and comprehension abilities among children with dyslexia butWellington and Osborn (2001) pointed out that not all learners could perform at the same level or could experience comparable degree of picture facilitated reading accuracy.Wellington and Osborn (2001) stated that before pictures can be appropriate for teaching and learning, the information processing skills of learners must be activated through, ability to select, organize, integrate and encoding of worded information. Based on the aforementioned, readers needed the information processing skills to interprete illustration in both pictures and in reading texts. With the skills, readers should be able to draw inferences from text, develop knowledge from background knowledge, form positive attitude, develop ability to ask questions and answer same through inferring and visualization. The ability of readers to read, comprehend and create meaning from materials being read is dependent on the ability to process information from illustration and text. Unfortunately, some potentials necessary for making reasonable meaning out of a contextual material may be absent when there is a complexities in illustration (Giorgis, 1999). While some empirical studies support the use of illustration in reading, comprehension of written materials, and it is ability to provoke questioning skills among persons with learning disabilities and poor readers Singh and Solman (1990) were of the opinion that illustration may not be beneficial to some readers especially those with learning disabilities when visual cues are not added to such illustration.

A 1978 study investigated the effect of different types of pictorial supports on students attention on some important features of concepts described in written materials and the relevance pre-training instruction on how to employ pictures tonotices, label relevant rules and concepts using the pretest-posttest quasi experimentaldesign among 60 elementary school children. After the experiment, Robert (1978)averred that students performed better when instructor provided them with picturesrather than allowing them to draw out a picture from worded concepts. Althoughboth groups, that is, those who were provided with pictures and those who drew outdiagrams from worded concepts performed well because the procedure helped themto develop ability to form mental images of the material studied. Robert (1978) recommended based on the finding of the study that when specific pre-training instruction is given to learners on how to use pictorial in their learning

task that they tend to perform better. Therefore, learning task should be explicitly described to learners most especially in arithmetical rules, intersection and empty set.

Based on the assimulation theory, Adigun(2017) investigated on the learning outcomes (achievement in and attitude towards Biology) of students with hearing impairment in Ibadan using the Computer-assisted Instructions (CAI) and Concept Mapping (CM) instructional strategies for a period of eight weeks among students with hearing impairment. He discovered that Computer-assisted instruction was more effective in enhancing achievement of students with hearing impairment in Biology than concept mapping. He recommended that teachers of Biology should adopt Computer-Assisted Instruction and concept mapping to improve learning outcomes of students with hearing impairment learning outcomes.

2.3.5 Pictorial Illustration Strategy and Attitude to Basic Science of Students with Hearing Impairment

Pictures in teaching is becoming an essential factor in the teaching-learning processes.Various types of visual images such as paintings, diagrams, photographs, illustrations, maps and many others in the classroom has proved to be an effect model of teaching learners.The use of picture in teaching have helped to develop and arouse the interest of learners.Pictures and other visual images used during teaching activities have been effectively used to eradicate passiveness in the classroom and thus assist learners to store knowledge gained in the long term memory therefore, they tend to have higher rate of recalling learnt concepts. Onwioduokit and Akinbobola (2005) and Akinbobola (2007) in a study on students' performance in Physics found that students learned and performed better in Physics when taught using the pictorial advance organizer. Thus, the duo concluded that in order to make science learning faster and seamlessly stressful, science instructors should endeavour to teach using picture, and other visual images to teach scientific concepts and such gestures will stimulate attention and motivate learners.

Since the 2007 study of Akinbobola and that of Onwioduokit and Akinbobola(2005), the attitude of science students towards Physics has been a phenomenon that should enjoy an in-depth study from researchers.Therefore, Akinbobola in 2014 proceeded to investigating the present status in the attitude of learners towards Physics, in the study using the Students'Attitude Towards

Physics Questionnaire (SATPQ) to collect data from 180Physics students with a 4 X 2 factorial matrix design where participants weregrouped into the pictorial group, written group and verbal advance organizersgroups. Based on the data collected which was analysed with a T-test,findings revealed that participants in the pictoral group was more potent toenhancing the attitude of learners towards Physics.

However, advance verbal organizer and written strategies were less effective to have enhanced theattitude of learners towards physics. In a similar vein, John and Litcher(2000) in Adeosun (2017) submitted that the impact of picture in the teaching-learning processes cannot be underestimated because it serves as a veritable tool for permanent learning experiences.Therefore, in order to make learning relevant and meaningful, Adeosun (1986) averred that students that were exposed to pictures were able to retain and recall a greater part of the course content than those that were were taught without the use of pictures. Also that teachers teaching sciences to learners should expose learners to photographic materials and other pictorial materials that could facilitate positive disposition towards learning sciences.

Stephens, Stephens and Eisenhart-Rothe (2010) during a pilot study among children with hearing impairment in 20 less developed countries from Latin America, Africa and Africa which was compared with Western Europe. Stephens, Stephens and Eisenhart-Rothe (2010) used a standardised questionnaire to collect data from 357 teachers from Latin America, Africa and Africa which was compared with Western Europe and 107 teachers from Western Europe about their attitude towards children with hearing impairment. Their findings revealed that teachers' age and perhaps their working experience influence the attitude of the respondents.In furtherance of the studies on attitude towards students with hearing loss,

Through the use of the Fountas and Pinnell Reading Assessment and the easy CBM long reading comprehension assessment, Jay (2016) was able to determine the students with specific learning disabilities who were in the seventh but has weak inferential thinking skills The researcher employed the direct and explicit teaching techniques as well as the graphic organizers to improve the metacognition of the participants. Jay (2016) used a baseline phase, intervention phase, and post-intervention phase to determine the learning outcome of the seventh grade participant. The graphic organizer that aided in the strategy of making an inference was the independent variable. The dependent variable was the measure of the participants'overall reading comprehension using the Fountas and Pinnell and

easy CBM assessment. Overall, the results of the study demonstrated improvement in reading comprehension in the Fountas and Pinnell Assessment. Five out of seven students showed growth and one student maintained proficiency levels with the easy CBM assessment. The study showed that metacognitive strategies enhanced overall reading comprehension when taught directly and explicitly as well as consistently within content areas.

Kehinde (2011) reported that the desire among science educators has been to find better ways of enhancing the teaching-learning process in order to engender desirable behavioural changes in the learner. Unfortunately, poor performance in science in public schools have been reported and documented. The prevailing poor performance has not justified the huge investment accorded the educational sector in Nigeria. Researchers have identified causes of this poor performance prominent among which is the method of teaching, that is the lecture method. This study therefore investigated effects of advance organizers on Senior Secondary School students performance in Chemistry concepts of electrolysis and oxidation reduction. It investigated the extent to which the use of three modes of advance organizers, namely: expository, framing and combined mode of expository and framing advance organizers enhanced the academic performance and attitude of Senior Secondary School Students in Chemistry in Ekiti State.

The study adopted the quasi-experimental design of the pre-test and post-test control group type. The population consisted of all SSS II Chemistry students in Ekiti state, while the sample consisted of 160 Senior Secondary School II Students drawn from 8 Secondary Schools spread across the three senatorial districts of Ekiti State using purposive multi stage random sampling technique. Each of the groups was randomly selected to the three experimental groups and the control group.Three research developed, validated and used to collect relevant data for the study. They are Chemistry Achievement Test (CAT), Chemistry Attitude Scale (CAS), and Mental Ability Test (MAT). The MAT was needed to distribute the subjects into three mental ability groups of high, average and low.The reliability coefficients of the instruments yielded 0.86, 0.78 and 0.91 respectively.Ten hypotheses were generated for the study and tested using Analysis of Variance (ANOVA), Analysis of Covariance (ANCOVA), and Multiple Classification Analysis (MCA) at 0.05 level of significance. The results revealed that there was a significant difference

between the pre-achievement mean scores and post-achievement mean scores as well as pre-attitude mean scores and post-attitude mean scores in the experimental groups.

There was a significant difference in the post achievement mean scores between the experimental and control groups and also a significant difference in the post-attitude mean scores between the experimental and control groups that is there were significant main effects of treatment on the dependent measures of cognitive achievement and attitude towards Chemistry. The combined strategy obtained the highest adjusted post test mean scores for cognitive achievement and attitude followed by the framing organizer group, then expository organizer group and lastly the conventional teaching method. There was a significant main effect of gender on cognitive achievement in which the female students performed better than their male counterparts while numerical ability did not have a significant main effect on cognitive achievement in Chemistry. However only the interaction effect of treatment and numerical ability had a significant effect on students' attitude mean scores in Chemistry. The findings have implications for chemistry curriculum planning and implementation in that the curriculum should be organized in such a way that show the interrelatedness of topics where a topic can serve as an advance organizer to another topic succeeding it. Advance organizers of expository and the framing varieties and the combined mode are effective strategies to strengthen the conventional lecture method and are therefore recommended, for teaching chemistry concepts at the Senior Secondary School level in conjunction with the conventional lecture method.

2.3.6 Gender and Academic Achievement of Students with Hearing Impairment in Basic Science

The thought of the impact of gender on academic achievement of elementary students provoked the interest of Filiz and Semra in 2013. Hence, Filiz and Semra (2013) examined the interconnectedness of gender, academic procrastination and sciences achievement among 2335 females and 2379 males in the elementary schools using the Tuckman Procrastination Scale and a Science Achievement test as an instrument for the collection of data which was analysed using the multiple regression analysis. Filiz and Semra (2013) found a significant relationship among the variables tested. In their study, academic procrastination and gender contribute

to the variation observed in science achievement among elementary students. However, there was a negative significant relationship between academic procrastination and elementary students' science achievement. In terms of gender, girls performed better in their sciences activities than their male counterparts.

Unlike the study of Filiz and Semra (2013) which examined gender differences in science achievement, Sayid and Milad (2011) focused their study on the impact of gender on performances of students on Literature and Mathematics vis-à-vis the role of locus of control, academic self-concept and the use of different learning strategies among 363 high school students who were in their first and third year in school. Using a structured questionnaire for data collection, Sayid and Milad (2011) found that while boys had more concentration and better information processing abilities in mathematics; girls had better performance in literature with greater attitude, high motivation better time management. Furthermore, the study stated that there was no gender difference found in academic self-concept, locus of control study aids and strategies but a gender difference existed in cognitive-motivational functioning in academic environment. However, boys had lesser adaptive approach to learning task than the girls.

Furthermore, a study was carried out by Ugwuanyi (2009) on the effect of different language modes on reading comprehension of pupils with hearing impairment from Enugu state, Nigeria. The population of the study was thirty five (35) pupils. Twenty four (24) were males while eleven (11) were females. Ugwuanyi (2009) in the study raised three research questionsand three hypothese which guided the conduct of the study questions for the study while a pretest –posttest quasi-experimental design and a teacher made Test of Reading Comprehension (TRC) for data collection. In all Ugwuanyi (2009) observed that academic achievement is not a function of gender difference most especially among the participants of his study after data generated by his research instruments were analysed with the Analysis of Covariance (ANCOVA) at 95 per cent confidence interval.Mcmullen (2004) reported that gender difference in achievement has been noted among girls and boys while boys tend to make attributions to ability. Klein (2004) argued on disparity in performance of males and females that sometimes both of them attributed to biological causes. Mayer and Massa (2003) stated that while female adolescents did not have preference for thorough activities, male counterparts preferred to learn through activity based instructional strategies whereas, adult female show greater inclination to learning in activities-packed instructional modes.

In a recent study which was conducted among college students of different levels of abilities in Biology who were in school to acquire the Nigeria Certificate in Education, Saidu and Suleiman (2014) found that there was an increase in the academic performance of low achievers who were taught at the outdoor field classroom, however, Saidu and Suleiman (2014) found no significant difference in the academic achievement the participant based on gender. In other words, outdoor classroom seems to be gender friendly. Unlike, Saidu and Suleiman (2014) who conducted their study among pre-service teachers, Achor and Amadu (2015) in their own study examined 160 secondary school II students achievement in ecology using a non-randomised, quasi-experimental design. Achor and Amadu (2015) purposively identified four co-educational secondary schools in Jalingo metropolis in Taraba State. After a 6-week treatment period, data collected from the participants were subjected to the analysis of Covariance which result showed that there was a statistical difference in the performance of students who participated in the outdoor educational programmes and those that were secluded and confined into a classroom. Similar to the findings of Saidu and Suleiman (2014), Achor and Amadu (2015) also observed no significant difference in the performance of both male and female students who participated in the outdoor educational programme.

In a Kenyan study which was based on Atkinson motivation theory, an assessment of home environment and academic motivation were determined as predictors of academic performance of pupils with hearing impairment at the upper primary in central province of Kenya. In the study, Nwangi (2011) randomly selected sampled seventy five (75) primary schools for the hearing impaired in central province who were between the ages of fourteen and eighteen. Nwangi (2011) used the home environment questionnaire as well as the academic achievement motivation questionnaire for data collection among the respondents. Due to the nature of the study, Nwangi obtained the end of the year academic record of the pupils to ascertain their academic strengths. Based on the results after data were analysed with Pearson's Product Moment Correlation analysis and t-test, findings showed that sex influenced their academic motivation and their academic performance. The mean score for academic motivation score of boys was (x =51.70) higher than that of girls (x=51.13).

In a related study in Enugu were two schools for pupils with hearing impairment purposively selected, Eskay, Onu, Ugwuanyi and Eze (2012)

determined the impact of teachers training on the use of local sign language among thirty four (34) pupils with hearing impairment and their academic performance in social studies. After the respondents were subjected to the Social Studies Achievement Test, findings revealed that gender had no significance influence on the academic performance of pupils with hearing impairment.Saidu (2014) result had no significance differences in the academic of both gender which means whether male or females gender there is no influence on academic achievement of the students.Research studies have showed that gender can influence students' achievement in various studies. Several studies report differences in environmental issues relating to gender. For instance in a study of Venass and Doris (2006) in an environmental study, males recruited for the study express bias for nuclear power while the female were much concerned about wildlife.

2.3.7 Gender and Attitude to Basic Science Students with Hearing Impairment

Irrespective of gender differences, attitude towards sciences has been a subject of discussion among researchers. Many other researchers have used various approaches to examine the relative impact of attitude of learners to academic performances. For example, Akinbobola (2015) in his study among some senior secondary schools, he used the pretest-posttest control group quasi-experimental design of a 4 x 2 factorial design to determine the effects of pictorial, written and verbal advance organizers on students' attitude towards Physics among 180 senior secondary two (SS2) from whom data were collected with the Students' Attitude Towards Physics Questionnaire (SATPQ). The study of Akinbobola (2015) revealed an insignificant difference in the attitude of male and female participants towards Physics who were exposed to pictorial, written and verbal advance organizers respectively.Although, no matter the gender difference persons with hearing impairment suffer social acceptance because of various antisocial behaviour displayed.

Fortunately, results of the study of Nsofor (2001) and Akinbobola (2008) which believed academic performances of both male and female learners can be improved upon when the learning condition is suitable. However, gender among students according to Abimbola and Bello (1997) is not a crucial factor that determines learning outcomes in sciences. In terms of learning outcomes in sciences, Osborne and Collins (2000) were of the opinion that the rejection of science subjects

by females is not unconnected to their perception about sciences as a difficult and demanding subject, it's crucial tasks and keen conservative approach attached to some concepts in sciences. Osborne (2003) in his study of literature on the attitudes towards sciences found that about 30.4% of female learners are found in Physics classes while there seems to be an even number of females to males in some other natural sciences such as Chemistry and Biology.

As noted by Jones and Rua(2000), the varied exposure of female learners outside the four walls of the classroom may have greater influence on their attitude towards sciences. Jones and Rua(2000) in his study reported that the gender differences in attitude towards sciences is a long standing issue but when females are compared to males who graduated from a post-secondary educational institutes, females would have higher grades in science, technology and mathematics subjects. When all domains of education vis-à-vis gender is studied among learners, Kolawole (2007) as well as Afuwape and Oludipe (2008) posited that a significant relationship existed between cognitive, affective and psychomotor domains of male and female learners. Although, Arigbabu and Mji (2004) could not ascertain any influence of gender on the cognitive, affective and psychomotor domains of learners in sciences.

Oba and Lawrence (2017) in their study reported that gender had no effect on students' attitude but there was slight achievement in Basic Science result thereby suggested that stakeholder should consider attitude of males and female in the development of curriculum. Also, in Austrialia when Cornall, Fien Skyes and Yekencken (1999) probed both male and females about the environmental concerns, Male students who participated in the study expressed concern for erosions and land degradation while endangered species were identified by females who participated in the study. Moreover, infractions in gender concerning environmental knowledge were found by Macdonald and Hara (2010). Also Macdonald and Hara (2010) reported a significant difference in the attitude of male and female students towards environmental education. In the same vein, Adekunle (2005) also established gender differences in the learning outcomes of male and female students in environmental concept of social studies when the participants were exposed to problem-solving and concept-mapping strategies, this could be attributed to gender 'sterotyping' whereby different roles that are attached to girls and boys influenced their performances. Olatundun (2008) found that gender had significant effect on pupils' environmental knowledge and attitude.

On the other hand, Olagunju, (2005) and Ogunleye (2003) found no significant effect of gender on students' knowledge and attitudes towards environmental education. Their findings revealed that females possessed more verbal commitment to the environment than males. In another study, Nkire (2011) who conducted research on impacts of a participatory instructional programme in Oyo State on non-formal adult learners environmental knowledge, attitude and practices, revealed that gender did not have any significant influence on the adult learners' environmental knowledge, attitude and practices. Though the males performed better than the females in the environmental attitude and practices, the difference were found to be insignificant.

Also Nkire (2011)'s findings and revealed that there was no significant main effect of gender on the participants' knowledge, attitude and practices on waste management, though female participants had better practice towards solid waste management than their male counterparts. Wang, Olagunju andAbiona (2008) in astudy on environmental education examined effects of gender on environmental knowledge, attitude and practice found no significant main effect of gender on learning outcomes.

2.3.8 Onset of Hearing Loss and Learning Outcomes of Students withHearing Impairment

Learning outcomes are attributes that signify what learners have achieved and their disposition towards the newly acquired concepts. The acquired learning task must essentially be assessible at the end of a programme. The ability to demonstrate and performance in a given task is essential in learning outcomes. Zumach et al (2010) with the knowledge of the importance of learning outcomes studied the longterm effects of early onset of hearing loss on academic and language skills notedthat deficit in hearing at an early stage of life would greatly impact academic skills and language development. Also Zumach, et al. (2010 acknowledging the role of home environment, parental socio-economic status and hearing loss noted that hearing loss among children and the parents socio economic status predicts educational performances. Ogundiran and Olaosun (2013) analysed the correlation of congenital and acquired deafness on academic achievement of students in a Nigeria college and found that mathematics performances of both group of students are not different, based on the onset of hearing loss.

