IDENTIFICATION AND REMEDIATION OF ERRORS IN BASIC SCIENCE AMONG UPPER BASIC STUDENTS IN NASARAWA EDUCATION ZONE, KANO, NIGERIA

BY

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A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF EDUCATION DEGREE IN SCIENCE EDUCATION

DEPARTMENT OF SCIENCE EDUCATION,
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DECLARATION

I hereby declare that this dissertation entitled “Identification and Remediation of Errors in Basic Science Among Upper Basic Students in Nasarawa Education Zone, Kano, Nigeria”has beencarried out by me, in the Department of Science Education, Faculty of Education, Ahmadu Bello University, Zaria under the supervision of Prof, F.K. Lawal and Prof. S.S Bichiand the information derived from the literature has been duly acknowledged in the text and the list of references provided. This dissertation has not beenpreviously presented for another degree in any university.

Chinyere Emily, OKEREKE **Date**

CERTIFICATION

This dissertationentitled “Identification and Remediation of Errors in Basic Science Among Upper Basic Students in Nasarawa Education Zone, Kano, Nigeria” by Chinyere Emily, OKEREKEwith Reg. no. P16EDSC8099 meets the regulations governing the award of the Degree of Masterof Education in Science Education, Ahmadu Bello University, Zaria and is approved for its contribution to scientific knowledge and literary presentation.

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DEDICATION

This Dissertation is dedicated to my parents, Venerable and Mrs B.U.OKEREKE, my wonderful siblings, my soulmate and husband OKAFOR, Chukwudozie and loved onesfor their unending prayers, love, patience and support towards me.

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TABLE OF CONTENTS

		Page
Title Page		**Error! Bookmark not defined.**
Declaration		ii
Certification		iii
Dedication		iv
Acknowledgements		v
Table of Contents		vii
List of Tables		x
List of Figures		xi
List of Appendices		xii
List of Abbreviations		xiii
Operational Definition of Terms		xiv
Abstract		xv
CHAPTER ONE : THE PROBLEM		
1.1	Introduction	1
1.1.1	Theoretical Framework	8
1.2	Statement of the Problem	9
1.3	Objectives of the Study	11
1.4	Research Questions	12
1.5	Null Hypotheses	12
1.6	Significance of the Study	13
1.7	Scope of the Study	14

1.8 Basic Assumptions 15

CHAPTER TWO : REVIEW OF RELATED LITERATURE

2.1 Introduction 16

2.2 Historical Development of Basic Science in Nigeria 16

2.2.1 Philosophy and Objectives of Basic Science 21

2.3 The Concept of Errors 22

2.3.1 Types of Errors Committed in Science 24

2.4 Methods of Teaching Science at the Upper Basic Level 25

2.4.1 The Demonstration Teaching Method 31

2.5 Strategies for Remediation 32

2.6 Academic Performance of Students in Basic Science 34

2.6.1 Academic Performance of Male and Female Students in Science 35

2.7 Overview of Similar Studies 36

2.8 Implications of the Literature Reviewed for the Study 42

CHAPTER THREE : METHODOLOGY

3.1 Introduction 43

3.2 Research Design 44

3.3 Population of the Study 45

3.4 Sample and Sampling Technique 46

3.5 Topics Selected for the Study 46

3.6 Instrumentation **Error! Bookmark not defined.**

3.6.1 Validation of Research Instruments 48

3.7 Pilot Testing 49

3.7.1 Reliability of Research Instruments 50

3.7.2 Item Analysis 50

3.8 Administration of Treatment 52P

3.9 Data Collection Procedure 54

3.10 Procedure for Data Analysis 54

CHAPTER FOUR : DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction 56

4.2 Answering the Research Questions 56

4.3 Summary of the Findings 62

4.4 Discussion of the Results 63

CHAPTER FIVE : SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction 66

5.2 Summary 66

5.3 Summary of Major Findings 67

5.4 Conclusion 67

5.5 Contributions to Knowledge 68

5.6 Recommendations 69

5.7 Limitations of the Study 70

5.8 Suggestion for Further Studies 70

References 71

Appendices 77

LIST OF TABLES

Table		Page
1.1:	Basic Science Student Performance Result from 2009 – 2015 in Kano State	4
3.1:	Population of the Study	45
3.2:	Sample for the Study	46
3.3:	Table of Specification according to Bloom's Taxonomy for BSPT	48
4.1:	Types of Errors Identified in Basic Science	57
4.2:	Frequency of the errors committed by schools	58
4.3:	Summary of ANOVA on the type of error committed in Basic Science by students among schools	59
4.4:	Comparison on difference of Errors Committed in Basic Science by Male and Female Upper Basic 2 Students	60
4.5:	t-test for difference in Errors Committed by Male and Female Students in Basic Science	**Error! Bookmark not defined.**
4.6:	Summary of Mean and Standard Deviation on the Academic Performance of Students in Experimental and Control Groups	61
4.7:	Summary of t-test for Difference in Academic Performance between Basic Science Students taught using Demonstration and Lecture Method	**Error! Bookmark not defined.**

LIST OF FIGURES

Figure		Page
3.1:	Research Design	44
3.2:	Flowchart of Demonstration Remediation Package	53