Persons with hearing impairment are a heterogeneous group of people which comprises diverse characteristics because of several factors which include but not limited to factors such as onset of deafness, severity of hearing loss, societal issues as well as home economic strenghts, parental status, social inclusion, wield some influences on the learning outcomes of students with hearing loss. Onset of hearing loss among other factors could influence learning outcomes among students with hearing impairment. Onset of hearing loss is a term used to describe the exact time the condition which result in loss of hearing occurs. Ademokoya and Shittu (2007), and Shemesh (2010) noted that hearing disability exists either before or after for the acquisition of speech and language. In other words, hearing loss can be experienced before or after the acquisition of speech and language.

Although, some persons with hearing loss had congenital deafness which are due to factors that affect the auditory system from conception or due to congenital abnormalities. As stated by Mba (1995), the strengths of persons with hearing impairment differ accordingly based on the onset of hearing loss. This implies that persons who suffer from congenital hearing loss have a great challenge to level of exposure to sound and language development. Acquired deafness is the loss of hearing that was not present at birth but develops sometimes during a person's life (Ogundiran and Olaosun, 2013). For practical purposes, it has also been described as the type of deafness that occurs after the acquisition of speech (Hindley and Kitson, 2000). In this type of deafness, the auditory system has already been programmed for language and spoken communication. Congenital deafness, on the other hand, is the type of deafness that is present at birth. The auditory system in congenital deafness has not been programmed for language and communication. Mba (1995) opined that the major calamity that may befall persons with hearing impairment is when the condition occur early in life even before the acquisition of speech and language. Invariably, loss of sense of hearing at an early stage in life goes beyond an impact on speech and language development but greatly affect and impair social relationship, social integration and personality of the individual. Unfortunately, they have limited ability to learning when the instruction is not reinforced with visual images.

Basically, communication difficulties due to loss of hearing are a condition that have basis for cognitive, emotional and personal growth which is essential for academic growth. However, a serious deficit in communication abilities impedes

a rapid educational growth most especially among children with congenital hearing loss. Unlike those who are congenitally deaf, persons who acquire deafness later in life had probably developed language skills which would enable them to perform relatively better in academic activities and in several social interactions (Ademokoya, 2006). Hallahan and Kauffman (1994) noted that such an individual has better chances to contribute meaningfully to teaching-learning processes.Hence either a congenital or acquired hearing loss, the structure of teaching must take into consideration the ability of the individual and the capacity to hear and understand spoken instructions (Bakare, 2013). The consideration of the academic ability and learning styles of both individuals with congenital and acquired hearing loss is necessary for effective planning in terms of teaching strategies, curriculum modification and application of teaching aids.

While persons with hearing loss have difficulties perceiving sound signals, understanding speech is a huge task for them and thus, they heavily depend on visual language for information processing. On the other hand those whose hearing condition, those individuals who hearing loss is minimal, amplification devices could be introduced to facilitate effective communication (Kirk and Gallagher, 1989). Kirk and Gallagher (1989) further noted that comorbid conditions could affect the learning outcomes of learners with hearing impairment may further hinder efficient academic outcome. More so, irrespective of onset of hearing loss, or additional disabilities, Johnson (1987) as well as Ademokoya and Shittu (2007) contended that achievement motivation, gender, parental involvement and not intelligence quotients can also affect academic pursuit of learners with hearing loss.

As a result of the presence or absence of previous language programming, a child with acquired hearing loss has educational needs very different from the child with congenital hearing loss. The educational programme for a child who is congenitally deaf focuses on acquisition of language and communication skills (usually the sign language), whereas that of a child with acquired deafness emphasizes the maintenance of intelligible speech and appropriate language pattern. According to a report submitted by Lang in 2003, academic performance of learners who are deaf and or hard of hearing is incomparable with that of their hearing counterparts. Thus, due to the effect of hearing loss on the vocabulary, equating intelligence quotient of both person with hearing loss and their colleagues without hearing loss might be a difficult task to pursue.

While Lang (2003) was of the opinion that intelligence quotient of persons with hearing loss and that of their colleagues with a such condition cannot be equated, Moores (1987) noted that even with loss in the sense of hearing, persons with hearing impairment still demonstrate better performance in non-verbal assessments even sometimes better than the hearing peers. However, even with non-verbal parameter, language deficit may still largely account for some flaws in the performance of persons with hearing loss because they may not be able to follow both written instructions perfectly or may not adequately understand the sign language interpreters. Command of English is only one indicator of a person's intelligence and ability. Children with deafness, even those with superior intelligence and abilities are at a great disadvantage in acquiring language skills. Norris (1975) pointed out that the grammar and structure of English in the hearing impaired often do not follow logical rules and a person with congenital hearing impairment must exert a great deal of effort to read and write with acceptable form and meaning. For example, if the past tense of 'talk' is 'talked', why is the past tense of 'go' not 'good'? If the plural of 'man' is 'men', then should not the plural of 'pan' be 'pen'? When standard measures of reading and writing achievement are used with students who are deaf, examiners typically find that the students' vocabularies are smaller and their sentence structures are simpler and more rigid than those of hearing children of the same age or grade level (Meadow, 1980).

No matter the grade level, writing short, incomplete and not properly arranged sentences is an attribute of students with hearing loss. At times, they omit word endings, and misplace suffices or prefixes. They may even have difficulty in differentiating questions from statements. Hence, attempting to solve word problems or worded questions in mathematics or quantitative reason becomes challenging. They therefore, tend to lag behing by almost three years when compared with their peers (Traxler, 2000). This is important to note since those with deafness like their hearing counterparts need a good knowledge of Mathematics, and they need all that if demands to learn it since is an integral part of the totality of man. Numbers and number operations such as addition, subtraction, multiplication and division are part of everyday life. For example, man has to know time in order to keep appointments and organise the day's activities. Also, the knowledge of monetary value is highly essential for buying and selling (Olubela, 2003). However, considering the characteristics and problems exhibited by students with deafness, a lot of

problems arise concerning the teaching of Mathematics. These problems often account for the lagging behind of children with hearing loss.

Ogundiran and Olaosun (2013) conducted a study to compare the academic achievement between students with congenital and acquired deafness in a Nigerian college and found no significant difference in the academic achievement between students with congenital and acquired deafness. The findings of Ogundiran and Olaosun (2013) was in harmony with the study of DeLeon, Berg and Battin (1979), which found no significant difference in the reading level of twenty two (22) adults who were said to be equivalent in terms of intelligence quotients, educational level and had almost the same degrees of hearing loss. However, both studies noted a significant higher mathematics skill among respondents who are congenitally deaf. The higher mathematical scores in mathematics observed by Ogundiran and Olaosun (2013) and DeLeon, Berg and Battin (1979) among the group of congenitally deaf respondents might not be unconnected with the ability to switch from coding auditory signals to visual learners right from birth while those in the acquired group may yet to be suffering from the trauma experiencing deafness. Also, no significant difference was found by Ogundiran and Olaosun (2013) in the Mathematics performance between students with congenital and acquired deafness. It has however been noticed that there are characteristics exhibited by students with deafness which create problems with the teaching and learning of Mathematics. Olubela (2003) outlined the following problems: language communication and reading problems, inattention and distractibility, deficiency in arithmetic – learning strategies, lack of needed working materials, visual and psychological problems. Thus, special strategies and specialist teachers with a sound knowledge of Mathematics and the cultural, linguistic, sociological, psychological, prosthetic and educational needs of the hearing impaired are necessary to meet the needs of these special students.

2.4 Appraisal of Literature

Evidence from the existing literature showed that a lot researches have been conducted in Basic Science for hearing and not much has been conducted on students with hearing impairment in basic science. The review of literature in the area of the study showed that few studies have been conducted especially in Basic Science on outdoor classroom using pictorial illustration for students with

hearing impairment. In view of this assertion, appraisal of some instructional strategies currently used by junior secondary school basic science teachers was examined.

The theoretical review of literature has revealed that students with hearing impairment experienced significant limitation in hearing mechanism not cognitive development. Students with hearing impairment have language barrier not brain damage. Deafness does not affect the intellectual capability to learn on the part of the students with hearing impairment. Hearing loss can be devastating and traumatic because is often mistaken for asserts minded or senility. The review of literature also shows that students attitude to Basic science with hearing impairment attitude results from experience that is learnt, mode of communication whether total communication or manual communication takes a pivotal role in the education of students with hearing impairment. Literature reviewed revealed that several factors are responsible for students' attitude toward basic science. The factors are namely;poor attitude, educational background of parents, parental expectation and occupation, school teachers and teaching, students' basic science achievement scores, anxiety towards basic science, students self-efficacy and self concept content knowledge and teaching topics with real life, enriched examples among others.

Literature further revealed that learning environment, suitable curriculum, modified and suitable instructional strategies which are delivered by highly specialized instructors are factors that could improve academic endeavours of students with hearing impairment. Theoretical review shows that visual and verbal information is very important for enhancing academic performance of students with hearing impairment. Students with hearing impairment needed intervention that includes drill and practice intervention to maximally enhance their learning outcome. The intervention implies learning about environment in relation to basic science. Basic science offers access to a wealth of information and encourages students' curiosity and heightens critical thinking and observational abilities. It is remarkable that notable scholars have worked on strategies to enhance learning outcome of students with hearing impairment. The researchers have made useful contributions to teaching but it becomes worrisome that students with hearing impairment still experience deficiency in basic science. Deficiency arises from the way the subject is taught and learnt in schools such as oral method, talk and chalk method among others.

Both theoretical and empirical review indicated the need for teacher to use specialized instructional strategies for students with hearing impairment. Such strategies include outdoor classroom and pictorial illustration. Moreover, research has shown that gender is a controversial issues therefore, the need to further research on effects of gender on learning outcomes. Furthermore, literature reviewed revealed that onset of hearing loss has moderating effect on learning outcomes of students with hearing impairment.

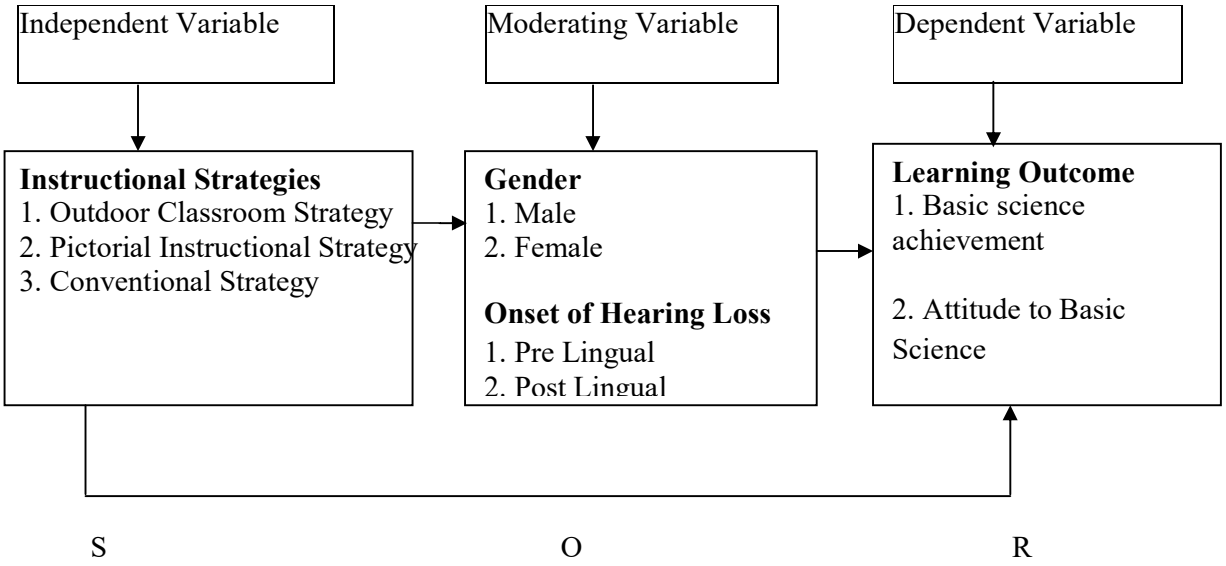
2.5 The Present Study

The presentday secondary school environment demands outdoor learning and pictorial illustration in school especially for students with hearing impairment who cannot hear what will be said by teacher except what he/she sees. This study investigated Outdoor classroom and Pictorial instructional strategy as determinants of students with hearing impairment learning outcomes. It also determines the influence of gender and onset of hearing loss on the achievement in and attitude to Basic Science of students with hearing impairment in Junior Secondary Schools in Ibadan, Nigeria.

2.6 Conceptual Model of the Study

The conceptual model on which this study is based is shown in figure 2.2 below. This model explains the construct on which the study is to be carried out. It depicts the variables and flow chart of the interactions of the variables. The independent variable to be manipulated in the study is at three levels. These levels are: Outdoor Classroom Strategy, Pictorial Instructional Strategy, and Conventional Strategy. The moderator variables are Gender expressed at two levels: male and female, and Onset of Hearing Loss also at three levels: pre-lingual and post-lingual. The dependent variable is the outcome of the manipulation of the independent variable against the moderator variables.

Conceptual Model of the Study



The conceptual model represents the stimulus-organism-response model where the stimulus(S) is the independent variable that is instructional strategies Outdoor Classroom Strategy, Pictorial instructional strategy and Conventional Strategy. The organism (O) or the moderating variable consists of two factors: Gender: male and female and Onset of hearing loss: pre lingual and post- lingual. These were considered because they are critical factors that determine the issues of the study. The response (R) or dependent variable is the result or outcomes of the study indicated as achievement in and attitude to Basic Scienc

CHAPTER THREE
METHODOLOGY

This chapter presents the research design, variables of study, selection of participants, concepts treated, research instruments, validation of research instruments, research procedure, methods and data analysis.

3.1 Research Design

This study adopted the pretest-posttest control group quasi-experimental design. The design is schematically represented as follows:

(E_1)	0_1	X_1	0_4
(E_2)	0_2	X_2	0_5
(C)	0_3	-	0_6

where:

0_1 0_2 0_3 - represent pretest observation for the experimental groups (I and II) and the control group

0_4 0_5 0_6 - represent posttest observation for the experimental groups (I and II) and the control group

(E_1) -represents treatment - experimental group I (Outdoor classroom instructional strategy)

(E_2) - represents treatment - experimental group II (Pictorial instructional method)

(C) - represents - control group (Conventional Strategy)

The study adopts a 3 X 2 X 2 factorial Matrix

A 3 X 2 X 2 factorial matrix was adopted with treatment at three levels, gender at two levels (male and female) and onset of hearing loss at two levels (pre-lingual and post-lingual)

3.1 3x2x2 Factorial Matrixes for the Study

	Gender				
	Male		Female		
	Onset of Hearing Loss				
Treatment	**Pre-lingual**	**Post-lingual**	**Pre-lingual**	**Post-lingual**	**Total**
Outdoor Strategies	3	1	4	2	**10**
Pictorial Illustration	4	2	2	2	**10**
Conventional	5	2	2	1	**10**
Total	**12**	**5**	**8**	**5**	**30**

Outdoor strategies group were ten (10), Pictorial illustration group were ten (10) and the control/conventional group were also ten (10). Total number of the treatment groups sum up to thirty (30). Onset of hearing loss which is the moderating variable are divided into pre-lingual and post-lingual. Numbers of pre-lingual students with hearing impairment were twenty (20) while the post-lingual were ten (10). Sum total of the participants were thirty (30).Gender which is the second moderating variable comprises of male and female students with hearing impairment. Seventeen (17) students with hearing impairment were males while thirteen students with hearing impairment for the study were females.

3.2 Selection of Participants

Participants in this study consisted of Thirty (30) students with hearing impairment in Junior Secondary School II in Ibadan Metropolis of Oyo State comprising seventeen (17) males and thirteen (13) females. Purposive sampling technique was used to select three schools for the study. Junior secondary school II Basic science students in each of the three schools were randomly assigned to each of the experimental and control group. The schools are: Methodist Grammar School (Deaf unit) Bodija, HLA Grammar School Agodi Gate, and IMG Grammar School Sharp Corner, Oke-Ado, all in Ibadan. A purposive sampling technique was used to select the Thirty (30) participants of the study.

3.2.1 The Criteria for the Selection of Schools

A random sampling was adopted in selecting schools used for outdoor classroom, pictorial instructions and the conventional instructions based on the following criteria:

1. The school must be an integrated school
2. The school must be government-owned
3. There must be availability of experienced basic science teachers with at least three years of teaching experience.
4. There must be the evidence that the students with hearing impairment have already been exposed to the basic concepts necessary for the understanding of the topic.

Justification for choice the of Ten (10) students from each school;

(1) They are students with hearing impairment;

(2) Intact class was used

(3) Willingness of the student to participate

3.3 Instrumentation

Four instruments were used in this study. They are:

1. Students' school health record
2. Basic Science Achievement Test (BSAT)
3. Students' Attitude to Basic Science Questionnaire (SABSQ)
4. Instructional guide (outdoor classroom instructional strategy (IGOCIS), Instructional guide on pictorial illustration instructional strategy (IGPPIS) and instructional guide on conventional strategy

3.3.1 Students' School Health Record

The school health record also provides information about the age of onset of hearing loss of each student in the school.

Basic Science Achievement Test (BSAT)

This instrument was developed from the content of the treatment package. This instrument consisted of two sections. A and B, Section A seeks to obtain personal background information from the students while B consisted of Fifty (50) multiple choice. The test therefore questions afforded the students the opportunity to choose one out of four options.

Table 3.2: Table of specification

	Living things (habitat)	**Adaptation of living things to the habitat**	**Relationship between living things in the same habitat**	**Uniqueness of Human being as an intelligent animal**	**Chemicals**	**Growth & development**	**Total**
Knowledge	2	1	1	1	2	2	9
Comprehension	1	2	0	2	2	1	8
Application	1	1	2	2	1	2	9
Analysis	1	2	2	2	1	1	9
Synthesis	1	2	0	1	2	1	7
Evaluation	2	1	1	1	2	1	8
Total+	8	9	6	9	10	8	50

Source: Bloom taxonomy (2017)

The face and content validity was determined by giving the instrument to experts in the fieild of test and measurement. The correction and criticism were used to make a final draft that was used on the field. Moreover, test retest validation was done, where copies of basic science achievement test were administered to twenty (20) students with hearing impairment in Junior secondary class two, who are not part of the sample selected for this study to ensure its reliability using Kuder-Richardson Formula (KR-20) which gave 0.79 Equally, the average discrimination and item difficulty indices was obtained in order to indicate which items of the test was neither too difficult or too simple. The discrimination indices was 0.56 and difficulty indices was 0.45.

3.3.2 Students' Attitude to Basic Science Questionnaire (SABSQ)

SABSQ was designed by the researcher to measure students' attitude to Basic science.SABSQ consisted of 15 items on a four Likert-type response. The items were rated on 4-Likert type ordinal scale ranging from Strongly Agree (SA), Agree (A), Disagree (DA), and Strongly Disagree (SD). In scoring the SABQ, scoring of positively structured statements was done in this order: SA-4, A-3, D-2 and SD-1. While scoring of negatively structured statements was be done in this order: SA-1, A-2 D-3, and SD-4. To determine the face and content validity, the instrument was given to experts in psychological test and measurement. The correction and criticism was used to make a final draft that was used on the field moreover, where copies of SABSQ were administered to twenty (20) students with hearing impairment in Junior secondary class two, who are not part of the sample selected for this study to ensure its reliability using Cronbach Alpha 0.67.

3.3.3 Instructional Guides

These are the Instructional Guides that were prepared by the researcher for the teachers were three in number. The first two were used for the experimental groups with the last one was used for the control group. The instrument consisted of step-by-step mode of teaching as shown in the appendix. The instructional guides are:

1 Instructional Guide on Outdoor Classroom Instructional Strategy (IGOCIS)

2 Instructional Guide on Pictorial Instructional Strategy (IGPPIS)

3 Instructional Guide on Control/Conventional Pictorial Instructional Strategy (IGCIS)

3.3.4 Outdoor Classroom Instructional Package (OCIP) on basic science

The OCIP is an operational guide on outdoor classroom strategy that was used by the teachers to allow for uniformity in the teaching method and to ensure that the objectives of the lessons were met. This guide actively involves the students in learning about their environment in order for them to have knowledge of the topic and also enhance students' understanding of the topic.

Steps involved in Outdoor Classroom Instructional Strategy (OCIP)

Topic: Learning about our environment

Subtopic: Habitat

Duration: 60 minutes

Instructional Objectives:

At the end of the lesson, students should be able to:

1. Define habitats
2. Identify the living organisms found in the different habitat
3. List the distinguishing features of organism found in the different habitat.

Procedure:

Phase 1: Preliminary phase (Before the outdoor classroom) (15 minutes)

Teacher's activities

Step I: Teacher takes attendance of the students

Step II: Teacher discusses the topic with the students

Step III: Teacher presents the purpose of the outdoor classroom to the students.

Step IV: Teacher gives background information by describing specific features to be observed the outdoor classroom.

Step V: Teacher through sign language interpreter informs students to jot down information received during the outdoor classroom.

Phase 2: Teacher's / Interpreter's / Students activities (outdoor classroom) (45 minutes)

Step I: The teacher conveys the students with hearing impairment to the sites

Step II: The teacher guides students with hearing impairment look for habitation on each plants and animals

Step III: The student ask questions from the teacher

Teacher's / Interpreter's / Student's activities (Post outdoor classroom)

Step I: The student present and discuss their observations from the site visited.

Step II: The teacher evaluates the students by asking question: e.g. List and discuss two major habitat.

Home work: Discuss the adaptation of plants in relation to water.

3.3.5 Pictorial Instructional Package (PIP) on basic science

The PIP is the teaching strategy that was used in describing and explaining the knowledge about environment with the aid of pictures to ensure that the objectives of the lessons were met. This was prepared and was used in the training of teachers to allow for uniformity in the teaching method. This strategy facilitates concept learning, the skill of classification which helps children develop high levels of reasoning and assessment abilities.
Steps involved Pictorial Instructional Strategy (PIS).

1. Teachers introduce the topic.
2. Teacher displays charts and shows students pictures based in the concept from a projected screen or from charts and the teacher leads the students in discuss.
3. Students are allowed to study the pictures displayed and identify the organisms.
4. The teacher explains concepts extensively with the use of pictures, photographs and drawings while actively involving students.
5. Students are asked questions by the teacher from pictures they have been shown and from what they have been taught.
6. Students copy note from the chalk board.
7. Teacher goes round the class to supervise the pupils while copying the note given to them.
8. Students' mistakes are corrected by the teacher where necessary.
9. Teacher answers students' questions.
10. Students write down assignment.

3.3.6 Control Group

Participants in this group were purposively selected. No treatment was administered on them although the participants were exposed to pre-test. Prior to the post-test the participants were given motivational information on knowledge about environment in basic science.

3.3.7 Validation of Instructional Guides

The instructional guides were validated by the researcher's supervisor, Basic science teachers and Basic science Educators. The face validity of the teachers' instructional guides was done by showing the items to three (3) Science Educators to determine its suitability in terms of clarity of ideas, language of presentation, class level, coverage, relevance and application to the study.

3.4 Procedure for Data Collection

Work Schedule

Week 1 – Introduction Pre-experimental activities

Week 2 – Pretest

Weeks 3 – Living things (Habitat)

Week 4 – Adaptation of Living things to the habitat

Week 5 – Characteristics of Organisms in the same habitat

Week 6 – Relationship between organism in the same habitat

Week 7 – Uniqueness of human being

Week 8 – Human being as an intelligent animal

Week 9 – Chemicals

Week 10 – Changes in living things (Growth and Development)

Week 11 – Evaluation

Week 12 – Post test

3.4.1 Training of Teachers

Training was done step-by-step through the explanation on the teaching guides on outdoor classroom and pictorial instructional strategy. The researcher visited the science teachers in their schools and trained them on how to go about the instructional and experimental procedures. The areas of disparity of ideas were discussed and the reason the guide should be used as expected was explained to them.

Two teachers were trained as research assistants for the experimental groups while the teacher for conventional method of teaching was asked to adhere strictly to the guide based on the lesson plan drawn from the curriculum. The training of teachers as research assistants lasted for one week.

3.4.2 Administration of Pretest

The second week was used by the researcher and the trained teachers as research assistants, to administer the pretest on the participating students using the outlined instruments.

1. Students' Attitude to Basic Science Questionnaire (SABSQ)
2. Basic Science Students' Achievement Test (BSSAT)

The instruments were administered to the students to assess their attitude to basic science and to test their level of understanding and acquisition of knowledge about their environment in Basic Science so as to be able to compare the effect of the treatment on them.

3.4.3 Treatment Procedures

The treatment was carried out on the experimental and control groups. Fourth to eleventh weeks was used for the implementation of the treatment for the experimental and teaching knowledge about environment to the control

Experimental Group 1: Outdoor Classroom instructional strategy

Topic: Learning about our environment

Subtopic: Habitat

Duration: 60 minutes

Instructional Objectives:

At the end of the lesson, students should be able to:

1. Define habitats
2. Identify the living organisms found in the different habitat
3. List the distinguishing features of organism found in the different habitat.

Procedure:

Phase 1: Preliminary phase (Before the outdoor classroom) (15 minutes)

Teacher's activities

Step I: Teacher takes attendance of the students

Step II: Teacher discusses the topic with the students

Step III: Teacher presents the purpose of the outdoor classroom to the students.

Step IV: Teacher gives background information by describing specific features to be observed the outdoor classroom.

Step V: Teacher through sign language interpreter informs students to jot down information received during the outdoor classroom.

Phase 2: Teacher's / Interpreter's / Students activities (outdoor classroom) (45 minutes)

Step I: The teacher conveys the students with hearing impairment to the sites

Step II: The teacher guides students with hearing impairment look for habitation on each plants and animals

Step III: The student ask questions from the teacher

Teacher's / Interpreter's / Student's activities (Post outdoor classroom)

Step I: The student present and discuss their observations from the site visited.

Step II: The teacher evaluates the students by asking question: e.g. List and discuss two major habitat.

Home work: Discuss the adaptation of plants in relation to water.

Experimental Group 2: Pictorial illustration instructional strategy

The students in this group were taught using the following steps:

STEP 1: Teacher introduces the topic and selects concepts required to teach the students with hearing impairment.

STEP 2: Teacher displays charts and shows students with hearing impairment pictures of various matter from a projected screen and from charts and the teacher leads the students into the lesson.

STEP 3: Students with hearing impairment are allowed to study the pictures displayed and identify the matter.

STEP 4: The teacher explains concepts extensively with the use of pictures, photographs and drawings while actively involving students with hearing impairment.

STEP 5: Students with hearing impairment will be asked questions by the teacher from the pictures they have been shown and from what they have been taught.

STEP 6: Students with hearing impairment will copy note from the chalkboard.

STEP 7: Teacher will go round the class to supervise the students with hearing impairment while copying the note given to them.

STEP 8: Students with hearing impairment mistakes are corrected by the teacher where necessary.

STEP 9: Teacher answers students with hearing impairments questions.

STEP 10: Students with hearing impairment write down assignment.

3.4.4 PostTest

The SABSQ and BSAT instruments were administered to the students with hearing impairment at the end of the treatment to determine the extent of the effect of outdoor classroom and Pictorial illustration instructional strategies as determinants of learning outcome of students with hearing impairment in Basic Science.

3.4.5 Summary of the Research Procedure

Week 1	-	Introduction and pre-experimental activities
Week 2	-	Pretest Administration
Week 3 – 11	-	Treatment and Evaluation
Week 12	-	Posttest Administration

Total = 12 weeks

3.5 Method of Data Analysis

Data was analysed using Analysis of Covariance (ANCOVA) with the pretest scores used as covariates. The Duncan Post-hoc was used to determine the sources of such significant differences, and graphs were used to interpret any significant interaction effects. All the null hypotheses were tested at $P < .05$ level of significance.

CHAPTER FOUR

RESULTS

This chapter presents the results obtained in the study. This is done based on the analysis of the fourteen hypotheses formulated for the study; the summary of findings concludes the chapter.Results of the demographic characteristics of the respondents were also analysed using descriptive statistics of frequency count and percentages. Frequence count and percentages is used for presenting information on theparticipants' age, gender and onset of hearing loss. The highest age of participants was 16 years while the lowest was 13 years. Gender was based on male and female of the participants in the study. Th onset of hearing loss was divided into pre-ligual and post-ligual. The hypotheses was analysed using analysis of covariance, while the direction of significants was determined using ducan.The analysed information is presented in seven (7) tables with a grahipical illustration.

4.1 Demographic Variables

Table 4.1: Distribution of the participants by Age

Age	Frequency	Percentage
13-14 years	12	40
14-15 years	10	33
15-16 years	08	27
Total	30	100

Table 4.1 showed that 12 (40%) were within 13-14 years, 10(33%) were within 14-15 years and 08(27%) were within 15-16 years. This implies that 40% of students with hearing impairment are within the age of thirteen to fourteen years, 33% of the total population for the study were within fourteen to fifteen years, while 27% of the participant were within age of fifteen to sixteen years; which sum up to 100%.

Table 4.2: Distribution of participants by Gender

Gender	Frequency	Percentage
Male	17	57
Female	13	43
Total	30	100

Table 4.2 showed that 17 (57%) were male and 13 (43%) were female.

Based on gender, 57% of the 100% were males while 43% of the total participant were females which means male students with hearing impairment are more than female students with hearing impairment.

Table 4.3: Distribution of participants by onset of hearing loss

Onset of hearing loss	Frequency	Percentage
Pre-lingual	20	67
Post-lingual	10	33
Total	30	100

Table 4.3 showed that 20 (67%) were pre-lingual and 10 (33%) were post-lingual.

67% of the students with hearing impairment were prelingual which implies that 67% of the students acquire deafness before language acquisition while 33% of the total participants became deaf after language acquisition.

4.2 Testing of Hypotheses

4.2.1 **Hypothesis 1a:** There will be no significant main effect of treatments on achievement of students with hearing impairment to basic science.

To test this hypothesis, Analysis of Covariance (ANCOVA) was adopted to analyse the post-test scores of the participants on achievement of students with hearing impairment to basic science using the pretest scores as covariate to ascertain if the post experimental differences are statistically significant. The summary of the analysis is presented in Table 4.4 below.

Table 4.4: Summary of 3x2x2 Analysis of Covariance (ANCOVA) Post-Test Achievement of Students with Hearing Impairment in Basic Science

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3346.334[a]	8	418.292	16.538	.000	.863
Intercept	296.841	1	296.841	11.737	.003	.359
Preach	7.846	1	7.846	.310	.583	.015
Trtgrp	1965.492	2	982.746	38.856	.000	.787
Gender	116.021	1	116.021	4.587	.044	.279
Onset	13.699	1	13.699	.542	.470	.025
trtgrp * gender	145.486	2	72.743	2.876	.079	.215
trtgrp * onset	27.221	1	27.221	1.076	.311	.049
gender * onset	5.000	1	5.000	.198	.102	.005
trtgrp * gender* onset	3.500	1	3.500	.138	.102	.002
Error	531.133	21	25.292			
Total	36812.000	30				
Corrected Total	3877.467	29				

a. R Squared = .863 (Adjusted R Squared = .811)

The results from Table 4.4 showed that there is significant main effect of treatments on achievement in Basic Science of students with hearing impairment ($F_{(2, 21)}$= 38.856, $p < 0.05$, $\eta^2 = 0.787$). This means there is significant difference in the mean scores of the achievement of students in basic science among participants that were exposed to Outdoor Classroom (ODC) and Pictorial Illustration (PI) when compared with the control group. Hence, hypothesis one is not accepted. It was therefore concluded that there is significant main effect of treatments in the achievement to basic science of students with hearing impairment. This implies that (ODC) and (PI) are effective in enhancing the achievement to basic science among the participants.To further provide information in enhancement of academic achievement of the participants among the three groups (OCD, PI and Control), it is good to ascertain the direction of the differences and determine the magnitude of the mean scores of the participants in each of the treatments and the control group). Thus, the Duncan post-hoc analysis was calculated and presented in Table 4.4.

Table 4.5: Significant Differences in the Treatment Groups

Trtgrp	N	Subset for alpha = 0.05		
		1	2	3
Control	10	19.5000		
Outdoor	10		36.8000	
Pictorial	10			43.1000
Sig.		1.000	1.000	1.000

The following observations were made on Table 4.5,

(i) There was statistical significant difference between the post-hoc test mean scores in enhancing the achievement of students with hearing impairment in basic science in the ODC and PI groups. The participants in the PI (Mean = 43.10) benefited better than those in the ODC (Mean = 36.800)

(ii) There was significant difference in the post-hoc test mean scores in enhancing the achievement of students with hearing impairment to basic science of participants exposed to ODC and control group. The participants in ODC (Mean = 36.800) enhanced the achievement of students with hearing impairment to basic science of participants significantly better than those in the control group (Mean = 19.500).

(iii) There was significant difference in the post-hoc test mean scores in enhancing the achievement of students with hearing impairment to basic science of participants exposed to PI and control group. The participants in PI (Mean = 43.1) enhanced the achievement of students with hearing impairment to basic science of participants significantly better than those in the control group (Mean = 19.5).

This implies that there is significant difference between the mean score of participants in PI, ODC and those in the control group, while PI and ODC are more effective than control group, and even pointed out that the PI had the greatest potency of enhancing achievement of students with hearing impairment to basic science of participants than ODC

Hypothesis 1b: There is no significant main effect of treatments on attitude of students with hearing impairment to basic science.

To test this hypothesis, Analysis of Covariance (ANCOVA) was adopted to analyse the post-test scores of the participants on attitude of students with hearing impairment to basic science using the pre-test scores as covariate to ascertain if the post experimental differences are statistically significant. The summary of the analysis is presented in Table 4.6 below.

Table 4.6: Summary of 3x2x2 Analysis of Covariance (ANCOVA) Post-Test Attitude of Students with Hearing Impairment to Basic Science

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	884.032[a]	8	110.504	11.904	.000	.819
Intercept	53.893	1	53.893	5.806	.025	.217
Preatt	132.339	1	132.339	14.257	.001	.404
Trtgrp	589.280	2	294.640	31.741	.000	.751
Gender	20.765	1	20.765	2.237	.150	.096
Onset	50.991	1	50.991	5.493	.029	.207
trtgrp * gender	28.848	2	14.424	1.554	.235	.129
trtgrp * onset	47.235	1	47.235	5.089	.035	.195
gender * onset	.000	1	.033	.858	.161	.000
trtgrp * gender * onset	.000	1	.002	.875	.161	.000
Error	194.935	21	9.283			
Total	20791.000	30				
Corrected Total	1078.967	29				

a. R Squared = .819 (Adjusted R Squared = .751)

The results from Table 4.6 showed that there is significant main effect of treatments on attitude of students with hearing impairment to basic science ($F_{(2, 21)}$= 31.74, $p < 0.05$, η^2 = 0.751). This means there is significant difference in the mean scores of the attitude of students with hearing impairment to basic science among participants that exposed to outdoor classroom (ODC) and pictorial illustration (PI) when compared with the control group. Hence, hypothesis two is not accepted. It was therefore concluded that there is significant main effect of treatments on attitude of students with hearing impairment to basic science. This implies that (ODC) and (PI) are effective in enhancing the attitude of students with hearing impairment to basic science.

To further provide information in enhancement of attitude of students with hearing impairment to basic science among the three groups (ODC, PI and Control), it is good to ascertain the direction of the differences and determine the magnitude of the mean scores of the participants in each of the treatments and the control group). Thus, the Duncan post-hoc analysis was calculated and presented in Table 4.6.

Table 4.7: Significant Differences in the Treatment Groups

Trtgrp	N	Subset for alpha = 0.05		
		1	2	3
Control	10	20.1000		
Outdoor	10		25.8000	
Pictorial	10			31.0000
Sig.		1.000	1.000	1.000

The following observations were made on Table 4.7,

(i) There was statistical significant difference between the post-hoc test mean scores in enhancing the attitude of students with hearing impairment to basic science in the ODC and PI groups. The participants in the PI (Mean = 31.00) benefited better than those in the ODC (Mean = 25.800).

(ii) There was a significant difference in the post-hoc test mean scores in enhancing the attitude of students with hearing impairment to basic science exposed to ODC and control group. The participants in ODC (Mean = 25.80) enhanced the attitude of students with hearing impairment to basic science significantly better than those in the control group (Mean = 20.10).

(iii) There was a significant difference in the post-hoc test mean scores in improving the attitude of students with hearing impairment to basic science exposed to PI and control group. The participants in PI (Mean = 31.00) enhanced the attitude of students with hearing impairment to basic science significantly better than those in the control group (Mean = 20.10).

The results from Table 4.7 showed that there is no significant interaction effect of treatments and onset of hearing loss of achievement of students with hearing impairment to basic science ($F_{(2, 21)}$= 1.076, $p > 0.05$, $\eta^2 = 0.049$), the hypothesis is therefore accepted. This implies that the interaction of the treatments and onset of hearing impairment has no significant interaction effect in enhancing achievement of students with hearing impairment to basic science. Thus, the null hypothesis nine is accepted.

This implies that there is significant difference between the mean score of participants in ODC, PI and those in the control group, while ODC and PI are more effective than control group, and even pointed out that the PI group had the greatest potency of enhancingattitude of students with hearing impairment to basic science than ODC.

4.2.2 Hypothesis 2a: There will be no significant main effect of gender on achievement among students with hearing impairment in basic science.

The results from Table 4.1 showed that there is a significant main effect of gender on achievement among students with hearing impairment in basic science ($F_{(1, 21)}$= 4.59, $p > 0.05$, $\eta^2 = 0.279$). This means there is a significant difference in the mean scores of the achievement of students with hearing impairment to basic science of both male and female when compared with each other.

Hypothesis 2b: There will be no significant main effect of gender on attitude of students with hearing impairment to basic science.

The results from Table 4.3 showed that there is no significant main effect of gender on attitude of students with hearing impairment to basic science ($F_{(1, 21)}$= 2.24, p > 0.05, η^2 = 0.096). This means there is no significant difference in the mean scores of the attitude of students with hearing impairment to basic science of both male and female when compared with each other.

4.2.3 Hypothesis 3a: There will be no significant main effect of onset of hearing loss on achievement of students with hearing impairment in basic science.

The results from Table 4.1 showed that there is no significant main effect of onset of hearing law on achievement of students with hearing impairment to basic science among participants($F_{(1, 21)}$= 0.542, p > 0.05, η^2 = 0.025). This means there is no significant difference in the mean scores of the achievement of students with hearing impairment to basic science among participants when compared with each other. Hence, the hypothesis was accepted.

Hypothesis 3b: There will be no significant main effect of onset of hearing loss on attitude to basic science among students with hearing impairment.

The results from Table 4.3 showed that there is a significant main effect of onset of hearing loss on attitude to basic science of students with hearing impairment ($F_{(1, 21)}$= 5.493, p < 0.05, η^2 = 0.207). This means there is a significant difference in the mean scores of the onset of hearing loss on attitude to basic science of students with hearing impairment when compared with each other. The pre-lingual (mean = 26.00) participants benefitted better than the post-lingual (mean = 24.17) participants. Hence, hypothesis six was not accepted

4.2.4 Hypothesis 4a: There will be no significant interaction effect of treatment, onset of hearing loss and gender inenhancingachievement of students with hearing impairment in basic science among participants.

The results from Table 4.1 showed that there is no significant interaction effect of treatment and gender on achievement of students with hearing impairment among participants ($F_{(2, 32)}$= 0.121, p > 0.05, η^2 = 0.004). Thus, the null hypothesis is also accepted

Hypothesis 4b: There will be no significant interaction effect of treatment and gender on attitude to basic science of students with hearing impairment.

The results from Table 4.3 showed that there is no significant interaction effect of treatment and gendermong participants ($F_{(2, 21)}$= 1.554, p > 0.05, η^2 = 0.129).Since the value of P>0.05.

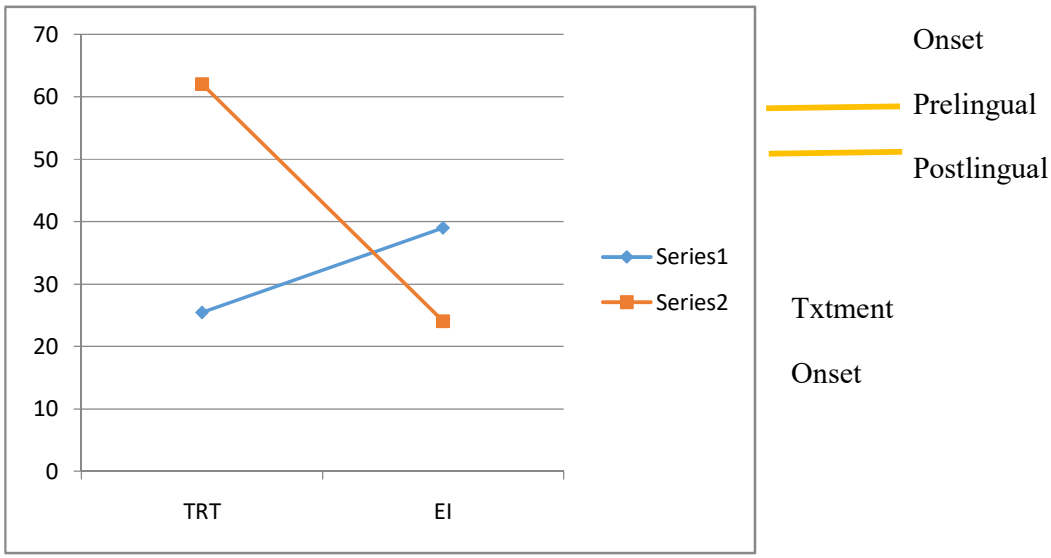
The researcher concludes that there is no significant interaction effect of treatment and gender on attitude of students with hearing impairment. Thus, the null hypothesis eight is also accepted.

4.2.5 Hypothesis 5a: There will be no significant interaction effect of treatment and onset of hearing loss on achievement in basic science of students with hearing impairment.The findings on the interaction effect of treatments and onset hearing loss on achievement of students with hearing impairment in basic science are not significantly interacted. It showed that regardless of time of hearing loss, there is no interaction between the treatment and onset of hearing loss on achievements of students with hearing impairment.The results from Table 4.6 showed that there is a significant interaction effect of treatments and onset of hearing loss on achievement in Basic Science of students with hearing impairment ($F_{(1, 21)}= 5.000$, $p < 0.05$, $\eta^2 = 0.195$) the hypothesis is therefore not accepted.This implies that the interaction of the treatments and onset of hearing loss on achievement in Basic Science of students with hearing impairment has a significant interaction effect in improving Basic Science achievement of students with hearing impairment. Thus, the null hypothesis 5a is also not accepted.

Hypothesis 5b: There will be no significant interaction effect of treatment and onset of hearing loss on attitude to basic science of students with hearing impairment.

The results from Table 4.6 showed that there is a significant interaction effect of treatments and onset of hearing loss on attitude to basic science of students with hearing impairment ($F_{(1, 21)}= 5.089$, $p < 0.05$, $\eta^2 = 0.195$) the hypothesis is therefore not accepted. This implies that the interaction of the treatments and onset of hearing loss on attitude to basic science of students with hearing impairment has a significant interaction effect in improving the attitude to basic science of students with hearing impairment. Thus, the null hypothesis 5b is also not accepted.

Fig 4.1: Graph Showing the Interaction effect between Treatment and On-set of Hearing Impairment



Blue lines stand for treatment while red stands for onset of hearing loss

It is obvious that the participants with pre-lingual deafness have higher score than participants with post-lingual deafness

In a bid to determine the significant difference in mean performance, the Duncan post-hoc analysis is conducted and the result is displayed in Table 4.5

4.2.6 Hypothesis 6a: There will be no significant interaction effect of gender and onset of hearing impairment on achievement of students with hearing impairment to basic science.

The results from Table 4.1 showed that there is no significant interaction effect of gender and onset of hearing loss on achievement of students with hearing impairment to basic science ($F_{(1, 21)}= 0.198$, $p > 0.05$, $\eta^2 = 0.005$). The hypothesis is therefore accepted. This implies that the interaction of the gender (male and female) and onset of hearing impairment has no significant interaction effect on academic achievement of students with hearing impairment to basic science. Thus, the null hypothesis eleven is also accepted.

Hypothesis 6b: There will be no significant interaction effect of gender and onset of hearing loss on attitude to basic science of students with hearing impairment.

The results from Table 4.3 showed that there is no significant interaction effect of gender and onset of hearing loss on attitude to basic science of students with hearing impairment ($F_{(1, 21)}= 0.858$, $p > 0.05$, $\eta^2 = 0.000$) The hypothesis is therefore accepted. This implies that the interaction of the gender and onset of hearing loss has no significant interaction effect in improving attitude to basic science of students with hearing impairment. Thus, the null hypothesis twelve is also accepted.

4.2.7 Hypothesis 7a: There will be no significant interaction effect of treatment, gender and onset of hearing loss on achievement of students with hearing impairment to basic science .

The results from Table 4.1 showed that there is no significant interaction effect of treatment, gender and onset of hearing loss of achievement of students with hearing impairment to basic science ($F_{(1, 21)}= 0.138$, $p > 0.05$, $\eta^2 = 0.002$). The hypothesis is therefore accepted. This implies that the interaction of the treatments, gender and onset of hearing loss of achievement of students with hearing impairment to basic science has no significant interaction effect in enhancing achievement of students with hearing impairment to basic science. Thus, the null hypothesis thirteen is also accepted.

Hypothesis 7b: There will be no significant interaction effect of treatment, gender and onset of hearing loss on attitude to basic science of students with hearing impairment.

The results from Table 4.3 showed that there is no significant interaction effect of treatment, gender and onset of hearing loss on attitude to basic science of students with hearing impairment in enhancing attitude to basic science of students with hearing impairment ($F_{(1, 21)}$= 0.875, $p > 0.05$, $\eta^2 = 0.000$). The hypothesis is therefore accepted. This implies that the interaction of the treatment, gender and onset of hearing loss has no significant interaction effect in improving attitude to basic science of students with hearing impairment. Thus, the null hypothesis fourteen is also accepted.

4.3 Discussion of Findings

4.3.1 Outdoor Classroom and Pictorial Illustration, on Achievement in BasicScience and Attitude to Basic Science Among Student with HearingImpairment.

The study found the main effect of treatment on the achievement in Basic Science among students with hearing impairment. This implies that the treatments have a significant main effect on achievement in basic science.To further establish and determine the actual source of the observed significant main effect in ANCOVA, a Duncan Post Hoc Analysis was carried out on the post-test mean scores of the groups.The post hoc multiple comparisons showed the performance of the participants in all the groups. The direction of decreasing main effect of treatment on the achievement in basic science among students with hearing impairment is pictorial illustration, outdoor classroom, control group. The post hoc multiple comparisons further showed that pictorial illustration was more significant than the outdoor classroom instructional strategy among students with hearing impairment.

The findings of this study corroborates the outcomes and assertions of studies of Ekeke(2007) who reported that that learning strategy improved content learning. This was confirmed bt Thorborn and Allison (2010) cwho submitted that using learner-centred strategies will help ensure that learners learn appropriate skills which will in turn result to improve academic achievement. The assertion by Kelly and Mousley (1998), that the use of multimedia in teaching and learning processes when combined with perfect interpretation through sign language, questioning techniques, and structured lecture materials are important for the expected changes in

academic performances of the students with hearing loss. This aligns with the present finding that learning outcome of students with hearing impairment is enhanced through the use of pictorial illustration.

Previous findings by Lang(2005) and Oladiran(2014) is in agreement with the present study that students taught with pictorial illustration hearing strategy performed better than those taught with a conventional teaching strategy (traditional method). Furthermore, Olatundun (2008) showed a higher adjusted environmental knowledge mean score among pupils who were exposed to outdoor educational activities than that of their counterparts who were taught with the conventional teaching method. Gbadamosi (2012), Saidu and Suleiman (2014), Oladiran (2014), found a positive effect on the educational skill as well as academic achievement of students who were exposed to outdoor classroom than those exposed to the conventional teaching method. The scores recorded in outdoor classroom may be due to the fact that students were taken out of the classroom the places where they could gain first-hand experience and study in a real life setting.Forexample, students with hearing impairment visited zoological garden where they learnt about habitation of plants and animals. It gave the opportunity for teachers, sign language interpreters and students with hearing impairment to interact with the workers and materials in the zoological garden. The result supports the findings of Olatundun(2008), Gbadamosi (2012) and Oladiran (2014) who all reported that outdoor classroom enriched knowledge and enhance cognitive retention and performed better than those taught through a conventional teachers strategy (traditional method).

Moreover, outdoor classroom seems to have offered the participants a great deal of motivation for effective learning. Behavioural psychologists such as Skinner (1986), Dillenburger, Karola and Keenan (2009) emphasized the importance of learners' active participation in the learning activity and gives immediate feedback. Smith and Sobel (2010) affirmed that educational outdoor empowers learners to take ownership of their learning as they move from teacher-mediated learning to a higher psychological functioning. Moreover, Jacob (2018) exposed one group to a conventional teaching strategy and the other hand to pictorial illustration and found that using pictorial illustration had a more significant effect on students' performance than the conventional teaching strategy. Gurajat (2013) examined the significance of pictorial illustration in mathematical learning of students' with disabilities and conventional a strategy and found that the incorporation of concrete –

pictorial abstract strategy to teaching is a great means of increasing the chance of reaching all learners of diverse learning styles and also discovered that it helped the students to gain conceptual knowledge rather than mere procedural knowledge than the conventional strategy used to teach them. Gbadamosi (2012) studied two hundred and sixty four (264) participant in primary five (5) pupil participants in public primary schools in Oyo town of Oyo State and reported a significant effect of outdoor classroom (Educational trip) on students' learning achievement. Her study showed that the participants in the experimental groups outperformed the control one.

However,the lower score obtained in outdoor classroom over pictorial illustration might be attributed to the attitude of some learners with hearing impairment whereas, they took the teachers activities for fun. The findings negate the studies of Gbadamosi (2012) and Oladiran (2014) study who submitted that outdoor classroom enriched knowledge and enhanced cognitive retention Duffin and Peer Associate (2007) study also revealed that students 'learning did not always translate to higher scores on standardized test of academic achievement, they are reflective of forms of competence and learning that are meaningful to parents and students themselves.

In addition, students with hearing impairment in listeners, the control group were passive listener's to the teachers' reservoir of knowledge, as teachers dominated the lesson. This strategy encouraged learners to learn by rote and they were unable to master what they learnt. It also resulted in poor feedback. This can be attributed to what Oladiran (2014), Olatundun (2008), and Mayer (1998) referred to as minimal students' participation usually found in the traditional classroom where teachers' talk dominates classroom interaction. It may therefore be reasonable to contend that outdoor classroom and pictorial illustration instructional strategies encouraged a relatively high level of independence and free flow of information among students with hearing impairment thereby providing active learners participation in the environmental knowledge of students with hearing impairment.

This study found a significant main effect of treatments on the attitude of students with hearing impairment towards Basic Science.This implies that the treatment has significant main effect on the attitude of the participants towards Basic Science. The Duncan post HOC Analysis in table 4.2 showed that the direction of increasing main effect of treatments on the attitude of students with

hearing impairment towards basic science is that attitude of students with hearing impairment in the outdoor classroom and pictorial illustration to basic science are significantly better than those in control group.The result corroborates the findings of Mygind (2009)found that students' social relations improved, experienced less noise, and were more satisfied spending time in the forest than in the classroom. And the report of Onwioduoket and Akinbobola (2005), Akinbobola (2007), Akinbobola (2015) who submitted that there is a relationship between attitude and instruction.

For instance, Fagerstam and Blom (2013) found outdoor classroom to improve students 'social relationship and receive more satisfaction spending time in the forest also several students perceived outdoor and pictorial illustration more stimulating, fun and relevant than their usual schools activities.Similarly, students by Erik(2012), Gbadamosi (2012), Oladiran (2014) showed that instructional strategies gave positive attitude to the environmental education issues of student.This study is in line with Saidu (2014) who reported that outdoor classroom teaching strategy had a significant difference on performance of students which mean outdoor teaching found to influence the academic performance of students who are low achievers and also Adesoji (2008). Oyovwi (2020) published his study on outdoor school activities in Delta State, Nigeria which was a quasi-experimental design found out that there was significant difference in mean achievement scores based on the findings he recommends that science teacher adopt outdoor science activities. Usman (2010) studied effects of indoor and outdoor instructional methods on Academic achievement of Junior Secondary School Integrated Science Students in Zaria found that student performed well in outdoor classroom than indoor classroom.

However, the result negates the work of Fillipattou(1995), Osborn (2001) and Adigun (2017) who found out that attitude of students to science subject had no significant main effect on the instructional strategies used by the teacher.The results on table 4.1b reveal that there is no significant main effect of gender on the attitude of students with hearing impairment towards basic science. This implies that gender has no significant effect on the attitude of students with hearing impairment towards basic science. Therefore, both male and female when compared with each other had no significant difference through their mean scores on their attitude towards Basic Science. This finding supports Nsofor (2001), Akinbobola (2008), Olagunju (2005), Ogunleye (2003), Nkire (2011), Gbadamosi (2012) who found that both male and female have equal attitude towards environmental and science related subjects.

4.3.2 Effect of Gender on Students with Hearing Impairment Achievement in Basic Science and Attitude to Basic Science

The study also found significant main effect of gender on achievement in basic science among students with hearing impairment. This implies that after the participants had been exposed to treatment packages, their academic achievement was influenced by their gender. This study is in line with findings of Adekunle (2005) who reported that female students had the higher environmental knowledge and attitude means scores than their male counterparts. Gifford (1983), Olatundun (2008) and Nkire (2003) who obtained significant interaction effects of treatments and gender. The researchers reported that the male students would do better in school subjects given the use of the concept mapping strategy while the problem-solving strategy would improve female students' achievement tremendously.Osborne (2003), Afuwape and Oludipe (2008) who posited that a significant relationship existed between cognitive, affective and psychomotor domains of male and female learners. Filiz and Semra (2013) also reported that girls appeared to have higher achievement in science compared to boys. This could be attributed to gender stereotyping whereby different roles that are attached to girls and boys influenced their performance .In a contrary developement, Sayid, Onu, Ugwuanyi and Eze (2012), Olagunju (2005), Ogunleye (2003), Gbadamosi (2012) also found that gender had no significant main effect on treatment because female students obtained slightly higher scores than their male counterparts.This could be attributed to the fact that treatments provided equal learning opportunities for both sexes. On the other hand, this finding contradicted the findings of Osborne and Collins (2000) Osborne (2003) and Jones (2000)who claimed that there was a significant gender difference in the attitude of male and females toward science based subject among both student with hearing and hearing impairment. Kehinde (2011) discussed on pictorial advance organizer in science subject among secondary school student he found out that there was main effect of treatment on the dependent measure of cognitive achievement and attitude towards science, which implies that there was significant main effect of gender on cognitive in which the female student performed better than their male counterparts which contradicts this result.

Jones reported that girls and boys have different attitude towards science he also suggested that girls have different experiences outside the school and this affects their attitude. Although females get higher grades in science than their male counterparts. Studies

of Venass and Doris (2006) found that male tends to have positive attitudes towards science and environmental studies while female tended to report treat towards environmental studies. Cornell, Fien, Skyes band Yekenchen (1991) when asked to name the most important environmental studies in Australia, found out that more female students identified endangered animals while more male students mentioned soil erosion and land degradation. Arigbabu and Mji (2004), Macdonald and Hara (2010) in environmental studies reported that there was significant gender difference in environmental knowledge and attitude of male and female students. Saidu (2014) result had no significance differences in the academic of both gender which means whether male or females, there is no influence on academic achievement of the students.Oba and Lawrence (2017) in their study reported that gender had no effect on students' attitude but there was slight achievement in Basic Science result thereby suggested that stakeholder should consider attitude of males and female in the development of curriculum.

4.3.3 Main Effect of Onset of Hearing Loss on Students with HearingImpairment Achievement in Basic Science and Attitude to BasicScience.

The result from table 4.5 shows that there is no significant interaction effect of treatments and onset of hearing impairment on academic achievement of in basic science students with learning impairment. This implies that onset of hearing impairment (prelingual or post lingual) has no significant interaction effect on achievement in basic science among the participants. In other words, hearing impairment as a condition has all-round influence on the scholarstic outcomes of students with hearing loss. Hearing loss has a detrimental effect on the academic achievement of students with hearing impairment due to the inability to communicate verbally or respond to auditory-verbal stimuli. They lack potentials for incidental learning, most especially in science subjects such as biology which requires effective and efficient use of all the sense organs for observation, recording, experimentation, drawing of inferences, and classification.

This finding is in tandem with Moore (2001),Ademokoya (2007) who contended that achievement motivation, gender, parental involvement and not intelligence quotients can also affect academic pursuit of learners with hearing loss. Paddock, O'Neill and Howell (2008) and Oyewumi (2013) who noted that individuals with hearing impairment frequently experience unusual language and communication structures, reduced opportunity for a two-way interaction,

limited access to incidental learning, partial understanding of what is happening around them, low academic performance and difficulty in abstract thinking. Moore (2001) and Johnson (2002) noted that a long-term problem for deaf individual is their academic achievement, particularly in reading.

The result on Table 4.4 reveals that there is no significant main effect on the onset of hearing impairment on the attitude of students with hearing impairment towards basic science. This implies that onset of hearing impairment had no significant effect on the attitude of students with hearing impairment towards knowledge about environment in basic science. The result further reveals that the mean score for post lingual hearing impairment is lower than prelim-gual hearing impairment. This means that pre-linqual, students with hearing impairment had positive attitude towards basic science compared to post-lingually students with hearing impairment towards basic science toward basic science, perhaps because they were not exposed to language at all before they became adolescents or maybe their home environment is rich in language before birth and during growing period. This findings negate the studies of Simpson and Oliver (1990), Lang ((2006), Baldwin, et al (1999) and Adigun (2017) who found out that onset of hearing loss had a significant effect on the attitude of students with hearing impairment towards science subjects and also revealed that students with post lingual hearing loss showed a relatively higher positive attitude towards biology than their counterparts with pre-lingual hearing loss. They also noted that classroom and home environment, prior language knowledge and experience shape the learning process of students with hearing impairment and therefore affects their attitude. Zumach, et al (2010) on the other hand, acknowledged that home environment, and low socio-economic status have more influence on attitude of students with hearing impairment toward basic science.

4.3.4 Interaction Effects of Treatment and Gender on Student with Hearing Impairment Achievement in Basic Science and attitude to Basic Sciences

The study found no significant interaction effect of treatment and gender on achievement in basic science and attitude to basic science among students with hearing impairment.It implies that when treatment and gender interacted in the area of achievements in and attitude to basic science of students with hearing impairment,

there is effect . The post hoc revealed that there is no difference in the gender performance between the outdoor classroom and pictorial illustration groups. This can be interpreted that gender in achievement and attitude is an inconclusive phenomenon. However, Mcmullen (2004) reported that gender differences in achievement have been noted among girls while boys tends to make attributions to ability. Interestingly, this study found out that males students with hearing impairment outperformed females students with hearing impairment in basic science and there attitude to basic science was positive.

Also, the result of this study on the interaction of treatments and gender in achievement and attitude further indicate that there is no interaction between treatment and gender. This findings corroborate the works of Oladapo(2011), Nkire (2011), Gbadamosi (2012) who found out that both male and female have equal achievement and attitude towards science based subjects and environmental issues .Also, Emman's(2013) research finding revealed that female outperformed male students around the world in science because females are more extremely capable in area of science than males.Controversely Bushra, Rabia, Anum and Rukhsana (2016) reported that male students with hearing impairment outperformed female students with hearing impairment may be due to visual spatial advantages and the differences they have on sign language fluency and auditory

This present findings negate findings of Nsofor (2001) ,Osborne and Collins (2000) revealed that girls' rejection of science subject was as a result of their perception that it is a difficult subject and most of their teaching activities and curricula lack demanding activities which inform girls negative attitude to the subject.Vanass and Doris (2006) and Gifford (1983) found that males possess more environmental knowledge in science subject than female counterparts.

4.3.5 Interaction Effect of Treatment and Onset of Hearing Loss on Achievement of Students with Hearing Impairment in Basic Science and Attitude to Basic Science

The findings on the interaction effect of treatments and onset hearing loss on achievement of students with hearing impairment in basic science are not significantly interacted. It showed that regardless of time of hearing loss, there is no interaction between the treatment and onset of hearing loss on achievements of students with hearing impairment whereas in their attitude to basic science there

is interaction between the treatment and onset of hearing loss. This means literarily, there is an interaction on the attitude to basic science, be it pre-lingual or post-lingual hearing loss. On the result of interaction of treatments and onset of hearing loss in basic science achievement of students with hearing impairment.

The highest mean score is recorded with pictorial illustration strategy group followed by outdoor classroom and there is an observed difference between the two groups on measures. The post-lingual hearing loss was measured high when the post hoc is run. This means that the onset of hearing loss has influence on the attitude of students with post-lingual hearing impairment in basic science that were exposed to outdoor classroom and pictorial illustration strategies. It could be interpreted that the attitude to basic science of post-lingual students with hearing impairment is positive. This finding is in support of assertions of Mba (1995) and Bakare (2006) who demonstrated that students with disabilities irrespective of the onset of their conditions were able to learn and have positive attitude to their academics. Also, Heward (2013) reported that individuals with significant degrees of hearing loss do find it too difficult to understand speech, as a result they depend heavily on their sight to engage in communication for academic and non-academic purposes which alone deprive them the opportunity to perform excellently in academics. Okuoyibo(2006)on the other hand indicatedthat persons with mild or moderate degrees of hearing loss (hard-of-hearing) and irrespective of their onset of their hearing loss have issues with their academics, though some degree of hearing loss however could with some amplification can meaningfully engage in verbal communication which can enhance their learning. The late group has better prospect in school learning than the former since a great deal of school instructions are done orally than manually (sign language). Similarly, Kirk and Gallagher (1989) in their study found out thatlearners with hearing impairments have other disabilities with some implications for their school performance. These findings support the study of Johnson (1987) Ademokoya and Shittu (2007) who argued for academic achievement and onset of hearing loss in school children with hearing impairments with additional cognitive or physical disabilities do experience greater academic disadvantages than their colleagues having just hearing disability alone to contend with. So far it could be reasonably adduced that academic performance of school children with hearing impairment is not only consequent on their intelligence quotient or the disability they suffer from other factors such as gender, achievement motivation and the onset of their hearing loss could in addition to other factors earliermentioned account for how these children fair in their academic pursuits.

Lang (2003) reported that academic performance of deaf children often lags behind than their hearing counterparts which invariably affect their academic achievement. He argued that presence or absence of previous language programming of a child with post-lingual hearing loss has educational needs which is different from the child with pre-lingual hearing loss.Ogundiran and Olaosun (2013) conducted a study to compare the academic achievement between students with pre-lingual and post-lingual deafness in a Nigerian college and found no significant difference in the academic achievement between students with deafness though this means that onset of hearing loss is not a major determinants whether or not students with hearing impairments should be exposed to environmental knowledge in Basic Science especiaaly outdoor classroom and pictorial illustration instructional strategy.

4.3.6 Interaction Effect of Gender and Onset of Hearing Loss on Students with Hearing Impairment Achievement in Basic Science and Attitude to Basic Science

The finding of the study shows that there is no Interaction effect of gender and onset of hearing loss on achievement in Basic Science and attitude to Basic Science among students with hearing impairment.No significant interaction effect of gender and onset of hearing impairment on students with hearing impairment achievement in Basic Science among student with hearing impairment was observed in this study.This implies that gender and onset of hearing impairment had no moderating effect on the achievement of students with hearing impairment in Basic Science. In other words, whether students with prelingual or post lingual hearing impairment who are male or female, there was no differences in their achievement in knowledge about environment in basic science.

Ademokoya and Shittu (2007) noted that onset of their hearing loss could, in addition to other factors earlier mentioned, account for how these children fair in their academic pursuits. The study found no significant interaction effect of treatments, onset of hearing impairment and gender on achievement in basic science among student with hearing impairment. Though, onset of hearing impairment and gender are not a major determinant of whether or not students with hearing impairment should be exposed to environmental knowledge in basic science especially under pictorial illustration and outdoor classroom instructional strategies.

In other words, students with hearing impairment should be adequately exposed to real life and learner-centred educational instructions (outdoor classroom and pictorial illustration) that will enhance learning outcomes most especially in basic science and other related science subjects. This finding agree with the work of Olatundun (2008), Oladiran (2014), Gbadamosi (2012), Blair (2009), Chowdbury (2008) and Flexer and Borun (2004) who averted that outdoor classroom usage for teaching and learning cannot be overemphasized. Outdoor classroom gives students with hearing impairment opportunities to learn about real life environmental issues. Palmberg and Kuni (2005) were of view that students who are exposed to outdoor classroom have a stronger relationship with nature and exhibited higher moral than those who were not exposed to such activities Lang (2005) as well as Kelly and Mousley (1998) studied effectiveness of problem-solving and pictorial illustration instructional strategies. They found out that students with hearing impairment primarily learn through the sense of vision and suggest multimedia approaches to enhance factual recall as compared to traditional lecture formats.

The mean score was not statistically significant on the attitude of students with hearing impairment to Basic Science. This implies that both gender and onset of hearing impairment had no interaction effect on the attitude of students with hearing impairment to basic science. The finding supports that of Ogundiran and Olaosun (2013) who said that whether congenital or acquired male or female with hearing impairment, they had no interaction effect with the attitude of students with hearing impairment to science subjects. Osborne and Collins (2000) reported that girls rejection of science was as a result of their wrong/negative perception about science based subjects.

It also revealed that both gender and onset of hearing loss on achievement in and attitude to Basic Science had no significant interaction effect towards Basic Science when exposed to the treatments. This implies that whether male or female and pre-lingual or post-lingual hearing loss had no significant interaction effect on the treatment . this findings confirmed the study of Okuoyibo (2006) who reported that children with hearing impairment do experience greater academic disadvantage. Also, attitude of a learner toward any subject (Basic Science) inclusive will determine the measure of the learner's attractiveness or repulsiveness to the subjects. Adebowale (2000) found that lack of interest in Basic Science makes it difficult for teachers to impart pertinent knowledge to learn the subjects. On the onsetof hearing loss, Moss (1995) reported early and consistent use of a system of total

communition serves as a spring board for intellectual development and subsequent academic achievement.

4.3.7 Interaction Effect of Treatment, Gender and Onset of Hearing Loss on Students with Hearing Impairment Achievement in Basic Science and Attitude to Basic Science

The study found out that there is no significant interaction effect of treatments, gender and onset of hearing loss on students with hearing impairment achievement in Basic Science and attitude to Basic Science. The result indicated that the interaction of the three variables is not significantly inter-related on both achievement and attitude of students with hearing impairment in Basic Science. The result also shows that onset of the hearing loss, whether pre-lingual or post-lingual, or male and female in both groups is not interacted.

The results from Table 4.4 showed that there was no significant interaction effect of treatments, gender and onset of hearing impairment on the attitude to basic science of students with hearing impairment. This means that if the same treatment is given to the males and females with hearing impairment irrespective of their onset of hearing impairment similar results would be achieved in their attitude to basic science. It also means that onset of hearing loss and gender are not major factor that determine achievement in and attitude to Basic Science among students with hearing impairments when exposed to outdoor classroom and pictorial illustration. In other words, students with hearing impairment should be adequately exposed to learner centred educational instruction such as the pictorial illustration and outdoor classroom that will enhance learning outcomes of students irrespective of their hearing level of onset of hearing impairment in Basic Science. This may be the reasons the philosophers of science such as Kinchin (2000), Reed (2010), Ajaja (2011) and Madden (2013) rejected the traditional ways of teaching science Oladapo (2011) and Gbadamosi (2012) found no significant interaction effect of treatment, gender and school location on environmental knowledge, attitude and practice. The outdoor classroom and pictorial illustration strategies are more effective for pre-lingual and post-lingual male and female students with hearing impairment than the conventional method of teaching.Also Nsofor (2001) and Akinbobola(2008) observed that both males and females could do well in science if exposed to similar learning conditions. The development of pictorial illustration and outdoor classroom are efforts are to improve science education among students with hearing

impairments. Furthermore previous studies on student related factors are focused on predisposing factors is an indication that science teachers educator search for meaningful solution to problems facing students with hearing impairment in learning scientific concepts.

The result is further explained that male gender achievements score is higher than their female counterparts; as male can vividly do better than female in academic achievement in science while female followed them. It can also be concluded that male gender when exposed to similar treatment can do better in academic achievement in Basic Science than their female counterpart. Therefore, these findings support the report of Nwagi (2011) wherein males have higher attitude score achievement than female students in upper Junior Secondary School. Eskay, Onu, Ugusuanyi and Eze (2011) report revealed that regardless of the gender, gender has no significant influence on academic achievement of pupils with hearing impairment. Adigun (2017) studied onset of hearing loss and attitudes of student with hearing impairment towards the study of Biology reported that there is no significant interaction effect of treatment and onset of hearing loss on the attitude of students with hearing impairment in Science (biology) which means that pre-lingual and post-lingual students with hearing impairment when exposed to similar treatment had no significant interaction effect. It is because the two groups have different potential and oppurtunities to learn just as it's requires different teaching method, curricular and facilities.

4.4 Summary of Findings

The result can be summarized as

There was a significant main effect of treatments, attitude and gender on achievement in basic science among students with hearing impairment. Although, the result shows no significant main effect of gender on attitude to basic science among students with hearing impairment. Moreover, the main effect of onset of hearing impairment on achievement in basic science among students with hearing impairment was not significant. However, the main effect of onset of hearing impairment on attitude to basic science among students with hearing impairment was signifncant.

The findings also revealed that there was no significant interaction effect of treatment and gender in the achievement in basic science among students with hearing impairment. It shows that interaction effect of treatment and gender on attitude to attitude to basic science among hearing impairment was not signifncant. Further observation shows that there was no significant interaction effect of treatment and onset of hearing impairment on achievement in basic science among students with hearing impairment. There was a significant interaction

effect of treatments and onset of hearing impairment on attitude to basic science among students with hearing impairment. The interaction effect of gender and onset of hearing impairment on achievement in basic science among students with hearing impairment was not significant.

Results from the study shows that there was no significant interaction effect of treatment, gender and onset of hearingimpairment on attitude to basic science among students with hearing impairment. There were no significant interaction effect of treatment, gender and onset of hearing impairment on achievement in basic science among students with hearing impairment.There were no significant interaction effects of treatments gender and onset of hearing impairment on attitude to basic science among students with hearing impairment.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

This chapter provides a link with the previous researches in order to give a concise thoughtby summarising the research work, concluding and giving appropriate recommendations

5.1 Summary

This study critically investigated the pictorial illustration and outdoor classroom instructional strategies as determinants of learning outcomes (that is achievement in and attitude towards basic science) among students with hearing impairment in Ibadan, Oyo State, Nigeria. The study specifically deal with environmental concept (living things and non-living things in the environment) and chemicals in basic science and the learning outcomes of the participants were viewed from perspectives of achievement in and attitude towards basic science. The study adopted the pre test-post test control group quasi experimental design.

Thirty (30) students with hearing impairment was purposefully selected while simple random technique was used to select three schools used for the study. Four instruments were also used for data collection. Data collected were analysed using Analysis of Covariance with the pretest scores used as covariates. The Duncan post hoc was also used to determine the source of such a significant difference. A graph was used to interpret significant interaction effects. Fourteen (14) hypotheses guided the study which were tested at 0.05 level of significance. The major findings of the study showed that the treatment outdoor classroom and pictorial illustration strategies are effective in enhancing academic achievement of students with hearing impairment Pictorial illustration is better in enhancing academic achievement of students with hearing impairment. There is no gender effect on attitude towards basic science among students with hearing impairment and there was interaction effect of treatmenst and onset of hearing loss on attitude to basic science among students with hearing impairment.

5.2 Conclusion

The study determined the effect of outdoor classroom and pictorial illustration strategies as determinants of learning outcomes in Basic Science of students with hearing impairment in Ibadan, Oyo State, Nigeria.(It measured learning outcomes from two different views which were achievement in Basic Science and attitude of students with hearing impairment towards Basic Science). The study also explored the moderating effects of gender and onset of hearing impairment on learning outcome of students with hearing impairment in Basic Science. Based on the findings, it is concluded that, Pictorial illustration strategy is more effective of the two strategies because pictures transform texts into a representation which is more memorable and can also motivate emotional responses like enjoyment and attitude. Gender have significant effect on Basic Science achievement especially male students with hearing impairment but not on attitude to Basic Science. The study also found a significant main effect of onset of hearing impairment on attitude of students with hearing impairment in Basic Science.

5.3 Recommendations

Based on the findings of this study, it is recommended that:

1. Teaching and learning activities in the classroom should involve pictorial illustration which will enhance academic achievements of students with hearing impairment and motivate their learning.
2. Students with hearing impairment in basic science classrooms and other science subjects should be motivated to participate in outdoor activities such as outdoor classroom high quality graphic design and photographic illustration usage so as to make teaching and learning effective and enhanced academic achievement.
3. Special education teachers should adopt pictorial illustration and outdoors classroom in teaching learning about the environment and its concept to students with hearing impairment in Basic Science instead of using conventional method of staying in the classroom They should take the students to the environment for site seeing and picture illustration for better learning outcome.
4. Teachers should consider gender of student with hearing impairement interms of Basic Science achievement when teaching in the class.
5. There should be special provision for outdoor classroom in the school timetable, particularly in the morning and it should be designed as part of school programme.
6. Apart from pictures in the textbooks, there should be connectivity to the internet whereby teachers can access digital web-based design and pictorial illustration to teach and enhance

academic achievement and promote positive attitude to learning sciences by students with hearing impairment.

7. Teachers and curriculum planners should note that onset of hearing impairment is an important variable that enhances learning outcome of students with hearing impairment.

5.4 Implication of Findings

1. The study exposed students with hearing impairment to hand on activities and learner-centred instructional strategies using pictorial illustration and outdoor classroom instructional strategies which aided effective learning outcomes in Basic Science. The study showed Basic Science is better taught using pictorial illustration and outdoor classroom strategies than the conventional method in Junior Secondary School. The higher performance of students with hearing impairment exposed to pictorial illustration and outdoor classroom has implication for teaching Basic Science concepts which increases the learner active involvement in the teaching-learning process. These teaching strategies make learning interesting especially among students with hearing impairment, and inculcate positive attitude to Basic Science.
2. The study also showed that there is the need to create teaching strategies on real world experience like outdoor classroom to facilitate meaningful understanding of Basic Science among students with hearing impairment. The study revealed the need for teacher and educational administrators to take cognizance of the influence of onset of hearing impairment on the learning outcomes of students with hearing impairment.The study has revealed that gender had significant effects on learning outcomes of students with hearing impairment. This means that academic achievement of students with hearing impairment is determined by methods of teaching used by thwe teacher Hence, there is need for teachers to be re-oriented on the use of participatory community based strategies teaching and learning to enhance academic achievement in basic science among students with hearing impairment.

5.5 Contribution to Knowledge

The thesis contributed to the body of existing knowledge in the following ways:

1. The two instructional strategies (Outdoor Classroom and Pictorial Illustration Instructional strategies effectively enhance the learning outcomes of students with hearing impairment

in Basic Science). However, Pictorial Illustration Instructional strategy is more potent when compared with the Outdoor Classroom Instructional Strategy.

2. The study showed that onset of hearing impairment had significant influence on learning outcomes of students with hearing impairment irrespective of their gender.
3. The study also showed that gender had significant main effect on achievement in basic science of students with hearing impairment.
4. The instructional strategies (Pictorial illustration and outdoor classroom strategies) are 21st classroom compliant in terms of access to quality digital images in web-based materials and high quality of graphic diagrams and photographic illustration which arouse the interest of student with hearing impairment to learn basic science and ability of the students with hearing impairment to engage in hand on real world activities in the outdoor classroom teaching and learning as a learner-centred approach. This is connected with Chinese saying "What I heard I forget but what is seen and practise remember".

5.6 Limitation of the study

This study was limited in scope to students with hearing impairment in Ibadan, Nigeria. More data would have been retrieved if a wider scope was used for the study. Also, disruption of normal classes experience during the outdoor classroom andlack of uniform sign language in scientific concept is a limitation. It took a lot of time to convince parents to release their wards for outdoor classroom. Also, it took time for the teacher and sign language interpreter to get attention of students with hearing impairment because they took the outdoor classroom for fun.

5.7 Suggestions for Further Studies

This study has generated insights for further researchers into the effects of pictorial illustration and outdoor classroom instructional strategies as determinants of learning outcomes of students with hearing impairment in basic science in Ibadan, Oyo State, Nigeria, Further researchers should endeavour to replicate the study in primary school, private school for the deaf in Southwest Nigeria so that the generalizations could be made. Additional research works could investigate moderating effect of parents socio-economic status, self-efficacy and teacher's factors.

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APPENDIX I

UNIVERSITY OF IBADAN

FACULTY OF EDUCATION

DEPARTMENT OF SPECIAL EDUCATION

BASIC SCIENCE ACHIEVEMENT TEST

Section A: Personal Data of the Participant

Name:

Gender:

Onset of Hearing Loss: Pre-lingual ( ), Post- lingual ( )

Section B

Instruction: Tick the appropriate option from letter A -D

1. Which of these is not a living thing? (a) Mango tree (b) Snake (c) Dog (d) Bottle
2. The branch of basic science that studies plants and animals is (a) Physics (b) Chemistry (c) Biology (d) Zoology
3. The process by which green plants produce food is called
   (a) Nutrition (b) Photosynthesis (c) Excretion (d) irritability
4. Ability of living things to get rid of waste product of
   (a) Reproduction (b) Respiration (c) Excretion (d) Movement
5. One of the two major habitats where living things live is (a) Sky habitat (b) Sun habitat (c) Terrestrial habitat (d) Moon habitat

6. The above picture is an example of _____ habitat
   (a) Terrestrial (b) Arboreal (c) Aquatic (d) Celestial
7. The picture below is an example of _____ (a) Pharmaceutical chemical use (b) Industrial chemical use (c) Laboratory chemical use (d) Agricultural chemical use

8. The picture below is an example of _____ habitat

(a) Terrestrial (b) Ocean (c) Aquatic (d) Celestial

9. A ---------- is a place where organisms live (a) sulphur (b) habitat (c)rubber (d) pencil
10. Special features which help organisms to survive in a particular habitat are called
    (a) Colony (b) adaptation (c) living (d) land
11. Non-hazardous and Non-toxic chemicals are chemicals that have no negative effect when they come into contact with the body. Yes or No
12. The picture below shows the adaptation of plant and animal in _____
    (a) Desert (b) Forest (c) Southern Guinea Savannah (d) Tropical rain forest

13. One of the characteristics of living things is:
    (a) they have metal property (b) cannot move from one place to another (c) they can move from one place to another (d) they lack intelligence
14. Human beings are unique because they are _____ animals
    (a) Intelligent (b) Dull (c) Wild (d) Aquatic
15. Among the animals only human beings have the ability for _____ and _____
    (a) Reproducing and excreting (b) reasoning and problem solving (c) respiring and growing (d) photosynthesizing and digesting
16. Aquatic habitats are all the bodies of water where living organisms live. Yes or No

17. The above picture shows _____ (a) Relationship between animals in the same habitat (b) Relationship between plants in the same habitat (c) Relationship between plants and animals (d) Relationship between species in different habitat

18. Example of highly hazardous and toxic chemicals is_____

(a) Water (b) iced-block (c) tea (d) carbon monoxide

19. The above picture shows _____

(a) Astronaut (b) Scientist preparing laboratory chemicals (c) A Mechanic

(d) An Engineer

20. A chemical is an element that has a specific molecular composition and may be produced during a natural process.

Yes or no

21. Frogs and Toads are described as amphibians because they can live on land and water.

Yes or No

22. Classes of chemicals include _____

(a) Solid (b) liquid (c) classification based on use hazardous nature (d) classification based on chair

23. The human brain enables human beins to _____

(a) eat, clap and dance (b) think, clap and dance (c) think, reason, dance, remember, solve problem, communicate (d) dance, reason and eat

24. Living things (animals) that feed on flesh and plant are called

(a) Omnivores (b) carnivores (c) herbivores (d) scavengers

25. Moderately hazardous and toxic chemicals are _____

(a) insecticide (b) fertilizer (c) chemistry (d) A & B

26. The major characteristics of non-living things is

(a) they grow rapidly (b) they do not grow (c) they grow occasionally (d) they make living thing grow

27. Plants and animals possess certain features which make them adapt to either aquatic, terrestrial or arboreal.

Yes or no

28. _____ higher animal which brain (a) Primate (b) Aves (c) Amphibian (d) Arboreal

29. The chemical used in the production of pharmaceutical and cosmetic products is._____(a) glycerine (b) zinc oxide (c) menthol (d) all of the above.

30. Agrochemicals are substances used to manage an agricultural ecosystem such as fertilizer, herbicides, insecticides, pesticides and soil conditioners.

Yes or no

31. Arboreal habitat is also air habitat.
    Yes or no
32. Aquatic plants include spirogyra, Pandoma.
    Yes or no
33. Plant stores carbohydrate as starch while animasl store carbohydrate as ----------
    (a) Glucose (b) fructose (C) glycogen (d) starch
34. Pawpaw tree, orange tree, cashew tree and mango tree are examples of terrestrial plants
    Yes or no
35. Changes in which new substances are formed are referred to as
    (a) Chemical change (b) biological changes (c) physical changes (d) art changes
36. All of the above are subdivision of terrestrial habitat except _____
    (a) Tropical rain forest (b) southern guinea savannah (c) Burkina Faso guinea (d) Desert

Fill in each of the gapsin 37-39 with any of the items that is appropriate. Choose from the following – Changes, sizes, weight, height, basic, apt.

Growth changes are measured in 3 ways namely:

37. _____
38. _____
39. _____
40. Chemical changes in non-living things produce new substances
    True or false
41. _____ is a series of orderly changes by which living things come into maturity
    (a) Growth (b) Development (c) Respiration (d) Digestion
42. _____ is an increase in size of an organism due to increase in number of cells.
    (a) Development (b) Childhood (c) Population (d) Growth
43. Growth stops at _____
    (a) Adulthood (b) Baby (c) Childhood (d) Adolescence
44. Human beings are higher animals because of the presence of backbone
    Yes or No
45. Primates are higher animals which have large brains, forwards, facing eyes nails and grasping thumbs facing other fingers.
    Yes or No
46. During the period of puberty _____ and _____ are observable
    (a) agency and grey hair (b) gradual decline in body functions and no changes in size and weight (c) growth and development (d) decline in body organ and reduced elasticity of the skin

47. All of the above are examples of temporary changes that occur during developmental changes except (a) breathing (b) bedwetting (c) sweating (d) pimples in male and female at adolescence

48. The following are safety measures when using chemicals except.

(a) Adherence to the manufacturer safety instructions (b) Any spill of chemical must not be carefully cleaned (c) waste products and disposals must be discharged with proper neutralization (d) Ensuring proper labelling and storage chemical

49. ------ are chemicals used in all kinds of industries. (a) Industrial chemicals (b) Irritability chemicals (c) Pharmaceutical chemicals (d) Laboratory chemicals

50. -------- are examples of industrial chemicals.

(a) Food activities, surfactants, carbonates, alcohol(b) Acid, sulphate

(c) Hypochlorite (d) All of the above.

ANSWER/ MARKING GUIDE FOR BASIC SCIENCE ACHIEVEMENT TEST

(1) E- Bottle
(2) C- Biology
(3) B- Photosynthesis
(4) C- Excretion
(5) C- Terrestrial habitat
(6) C- Aquatic
(7) B- Industrial Chemical use
(8) A- Terrestrial
(9) B- Habitat
(10) B- Adaptation
(11) Yes
(12) A- Desert
(13) C- Can move from one place to another
(14) A- Intelligent
(15) B- reasoning and problem solving
(16) Yes
(17) A- Relationship between animals in the same habitat
(18) D- Carbon monoxide
(19) B- Scientist preparing laboratory chemicals
(20) Yes
(21) Yes
(22) C- Classification based on use and hazardous nature
(23) C-Think reason, dance, remember, solve problem
(24) A- Omnivores
(25) D- A and B
(26) B- They do not grow
(27) Yes
(28) A- Primate
(29) D- All of the above
(30) Yes
(31) Yes
(32) Yes
(33) C- Glycogen
(34) Yes
(35) A- Chemical
(36) C- Burkina Faso Guinea
(37) Size
(38) Weight
(39) height
(40) True
(41) B- Development
(42) D- Growth
(43) A- Adulthood
(44) Yes
(45) Yes
(46) C - Growth and development
(47) D- Pimples in males and female at adolescence
(48) B- Any spill of chemical must not be carefully cleaned
(49) A- Industrial chemicals
(50) D- All of the above

APPENDIX II

UNIVERSITY OF IBADAN

FACULTY OF EDUCATION

DEPARTMENT OF SPECIAL EDUCATION

STUDENTS' ATTITUDE TO BASIC SCIENCE QUESTIONNAIRE (SABSQ)

Introduction: This questionnaire seeks to investigate the attitude of students to Basic science

Instruction: The following statements are based on student attitude to Basic science. Please read the statement and give your opinion by ticking (√) the appropriate column against each statement. There are four options ranging from strongly agree (SA), agree (A), disagree (D), to strongly disagree (SD)

S/No	Statement/Item	SA	A	D	SD
1	Basic science is interesting to me				
2	I like Basic science more than other subjects				
3	I would like to have Basic science lessons more often				
4	I always get nervous working with living organisms in Basic science class				
5	I hate Basic science				
6	Nobody needs Basic science knowledge				
7	Basic science is one of the easiest subject				
8	I have difficulties often in understanding what we have learnt in Basic science class				
9	Basic science is not important in comparison with other subjects				
10	I prefer attending other subject classes to Basic science class				
11	Basic science knowledge is essential for understanding other related subjects and phenomena				
12	I would like to further my education in Basic science- related courses				
13	The progress of Basic science improves the quality of my live				
14	I like the way how Basic science is being taught in our school				
15	Working with organisms makes Basic science class enjoyable				

APPENDIX III

INSTRUCTIONAL GUIDE ON PICTORIAL ILLUSTRATION INSTRUCTIONAL GUIDE

WEEK 1

Topic: Learning about our environment

Sub-topic: Habitat

References Book: FOC NDU and Somoye, S. O. (2013). Basic Science for Junior Secondary Schools 2. Lagos: Longman Nigeria. Page 58-75

Instructional Materials: Charts, Pictures showing Habitat of living things

Behavioural Objectives: A the end of the lesson, students should be able to:

i. Define habitat
ii. Identify three examples of living things/organisms found in the habitat
iii. Describe features of organisms found in the habitat

Learner's Entery Behaviour:

The students are familiar with some of the examples of living things in the environment

Presentation

Step 1: The teacher asks questions on living things in the environment to before the starting lesson.

Step 2: The teacher introduces the topic to the students.

Step 3: The teacher explains the meaning of habitat to the students.

Step 4: The teacher shows different types of habitat for the students to see.

Step 5: The teacher discusses the examples of habitat to the students.

Step 6: The teacher shows pictures of different plant habitations the teacher helps the students in identifying different groups of plants in terrestrial habitation and aquatic habitat.

Step 7: The teacher explains the examples of animals in their habitat to the students. Animals can be grouped into pets, farm animals and wild animals. Examples of pets are: cats, dogs, etc. Examples of farm animals are goat, sheep, cow, hen, rabbit, mouse, grass cutters, etc.

Examples of wild animals are lion, tiger, leopard, snake, elephant, etc.

Step 8: The teacher helps the students in identifying different types of animals' habitation in the pictures and allows them to see such by themselves e.g Aboreal habitat animal eg monkey. Aquatic habitat e. g fish, turtle etc

Step 9: The teacher allows the student to copy note on the chalkboard.

Step 10 : The teacher goes round to check the students work.

EVALUATION: The teacher asks the questions on the topic taught as follows:

i. List and discuss two major habitats.

WEEK 2

INSTRUCTIONAL GUIDE ON PICTORIAL ILLUATRATION INSTRUCTIONAL GUIDE

Topic: Learning about our environment

Sub-topic: Adaptation of living things in their environment

Time: 40 minutes

References Book: FOC NDU and Somoye, S. O. (2013). Basic science for Junior Secondary Schools 2. Lagos: Longman Nigeria.

Instructional Materials: Colourful charts, pictures, laptop/projector

Behavioural Objectives: At the end of the lesson, students should be able to:

i. Define adaptation
ii. List various adaptive features of living things in their habitat
iii. State species of plants and animals found in a particular habitat.

Learner's Entery Behaviour

The students are familiar with the examples of plants, and animals living in their different habitats.

Step 1: The teacher introduces the topic to the students.

Step 2: The teacher displays charts and shows students picture of different plant and animals from their adaptations

Step 3: The teacher asks students to study the pictures displayed and identify how they are adapted to their environments.

Step 4A: The teacher displays pictures of adaptation of animals and plant to different environments and weather.

Step 4B: The teacher defines adaptation

Step 4C: The teacher lists and explains the various adaptive features of the living thing in their habitat.

Step 5: The teacher explains the different samples of species of plants and animals that shows the different species of plants and animals living in particular habitats.
Step 6: From the different plant and animal adaptation that were shown, the teacher helps the students to identify them.

Step 7: The teacher asks the students to notes from the board

Step 8: The teacher goes around the class to supervise the students while copying the note given to them.

Step 9: The teacher corrects students' and asks the students some questions.

Step 10: Students write down assignment

Evaluation: The teacher asks questions on the topic taught as follows:

i. Why do plants live on water do not depend on their root?
ii. Discuss special features that enable fish to live in water
iii. Identify plants and animals and discuss the nature of soil/water they live in.

INSTRUCTIONAL GUIDE ON PICTORIAL ILLUSTRATION INSTRUCTIONAL GUIDE

WEEK 3

Topic: Learning about our environment

Sub-topic: Characteristics of organisms in the same habitat and what they have in common

References Book: FOC NDU and Somoye, S. O. (2013). Basics Science for Junior Secondary Schools 2. Lagos: Longman Nigeria. Page 68

Instructional Materials: School environment, colourful chart, pictures, laptop,/projector

Behavioural Objectives: A the end of the lesson, students should be able to:

i. Discuss characteristics of plants and animals in the same habitat.
ii. List examples of plants and anima in each habitats

Learner's Entry behaviour: The students are familiar with the examples of plants and animals in different habitats.

Step 1: The teacher asks questions on previous lessons.

Step 2: The teacher introduces the topic and selects concepts required to teach the students.

Step 3: The teacher shows different adaptations of plants and animals in their environments.

Step 4: The teacher defines adaptation to the students.

Step 5: The teacher lists and explains the different adaptations to the students and again shows the pictures of different adaptations..

Step 6: The teacher gives characteristics of terrestrial plants that live on land.

Step 7: The teacher allows the students to ask questions.

Evaluation: Teacher asks questions on the topic taught as follows:

State two adaptations in:

(a) A named aquatic plant

(b)A named terrestrial plant

ASSIGNMENT

(c) A named desert plant

(d) A named aquatic animal

WEEK 4

INSTRUCTIONAL GUIDE ON PICTORIAL ILLUSTRATION

Topic: Learning about our environment

Sub-topic: Relationship between organisms in the same habitat

References Book: FOC NDU and Somoye, S. O. (2013). Basic science for Junior Secondary Schools 2. Lagos: Longman Nigeria.

Instructional Materials: Colorful charts, Pictures, Laptop/projector

Behavioural Objectives: A the end of the lesson, students should be able to:

i. Identify relationship between organism living in the same habitat
ii. Give examples of features they have in common

Learner's Entry behaviour

The students are familiar with living organisms

Step 1: The teacher introduces the topic organisms' relationship to the students

Step 2: The teacher displays charts and shows students pictures of animals that live on land and water

Step 3: The students study the picture displayed

Step 4: The teacher explains and shows the pictures containing relationship between animals in savannah and process of animals that live on trees in the forests and their adaptation.

Step 5: The teacher shows examples of animals that live in the forest e.g. snakes, monkeys

Step 6: The students copy note from the board

Step 7: The teacher goes round to supervise the pupils while copying note given to them

Step 8: The teacher corrects students' mistakes where necessary

Step 9: The teacher answers students' questions

Evaluation: The teacher asks questions on the topic taught as follows:

i. What is the difference between arboreal and terrestrial animals?

ii. Give examples of animals that flies

iii. Write five (5) forest animals and two (2) arboreal animals

WEEK 5

INSTRUCTIONAL GUIDE ON PICTORIAL ILLUSTRATION

Topic: Learning about our environment

Sub-topic: Uniqueness of human beings

References Book: FOC NDU and Somoye, S. O. (2013). Basics Science for Junior Secondary Schools 2. Lagos: Longman Nigeria.

Instructional Materials: Colourful charts, pictures, laptop/projector

Behavioural Objectives: At the end of the lesson, students should be able to:

i. Explain human beings
ii. Define primate

Learner's Entry Behaviour;

The students have seen chimpanzee, monkey, man before

Presentation:-

Step 1: The teacher introduces the topic to the students

Step 2: The teacher displays charts that shows man and animals to the students

Step 3: The students study the pictures displayed and identify the pictures

Step 4: The teacher lists the characteristics of man to the students in the picture

Step 5: The teacher shows the pictures of animals in order to explain the characteristics to them e.g. anima cannot stand upright

Step 6: The teacher shows the pictures of animals and human beings together that show how human being grasp things in their hands

Step 7: The teacher explains primate as animals which have large brains, forwards, facing eye, nails, and grasping thumb facing other fingers.

Step 8: The teacher asks questions from the students

Step 9: The teacher allows the students to copy notes

Evaluation: Teacher asks questions on the topic taught as follows:

i. Define primate animals
ii. Give examples of primates animals

Assignment

What made human being unique from other animals?

WEEK 6

INSTRUCTIONAL GUIDE ON PICTORIAL ILLUSTRATION

Topic: Learning about our environment

Sub-topic: Human beings as intelligent animals

References Book: FOC NDU and Somoye, S. O. (2013). Basic Science for Junior Secondary Schools 2. Lagos: Longman Nigeria.

Instructional Materials: Colourful charts, pictures, laptop/projector

Behavioural Objectives: At the end of the lesson, students should be able to:

i. State human being characteristics that make him unique
ii. List the functions of brain

Learner's Entry Behaviour: Students are human being too

Presentation

Step 1: The teacher introduces the topic to the students

Step 2: The teacher displays charts, pictures showing the brain of human being and animals to the students

Step 3: The teacher via sign language interpreter, explains both human being and animals' brain to the students

Step 4: The teacher list the usefulness of the brain of man

Step 5: The teacher shows pictures that show intelligent skills of human being

Evaluation: The teacher evaluates the lesson by asking the following questions from the students

1. X-ray the function of human brain
2. Discuss the difference between human brain and animal brain

WEEK 7

INSTRUCTIONAL GUIDE ON PICTORIAL ILLUSTRATION

Topic: Chemicals

Sub-topic: Classes of chemicals uses and hazardous

References Book: FOC NDU and Somoye, S. O. (2013). Basic Science for Junior Secondary Schools 2. Lagos: Longman Nigeria.

Instructional Materials: Colourful charts, pictures, laptop/projector

Behavioural Objectives: At the end of the lesson, students should be able to:

i. Explain human being
ii. Define primate

Learner's Entry Behaviour: Learners are familiar with some drugs

Presentation:

Step 1: The teacher introduces the topic to the students

Step 2: The teacher shows the pictures containing various chemicals and explains what chemical is all about

Step 3: The teacher shows the pictures of someone using chemical for different purposes e.g. the agricultural use, industrial use, pharmaceutical use, etc.

Step 4: Sign language interpreter explains the uses of chemicals that was shown as explained to the students

Step 5: The teacher shows sign of danger and safety measures of chemicals to the students

Step 6: The teacher gives room for questions from the students

Evaluation: the following questions are asked

i. Itemize the uses of chemicals
ii. Explain the factors to consider when using dangerous chemicals

WEEK 8

INSTRUCTIONAL GUIDE ON PICTORIAL ILLUSTRATION

Topic: Changes in Living things

Sub-topic: Growth and development

Duration: 40 minutes

References Book: FOC NCU and Somoye, S. O. (2013). Basic Science for Junior Secondary Schools 2. Lagos: Longman Nigeria.

Instructional Materials: Colourful charts, pictures, laptop/projector

Behavioural Objectives: At the end of the lesson, students should be able to:

i. Explain growth
ii. Define development

Learner's Entry Behaviour: Students are familiar with newborn babies

Presentation:

Step 1: The teacher introduces the topic to the students

Step 2: The teacher displays the pictures showing the baby at infant stage

Step 3: The teacher explains the meaning of growth: Growth is increase in size of an organism due to increase in number of cells

Step 4: The teacher shows pictures of the child at infancy, adolescent children and adulthood to the students and also explains their developmental stages

Step 5: The teacher explains their developmental stages

Step 6: The teacher shows the pictures of growth and explains that they are measures in size, weight, and height

Step 7: The teacher allow students to ask questions

Evaluation: The teacher evaluation by asking the following

1. Growth stops at _____

a. Adulthood. (b). baby, (c) childhood (d) adolescence

2. During the period of puberty, mention two things that are observable

Conclusion: The teacher concludes the topic by explaining the key points again.

APPENDIX IV

PROCEDURE FOR EXPERIMENTAL

GROUP 2: OUTDOOR CLASSROOM STRATEGY

WEEK 1

Lesson 1

Topic: Learning about our environment

Subtopic: Habitat

Duration: 60 minutes

Instructional Objectives:

At the end of the lesson, students should be able to:

(1) Define habitat
(2) Identify the living organisms found in the different habitats
(3) List the distinguishing features of organisms found in the different habitats.

Procedure:

Phase 1: Preliminary phase (Before the outdoor classroom) (15 minutes)

Teacher's activities

Step I: The teacher takes attendance of the students

Step II: The teacher discusses the topic with the students

Step III: The teacher presents the purpose of the outdoor classroom to the students.

Step IV: The teacher gives background information by describing specific features to observe the outdoor classroom.

Step V: The teacher through sign language interpreter informs students to jot down information received during the outdoor classroom.

Phase 2: Teacher's / Interpreter's / Students activities (outdoor classroom) (45 minutes)

Step I: The teacher conveys the students with hearing impairment to the sites

Step II: The teacher guides students with hearing impairment look for habitation on each plant and animal

Step III: The students ask questions from the teacher

Teacher's / Interpreter's / Student's activities (Post outdoor classroom)

Step I: The students present and discuss their observations from the site visited.

Step II: The teacher evaluates the students by asking question: e.g. List and discuss two major habitats.

Home work: Discuss the adaptation of plants in relation to water.

WEEK 2

Lesson 2

Topic: Learning about our environment

Subtopic: Adaptation of Living Things in their environment

Duration: 60 minutes

Instructional Objectives:

At the end of the lesson, students should be able to:

(i) Define adaptation

(ii) State various adaptive features of living things in their habitats

(iii) List species of plants and animals found in a particular habitats.

Procedure: Phase 1: Preliminary phase (Before the outdoor classroom) 15 minutes

Teacher's / Interpreter's activities

Step I: The teacher takes attendance of the students

Step II: The teacher defines and discusses the adaptation of living things in their environment

Step III: The teacher states various adaptive features of living things in their habitat.

Step IV: The teacher through the sign language interpreter's also explains the adaptation of plant and animal in the habitat.

Phase 2: Teacher's / Sign language / Interpreter's / Students with hearing impairment activities (45 minutes)

Step I: The teacher identifies the land habitat near the school and students are taken to the land habitat identified.

Step II: The students were allowed to observe the size of the habitat, measure the length and width of the area to be studied by measuring tape.

Step III: Students with hearing impairment were asked to identify plants and animals and nature of soil they see in the area.

Phase 3: Post outdoor classroom

Step I: Students with hearing impairment were asked on the observed activities and teacher summarise their observation

Step II: Teacher evaluates the lesson by asking questions on what they have jotted and observed e.g. why do plant that live on water do not depend on their root?

Home work: Discuss special features that enable fish to live in water.

WEEK 3

Lesson 3

Topic: Learning about our environment

Subtopic: Characteristics of organisms in the some habitat and what they have isn common

Duration: 60 minutes

Instructional Objectives: At the end of the lesson, students should be able to:

(1) Discuss characteristics of plants and animal in some habitats.
(2) List example of plants and animal in each habitats.

Procedure: Phase 1: (45 minutes)

Step I: Attendance

Step II: Discussion of characteristics of plants and animals in some habitats.

Step III: The teacher states examples of plants and animal found in the habitat.

Phase 2: Teacher's / Sign language / Interpreter's / Students with hearing impairment activities

Step I: The teacher explains the characteristics of plants found in some habitat.

Step II: The teacher shows and discusses examples of plants found in some habitat.

Step III: The teacher allows the students with hearing impairment to see the characteristics of plant in their environment by themselves and allows them to summarise the observation in a table as fast as possible.

Phase 3: Post outdoor classroom

Step I: The teacher collects observations of students with hearing impairment and explains further on what they have seen with the help of sign language interpretation.

Step II: The teacher asks this question: what are characteristics of terrestrial plants that live on land?

Step III: (i) Homework was given on list of living things found in terrestrial and aquatic habitats.

(ii) State two adaptations in:

(a) A named aquatic plant
(b) A named terrestrial plant
(c) A named desert plant
(d) A named aquatic animals
(e) A named terrestrial animals

WEEK 4

Topic: Learning about our environment

Subtopic: Relationship between organisms in the same habitat

Duration: 60 minutes

Instructional Objectives: At the end of the lesson, students should be able to:

(1) Identify relationship between living organism living in the same habitat

(2) Give examples of features they have in common

Procedure:

Phase 1: Preliminary phase (Before the outdoor classroom) 15 minutes

Teacher's activities

Step I: The teacher takes attendance of the students

Step II: The teacher discusses the relationship between living organisms living in the same habitat.

Step III: The teacher gives the difference between animals that live on the land and water

Phase 2: Teacher's / Sign language / Interpreter's / Students with hearing impairment activities (45 minutes)

Step I: The teacher explains and shows the relationship between animals e.g. animals in savannah and possess of animals that lives on trees, in the forest and their adaptation.

Step II: The teacher gives examples of animal living in the forest e.g. snakes, monkey and also that they have the adaptation of arboreal too.

Phase 3: Post outdoor activities

Step I: Students with hearing impairment were asked on what they have learnt so far.

Step II: The teacher re-explained to students with hearing impairment on the question seems not understand by students with hearing impairment.

Step III:The teacher evaluates the lesson by asking the following questions: what is the differences between aboreal all animals and terrestrial animals; (ii) Give examples of animals that fly.

Homework: Write 5 forest animals and 2 aboreal animals.

WEEK 5

Lesson 5

Topic: Learning about our environment

Subtopic: Uniqueness of human being

Duration: 60 minutes

Instructional Objectives: At the end of the lesson, students should be able to:

(1) Explain the meaning of human being

(2) Define primates

Procedures:

Phase 1: Preliminary phase (Before the outdoor activity/classroom) 15 minutes

Step I: The teacher marks the homework and take attendance for the day.

Step II: The teacher discusses the topic with the students with hearing impairment.

Step III: The teacher explains as usual the purpose of the trap and what is expected from the students.

Step IV: The teacher explains the characteristic features of themselves to them e.g. their backbones compared to animals e.g. ability to stand upright etc.

Phase 2: Teacher's / Sign language / Interpreter's / Students with hearing impairment activities

Step I: The teacher brings the students with hearing impairment out of the classroom.

Step II: The teacher asks them to observe carefully the human being they found outside and compare them with animals moving in the street.

Step III: The teacher explains the differences because human beings and animals too but they are higher animals, they have ability to stand upright. Human being belong to a group of animals called primates. They also grasp things in their hands. Man has the complicated and largest brain among animals that is why human beings are called homosaplen.

Phase 3: Post outdoor activities

Step I: Students with hearing impairment present their observation and the teacher explains again what they have observed for proper understanding.

Evaluation: The teacher evaluates the lesson giving students with hearing impairment questions to answer:

(i) What is the meaning of a primate?

(ii) What are examples of primates?

Home work: What are characteristics of human beings that make him unique.

WEEK 6

Topic: Learning about our environment

Subtopic: Human beings as intelligent animals

Duration: 60 minutes

Instructional Objectives: At the end of the lesson, students should be able to:

(1) State characteristics of human being that make them unique.
(2) List the functions of the brain.

Procedure:

Phase 1: Preliminary phase (Before the outdoor classroom) 15 minutes

Teacher's activities

Step I: The teacher introduces the lessons to the students

Step II: The students present and discuss their observation from the site visited

Step III: The teacher evaluates the students by asking questions

Evaluation: The teacher evaluates the lesson by asking the students the following questions

1. Explain why you are unique among other primate
2. List the usefulness of the brain
3. Suggest three ways of preserving organisms in a particular habitat
4. List and explain the intelligent skills.

WEEK 7

Lesson 6

Topic: Chemicals

Subtopic: Classes of chemicals, uses and Hazards

Duration: 60 minutes

Instructional Objectives

At the end of the lesson, pupils should be able to:

i. Explain chemicals

ii. List the classes of chemicals

iii. List and explain classification based on uses and hazards

iv. List the safety measures when using chemicals

Procedures

Phase 1: Preliminary (Before outdoor classroom, 15 Minutes)

Teacher' and sign language interpreter's activities

Step I: The teacher takes attendance of the students

Step II: The teacher discusses chemicals with the students while the sign language interpreter interprets the process.

Step III: The teacher presents the purpose of the trip

Step IV: The teacher builds background information by describing specific features to be observed in the trip e.g. uses of chemicals, hazardous usage and safety measures

Step V: The teacher informs the students to jot down information received during the trip

Phase 2: Outdoor Classroom 45 Minutes

Teacher/sign language interpreter and students' activities

Step I: Teacher conveys both sign language interpreter and students with hearing impairments to the venue where various chemicals can be found e.g. agricultural chemicals, industrial chemicals, pharmaceutical and laboratory chemicals.

Step II: The pharmacist, the teacher, and sign language interpreter guide the pupils to identify available chemical and explanation was given on the use of chemicals and their side effect to the students

Step III: The students asked questions on safety measures of chemicals.

Evaluation: Teacher evaluates the lesson by asking the students somequestions:

i. List five chemicals you know

ii. Explain the following:

a. Highly hazardous and toxic chemicals

b. Moderately hazardous chemicals

c. Non hazardous and toxic chemicals

iii. Highlight 5 safety measures when using chemicals

WEEK 8

Lesson 8

Topic: changes in living things

Subtopic: Growth and development

Duration: 60 Minutes

Instructional Objectives

At the end of the lesson, students should be able to:

i. Describe increase in height and weight as growth changes

ii. Describe transition from infancy to adolescence and adulthood as developmental stages

iii. Identify growth and developmental changes

Procedures

Phase 1: Preliminary (Before outdoor classroom 15 Minutes)

Teacher/sign language interpreter's activities

Step I: The teacher takes the attendance of the students

Step II: The teacher discusses changes that happen to living things from infancy to adulthood while the interpreter interprets in sign language

Step III: The teacher presents the purpose of the trip

Step IV: The teacher give information of what is expected to observed in the trip

Step V: The teacher informs the students to jot down information received during the trip

Phase 2: Outdoor classroom (45 Minutes)

Teacher/sign language interpreter/students' activities

Step I: The teacher conveys students to the site

Step II: The teacher shows infants, adolescents, and adults to the students

Step III: The teacher ask the students to raise questions

Step IV: The teacher explains the questions asked by the students

Evaluation: Teacher evaluates by asking the following questions

i. Define growth

ii. Explain the development

iii. Identify characteristic features of different developmental stage

iv. Group growth and developmental changes as temporary or permanent changes

CONVENTIONAL INSTRUCTIONAL GUIDE (CONTROL GROUP)

WEEK 1

Topic: Learning about our environment

Sub-topic: Habitat

References Book: FOC NDU and Somoye, S. O. (2013). Basic Science for Junior Secondary Schools 2. Lagos: Longman Nigeria. Page 58-75

Instructional Materials: Chalkboard

Behavioural Objectives: At the end of the lesson, students should be able to:

iv. Define habitat
v. Identify three examples of living things/organisms found in the habitat
vi. Describe features of organisms found in the habitat

Learner's Entry Behaviour:

The students are familiar with some of the examples of living things in the environment

Step 1: The teacher introduces the topic and selects concepts required to teach the students.

Step 2: The teacher explains the meaning of living things to the students.

Step 3: The teacher discusses the examples of habitation of plants.

Step 4: The teacher explains the examples of animals to the students. Animals can be grouped into pets, farm animals and wild animals. Examples of pets are: cats, dogs, etc. Examples of farm animals are goat, sheep, cow, hen, rabbit, mouse, grass cutters, etc. Examples of wild animals are lion, tiger, leopard, snake, elephant, etc.

Step 5: The teacher explains different habitats to students

Step 6: Teacher asks the questions on the topic taught

ASSIGNMENT

1. List and discuss two major habitat.

2 Discuss the adaptation of plants in relation to water.

CONVENTIONAL INSTRUCTIONAL GUIDE

WEEK 2

Topic: Learning about our environment

Sub-topic: Adaptation of living things in their environment

Time: 40 minutes

References Book: FOC NDU and Somoye, S. O. (2013). Basic Science for Junior Secondary Schools 2. Lagos: Longman Nigeria.

Instructional Materials: Chalkboard

Behavioural Objectives: A the end of the lesson, students should be able to:

iv. Define adaptation
v. List various adaptive features of living things in their habitat
vi. State species of plants and animals found in a particular habitat.

Learner's Entering Behaviour:

The students are familiar with the examples of plants, and animals living in their different habitat.

Step 1: The teacher introduces the topic to the students.

Step 2: The teacher defines adaptation

Step 3: The teacher lists and explains the various adaptive features of the living thing in their habitat.

Step 4: The teacher explains the different species of plants and animals in particular habitat.
Step 5: Students copy notes from the board

Step 6: The teacher goes around the class to supervise the students while copying the note given to them.

Step 7: Students' mistakes are corrected and teacher asks the students questions.

Step 8: Students write down assignment

Evaluation: The teacher asks questions on the topic taught as follows:

iv. Why do plants that live on water do not depend on their root?
v. Discuss special features that enable fish to live in water
vi. Identify plants and animals and discuss the nature of soil/water they live in.

CONVENTIONAL INSTRUCTIONAL GUIDE

WEEK 3

Topic: Learning about our environment

Sub-topic: Characteristic of organisms in the same habitat

References Book: FOC NDU and Somoye, S. O. (2013). Basic Science for Junior Secondary Schools 2. Lagos: Longman Nigeria. Page 68

Instructional Materials: Chalkboard

Behavioural Objectives: At the end of the lesson, students should be able to:

1 Discuss characteristics of plants and animals in same habitat
2 List examples of plants and animals in each habitat

Learners' Entry behaviour: The students are familiar with the examples of living things.

Step 1: The teacher introduces the topic and selects concepts required to teach the students.

Step 2: The teacher explain characteristics of plants found in the same habitat.

Step 4: The teacher explains examples of plants found in some habitats.

Step 5: The teacher allows the students to ask questions.

Evaluation: The teacher asks questions on the topic taught as follows:

State two adaptations in

1 A named aquatic plant
2 A named terrestrial plant.

ASSIGNMENT

State two adaptation in ;

1 A named desert animal.
2 A named terrestrial animal.

CONVENTIONALINSTRUCTIONAL GUIDE

WEEK 4

Topic: Learning about our environment

Sub-topic: Relationship between organisms in the same habitat

References Book: FOC NDU and Somoye, S. O. (2013). Basic Science for Junior Secondary Schools 2. Lagos: Longman Nigeria.

Instructional Materials: Chalkboard

Behavioural Objectives: At the end of the lesson, students should be able to:

iii. Identify relationship between organism living in the same habitat
iv. Give examples of features they have in common

Learners' Entry behaviour. The students are familiar with living organisms

Presentation

Step 1: The teacher introduces the topic organisms' relationship to the students

Step 2: The teacher explains the relationship between animals in savannah and process of animals that live on trees in the forests and their adaptation.

Step 3: The students copy note from the board

Step 4: The teacher goes round to supervise the pupils while copying note given to them

Step 5: Students' mistakes are corrected where necessary

Step 6: The teacher answers students' questions

Evaluation: The teacher asks questions on the topic taught as follows:

iv. What is the difference between arboreal and terrestrial animals?
v. Give examples of animals that fly
vi. Write five (5) forest animals and two (2) arboreal animals

CONVENTIONAL INSTRUCTIONAL GUIDE

WEEK 5

Topic: Learning about our environment

Sub-topic: Uniqueness of human being

References Book: FOC NDU and Somoye, S. O. (2013). Basic Science for Junior Secondary Schools 2. Lagos: Longman Nigeria.

Instructional Materials: Chalkboard

Behavioural Objectives: At the end of the lesson, students should be able to:

I. Explain human beings
II. Define primates

Learner's Entry Behaviour; The students have seen chimpanzee, monkey and man, before.

Presentation:-

Step 1: The teacher introduces the topic to the students

Step 2: The teacher lists the characteristic features of man to the students in the picture

Step 3: The teacher explains primate as animals which have large brains, forwards, facing eye, nails, and grasping thumb facing other fingers.

Step 4: The teacher asks questions from the students

Step 5: The teacher allows the students to copy notes

Evaluation: The teacher asks questions on the topic taught as follows:

1 Define primate animals

2 Give examples of primate animals

Assignment

What made human being unique from other animals?

CONVENTIONAL INSTRUCTIONAL GUIDE

WEEK 6

Topic: Learning about our environment

Sub-topic: Human beings as intelligent animals

Reference Book: FOC NDU and Somoye, S. O. (2007). Basic Science for Junior Secondary Schools 2. Lagos: Longman Nigeria.

Instructional Materials: Chalkboard

Behavioural Objectives: At the end of the lesson, students should be able to:

I. State characteristics human being that make them unique
II. Lists the functions of brain

Learner's Entry Behaviour: Students are human being too

Presentation

Step 1: The teacher introduces the topic to the students

Step 2: The teacher via sign language interpreter, explains both human beings and animals' brain to the students

Step 3: The teacher lists the usefulness of the brain of man

Step 4: The teacher allows students to ask questions

Evaluation: The teacher evaluates the lesson by asking the following questions from the students

1 X-ray the function of human brain

2 Discuss the difference between human brain and animal brain

CONVENTIONAL INSTRUCTIONAL GUIDE

WEEK 7

Topic: Chemicals

Sub-topic: Classes of chemicals uses and hazards

References Book: FOC NDU and Somoye, S. O. (2013). Basic Science for Junior Secondary Schools 2. Lagos: Longman Nigeria.

Instructional Materials: Chalkboard

Behavioural Objectives: At the end of the lesson, students should be able to:

1 Explain human being

2 Define primate

Learner's Entering Behaviour: Learners are familiar with some drugs

Presentation:-

Step 1: The teacher introduces the topic to the students

Step 3: The teacher explains different use of chemical to the students e.g. the agricultural use, industrial use, pharmaceutical use, etc.

Step 5: The teacher explains the sign of danger and safety measures of chemicals to the students

Step 6: The teacher gives room for questions from the students

Evaluation: the following questions are asked

I. Itemize the uses of chemicals

II. Explain the factors to consider when using dangerous chemicals

CONVENTIONAL INSRUCTIONAL GUIDE

WEEK 8

Topic: Changes in Living things

Sub-topic: Growth and development

Duration: 40 minutes

Reference Book: FOC NDU and Somoye, S. O. (2007). Basic Science for Junior Secondary Schools 2. Lagos: Longman Nigeria.

Instructional Materials: Chalkboard

Behavioural Objectives: At the end of the lesson, students should be able to:

1. Explain growth
2. Define development

Learners' Entry Behaviour: Students are familiar with newborn babies

Presentation

Step 1: The teacher introduces the topic to the students

Step 2: The teacher explains the meaning of growth: Growth is increase in size of an organism due to increase in number of cells

Step 3: The teacher explains the process of development from child to infancy, adolescent children and adulthood to the students

Step 4: The teacher explains their developmental stages

Step 5: The teacher allow students to ask questions

Evaluation: The teacher evaluates the lesson by asking the following questions:

3. Growth steps at _____
   (a) Adulthood. (b) baby (c) childhood (d) adolescence
4. During the period of puberty, mention two things that are observable

Conclusion: The teacher concludes the topic by brief explaining all over what was taught

APPENDIX IV

OUTDOOR CLASSROOM INSTRUCTIONAL

Topic: (this is for each of the session

Objective:

At the end of the lesson, pupils should be able to:

i. Have knowledge about their environment

ii. Explain at least one concept in the environment

Procedures

Phase 1: Preliminary Phase (before the outdoor classroom)

Teacher/sign language interpreter's activities

Step I: The teacher takes attendance of the students

Step II: The teacher discusses the topic with the students

Step III: The teacher presents the purpose of the outdoor classroom to the students

Step IV: The teacher gives background information by describing specific features to be observed in the outdoor classroom

Step V: The teacher inform the students to jot down information received during the outdoor classroom

Phase II

Teacher/sign language interpreter's activities

Step I: The teacher conveys the students to the study sites

Step II: The teacher with the sign language interpreter guides the students to look for living things in the environment

Step III: The students with hearing impairment ask questions from the teachers

Phase III

Presentation/Evaluation

Teacher's/sign language interpreter's/students' activities

Step I: The students present and discuss their observations from the site visited

step II: The teacher evaluates the students by asking from the students what they learn

APPENDIX VI

TEACHER INSTRUCTIONAL GUIDE (TIG)

TOPIC: (this is for each of the session)

Objectives: (for all the lessons)

At the end of the lessons, students should be able to:

i. Have knowledge about their environment

ii. Explain at least, one concept in the environment

Duration: 45 minutes

Presentation:-

Step I: The teacher/sign language interpreter's activities

i. Take attendance of the students

ii. States the topic/interpreter interpret to the students

iii. Identifies subtopics/concepts/sub-concepts

iv. Specifies the learning objectives

Step II: Strategy implementation – Teacher/sign language interpreter perform the followings:

i. The teacher explains while sign language interpreters interpret the concepts to the students

ii. Allows the students to interact with their environment while sign language interpreter explain unclear information to them

iii. Gives summary while sing language interpreters sign what was summarized and interpret issues raised to the teacher during the course of learning

Step III: students/sign language interpreter activities

i. Students watch what was signed by sign language interpreter

ii. Students ask questions on the topic treated while sign language interpreters interpret to the teacher

iii. Students interact with materials supplied

Evaluation

Both present and post test on knowledge about our environment

Home work

The teacher gives homework on the next topic on the environment

APPENDIX VII

DEPARTMENT OF SPECIAL EDUCATION

FACULTY OF EDUCATION

UNIVERSITY OF IBADAN

LEARNING ABOUT OUR ENVIRONMENT CURRICULUM FOR USE BY STUDENTS IN JUNIOR SECONDARY SCHOOL TWO INVOLVED IN THE RESEARCH

PREPARED BY

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Derived from 9 years Basic Education Curriculum Nigeria Educational Research and Development Council first published 2006 and was revised in 2012 and Basic Science and Integrated Science Course for Junior Secondary School 2 by FOC, NDU and EO SOMOYE (2008) and revised in 2009, 2010, and 2013

SUPERVISOR: DR. OYEWUMI, ADEBOMI M.

LEARNING ABOUT OUR ENVIRONMENT MODULE

Topic	Performance objectives	Content	Activities		Teaching and learning resources	Evaluation guide
			Teacher	Students		
Learning about our environment	Identify the characteristic features of the different developmental stages Classify developmental changes as temporary and permanent	Developmental changes: - Infancy - Adolescents - Adulthood Characteristics features of stages of development Classifying growth and developmental changes as temporary/permanent	Guides students to group themselves according to different heights, weights, and sizes Leads class discussion on the differences between: - Infants and	Under teacher's instruction, group selected students according to heights, weights and sizes ; Compare: themselves with their	Spring balance Measuring cylinder Poster showing -babies -students -teachers and parents	State three major indices of growth changes in living things List three examples of developmental changes in infants, adolescents and adults State the characteristic of

			adolescents ; - Adolescents and adults	younger siblings Write short notes on their observation		growth and developmental changes Classify changes in living things as: -growth and -developmental changes -temporary and permanent changes
Chemicals	Students should be able to: Define chemicals, Classify chemicals based on their intended use and hazardous nature, State safety measures when using chemicals	Meaning of chemicals Classes of chemicals: a. based on use: - pharmaceutical/cosmetics -nuclear -agrochemical -industrial -laboratory b. based on hazardous nature: -highly hazardous and toxic -moderately hazardous and toxic -non hazardous and non-toxic Safety measures when using chemical: -adhere to the	Displays samples of chemicals in class Leads students in class discussion Guides students to identify hazardous and non-hazardous chemicals Demonstrates the use of some safety devices when handling chemicals Display relevant chart on safety signs placed on chemicals	Observe some displayed chemicals Participate in class discussion Observe and recognize the classes of chemical displayed Identify safety signs in chart and storage containers displayed Match chemicals with appropriate storage containers	Chemical bottles (labelled) Chemical bottles (non-labelled) Samples of chemical -Kerosine - insecticides , -camphor Engine oil in well labelled and appropriate container Chart showing classification of	Students to: Define chemicals State two classes of chemicals List 3 examples of each of the classes of chemicals Mention 3 safety measures in the use of chemicals

		manufacturer's safety instructions -follow safety guidelines for chemical storage and handling -observe and adhere to safety signs and instructions on chemical packages -ensure proper labelling and storage of chemical			chemical and their examples Charts showing safety signs	

APPENDIX VIII
LESSON NOTE

Week 1

Topic: Learning about our Environment

Every living organism, whether plant or animal, has a particular place where it normally lives. There are those that live on land and those that live in water. The kind of place or environment where an organism normally lives is called its habitat. Specifically, it means the home where an organism inhabits. Every organism is able to adjust itself to its habitat in order for it to survive. In this lesson, you will learn about the different habitats of living things and how they have been able to live in their particular habitats

Habitats

Different organisms are found in different habitats. There are two major habitats. These are:

i. terrestrial habitats
ii. aquatic habitats

Terrestrial Habitat

The terrestrial habitat refers to land environment. Living organisms found living in terrestrial habitats include human beings, domestic animals, wild animals and plants

The terrestrial habitats can be arboreal (in or on trees), on the ground or under the ground. Monkeys, birds and ants are arboreal, grasscutters live on ground, while earthworms live underground. The ground habitat may be of different kinds, such as tropical rainforest, savannah, grassland, semi desert and desert.

The aquatic habitat refers to water environment. The aquatic habitat contains different kinds of animals and plants that are called aquatic organisms. The organisms include fish, whale, turtles, crocodiles, tadpoles, water lettuce, water lilies, etc. Aquatic habitat can be estuarine, marine or fresh water. Estuarine refers to the river mouths where salt and fresh water meet. Examples are such areas as bays and lagoons. The organisms found in these areas include periwinkles and lobsters. The marine plants and animals include weeds, octopus, fish, whales and dolphins. The freshwater habitats include lakes, rivers, pounds and stream. The organisms found in fresh water habitat include fish, cray fish and crabs.

Week 2

Topic: Adaptation of organisms to their Habitats

Some species of plants and animals are found in a particular habitat and can only survive in that particular habitat. For examples, there are certain species of plants and animals that can survive only in rain forest habitat and not in the desert. Also, those that are found in desert hardly survive in rainforest habitat. When different plants and animals are carefully examined, there are certain features that will be seen or found on them that enable them to live in their particular habitat. Any special feature that helps an organism to live and survive in a particular habitat is called an adaptation.

Adaptation of Plants (in desert areas) in Relation to Water

Plants need water and show different adaptations with respect to the availability of water in their environment. Plants that live in areas with limited rainfall, such as the desert, have special features that make them different from other plants. The special features help them to increase their water intake and reduce water loss by transpiration.

i. They have extensive root system with a long taproot that is able to penetrate deep into the ground to tap the available water.
ii. Some have developed water storage tissues in their leaves and stems. This enables them to survive during the long dry season by suing the water stored in their tissues. Plants that develop storage tissues are called succulents, e.g. cactus
iii. Some have tiny small leaves or have their leaves reduced to green needles-like structures or tiny scales. The adaptation of the leaves help reduce the amount of moisture that will be lost to the atmosphere during transpiration.
iv. Some have adventitious roots that spread widely to cover large areas.

Plants that Live on Water do not have to Depend on their Roots to Absorb Water.

i. They have poorly developed root system.
ii. They have their leaves and stem covered with thin layer of cuticle that is permeable so that water, oxygen, mineral salts, carbon dioxide are easily absorbed into the whole surface of the plant.
iii. Generally, leaves of aquatic plants have large air spaces. The air spaces keep the plants buoyant and help thme absorb oxygen.

Week 3

Topic: Adaptation of Aquatic Animals

Fishes have the following special features that enable them to live in aquatic habitat:

1. Possession of tail and fins for swimming and balancing in water.
2. They have a streamlined body shape, which allows them to move smoothly through water without being pushed back by water current.
3. They have gills that are used for breathing in water
4. Possession of swim bladder needed by the fish for adjusting to changes in water pressure at different depths of water. This allows the fish to swim at different water.

Adaptation of Amphibians

Frogs and toads are described as amphibians because they can live on both land and water. They are adapted to live in both environments. The distinguishing features that enable them to live in water are:

1. Streamlined body shape
2. Web between their toes for swimming

Adaptation of Terrestrial Animals

Most terrestrial animals that live on land share the following features:

1. Lungs required for breathing on land
2. Scales on the body to reduce lot of water through the skin
3. Limbs for movement on land

Week 4

Topic: Adaptation of Animals

Adaptation of animals in and on land:

i. Ability to work for several days without drinking water e.g. camel
ii. Possession of scales e.g. reptiles
iii. Ability to regulate body temperature

Adaptation of Plants in and Land

i. Presence of underground stem in some plants
ii. Presence of little leaves
iii. Ability to store water in their fleshy stem

Plants and Animal Adaptation in the Savannah

These include:

i. Ability to excrete solid waste substances e.g. zebra, tiger, lion etc.
ii. Ability of some animals to burrow into the groom to avoid high temperature and escape from enemies

Adaptation of Plants in Savannah

This includes:

i. Presence of long tap root system for absorption of water from deep layers to the soil
ii. Presence of underground stems e.g. in grasses
iii. Ability to recover after dying out
iv. Ability to grow new shoots immediately after bush fire
v. Ability to use very little water

Week 5

Topic: Human Development

Human beings are living things because they move, feed, grow, respire, excrete, produce and respond to changes in their environment.

Among the living things, human beings are animals because they:

- Cannot make their food
- Move from one place to another
- Have no chlorophyll
- Have complex organs for respiration, excrete, reproduction and sensitivity
- Respond quickly to changes in their environment
- Practise courtship in production.

Although, human beings are animals, it is clear that in many ways, they are specia**l.**

Human Beings as Intelligent Animals

Human beings belong to a special group of animal called primates. Primates are higher animals, which have large brains, forward facing eyes, nails and hands with grasping thumbs facing the other fingers. Some animals like monkey, gorilla and chimpanzee also belong to this special group. But human beings show greater advancement than these other primate by:

1. Having higher intelligence due to highly developed brain
2. Demonstrating higher ability to handle tools due to the position of their thumb opposite the other fingers.

Week 6

Topic: Uniqueness of Human Beings

Human beings belong to the animal kingdom. Many people will not want to be called animals. A human being is an animal but a very special kind of animal. Human beings are higher animals because of the presence of backbones. They are said to be unique. But what makes them unique? What is it that makes human beings different from other animals? Among the animals, only human beings have the ability for reasoning and problem solving.

The human brain, which is bigger and more highly developed than other primates, makes a human being a special animal. The part of the human brain that is most developed is the cerebrum which controls thinking and speech. Thus, the human brain makes human beings the most intelligent living thing on earth.

The human brain enables human beings to:

i. Think
ii. Reason,
iii. Remember,
iv. Solve problems,
v. Make inference,
vi. Communicate (speak)
vii. Control the environment and other living things in the habitat.

The position of the thumb opposite the other fingers enables human beings to handle tools and manipulate things.

Week 7

Topic: Chemicals

A chemical is an element that has a specific molecular composition and may be deuced by or used during a chemical process.

The uses of Chemicals

The main use of chemicals is to promote and enhance a greater quality of life for not only the human race but countless other species. They all for the creation of modern inventions.

Chemicals are used as a basic function of everyday life. Chemicals are classified into two different categories; these are:

i. Classification based on use
ii. Classification based on hazardous nature.

Classification based on use

a. Pharmaceutical/cosmetics: The chemicals used in the production of pharmaceutical/cosmetics products such as zinc oxide, menthol, calcium carbonate acid, glycerine, etc.
b. Agrochemicals: These are substance used to help manage an agricultural system or the community of organism
c. Industrial chemicals: These are used widely in all kinds of industries, although the use of these chemicals has played a major role in the development of industry, examples include, alcohol, acid, sulphate, etc.
d. Laboratory chemicals: These are chemicals that are used in different laboratories. It is used to conduct scientific research or teaching practical sciences, e.g. hydrochloride acid, sulphuric acid, etc.

Classification of Chemicals based on Hazardous use

a. Highly hazardous and toxic chemicals: These are chemicals that may cause hazard to an individual if it enters the body or touches the body. E.g. hydrochloric acids, ethylene chloride, carbon monoxide, etc.
b. Moderately hazardous and toxic: These chemicals with mild effect on the body e.g. ammonia, insecticides, fertilizers, etc.
c. Non-hazardous and non-toxic chemicals: these are chemicals with no negative effect when it comes into contact with the body e.g. sodium salt, food additives, stearic acid, carbonates, etc.

Safety Measures

The followings are safety measures or precautions to observe when dealing with chemicals

i. Ensure proper labelling and storage of chemicals
ii. Use gloves when handling chemicals
iii. Any spills of chemical must be carefully cleaned
iv. Flush your body with plenty of fresh water and report to the laboratory technician
v. Waste products and disposals must be discharge with proper neutralization, etc.

Week 8

Topic: Defining Growth and Development

One of the changes that are easily noticeable in a healthy baby some weeks or months after birth is increase in height, size and weight. The food the baby eats is important in helping the body to produce new body cells that will add to the body size. The increase in size of an organism due to increase in number of cells is termed growth. In growth the body by itself makes its own new flesh to add to the existing one. Growth may be measured by increase in height and weight.

Development is a series of orderly changes by which a living thing comes into maturity. These changes are different from increase in size (growth).

Growth and Developmental Changes

As you grow, the changes in your height and size are noticeable. If you compare your height and weight last year with what you are now, you will notice that you have increased in both height and weight. The noticeable change in the body size over time is termed growth change.

Growth changes can be determined by measurement of height and weight at time intervals while development changes can be observed by appearance of certain characteristic features and capabilities. Development leads to transition from one stage of life to another. These stages are characterized by certain features. Developmental changes are progressive and move from simple to complex.