LIST OF APPENDICES

Appendix		Page
A:	Letter to the Validators	77
B:	Introduction Letter	78
C:	Basic Science Error Identification Test (BSEIT) and Marking Scheme	79
D:	Basic Science Performance Test (BSPT) and Marking Scheme	101
E:	Lesson Plan for the Control Group	91
F:	Lesson Plan for Experimental Group	100
G:	Item Analysis	110
H:	Item Analysis	111

LIST OF ABBREVIATIONS

ADSS: Army Day Secondary School

BECE: Basic Education Council Examination

BSPT: Basic Science Performance Test

BSEIT: Basic Science Error Identification Test

FME: Federal Ministry of Education

GGSS: Government Girls Secondary School

GSS: Government Secondary School

GJSS: Government Junior Secondary School

GGASS: Government Girls Arabic Secondary School

KERD: Kano Education Resource Department

NERDC: Nigeria Educational Research and Development Council

NEEDS: National Economic Empowerment and Development Strategy

NCE: National Council on Education

NCCE: National Commission for Colleges of Education

STAN: Science Teachers Association of Nigeria

OPERATIONAL DEFINITION OF TERMS

Basic Science: Basic Science can be seen as the early stage science teaching in which students are required to develop certain scientific skills and attitudes as they work in their everyday activities.

Demonstration Method: Demonstration method is a method in which the learners are provided with an opportunity to observe for themselves the object or processes that they wish to learn. It can be real-life, make believe situations or models.

Error Identification: The act of classifying inaccurate, mistake or incorrect action or responsesmade by students that gives influence in form of written or oral test.

Remediation: The action taken to treat or correct the identified errors in Basic Science.Remediation can be defined as an act or process of correcting or overcoming learning problems.

Upper Basic Student: Is the junior secondary student two (JSS 2) of Basic Science.

ABSTRACT

This study identified and remediederrors committed in Basic Science among Upper Basic 2 Students in Nasarawa Education Zone, Kano.The research designs usedweresurvey for Errors Identification and Quasi- experimental design to test the students' performance level involving pre-testand post-testwith 60 students each in both control and experimental groups. Thestudy population was 8569from28 Public schools. A sample size of 120 randomly selected Upper Basic 2 Students participated in the study. It comprised of60 males and 60 female students. The research instruments were Basic Science Error Identification Test (BSEIT) used to identify errors committed and Basic Science Performance Test (BSPT) used to test the students'performance inBasic Science. The instruments were validated by the supervisor and other experts in Basic science teaching. A pilot study was conducted to collect data for establishing the reliability coefficient 0.87 of the BSEITusing test re test method.Treatment was given to the experimental group using demonstration teaching method. Four research questions and three null hypotheses were raised, the null hypotheses of the research were tested usingt- test and ANOVA statistics at $p \leq 0.05$ alpha level of significance.Based on data analysis using the statistical package for social science (SPSS) hypotheses one and three wereretained while hypothesis two was rejected.The result showed that demonstrationteaching method was relatively more effective for remediating identified errors among Upper Basic students. Theacademic performances of students taught Basic Science using demonstration teaching method was higher thanthat of the students taught using lecture method.Thus, it is recommended that demonstration teaching method should be used to remedy Basic science errors among students.

CHAPTER ONE

THE PROBLEM

1.1 Introduction

Nigeria as a developing nation works to achieve fast development and growth in science and technology to boost its economy. Investments are made in various fields including science education, which can be actualized by giving quality education to its citizens. Shaibu (2014) defines science as a complex human activity that leads to the production of a body of universal statements called laws, theories, or hypothesis which serve to explain the observable behavior of the universe or part of it and which in themselves have predictive characteristics.

Also, Sulaiman (2014) sees science as a product (a body of knowledge) a process (a way of conducting enquiry) and an enterprise (the institutionalized pursuit of knowledge of the material world). Alao(2010) suggests that science teachers should be aware of certain rules which facilitate the selection of approaches of imparting knowledge to pupils. Thus, Alao (2010) observed that in selecting the methodology for a science lesson the science teachers should consider among other things innovative teaching strategies to enhance pupils' academic performance in the subject.

General Science was introduced to Nigerian schools between 1957 and 1969.The Russians lunched their space ship, the Sputnik in 1957, while the Americans put the first man on the moon in 1969.According to Balogun (1990) science was taught in Nigerian schools as Nature Study or Rural Science. At the junior secondary school, science was taught in an uncoordinated manner with various parts of Nigeria operating at different levels, some used Hygiene, Health Education or Nature Study. The first publication of the Nigerian Integrated

Science Project (NISP) was in 1970. This however faced many problems because there were no qualified teachers to teach science. In recognition of such inadequacies, the National Policy on Education (FRN, 2014) stressed that the aims of Basic Science Education should include among others, laying a sound basis for scientific and reflective thinking, developing in the pupils the ability to adapt to his/her environment and giving the pupils opportunities for developing manipulative skills that will enable him/her to function effectively in the society.

Balogun (1990) stated that as a result of the world wide curriculum reforms and in recognition of the changing needs of the Nigerian students, the West Africa Examinations Council (WAEC) invited Science Teachers Association of Nigeria (STAN) to review science curriculum. This led to the setting up of subject panels that developed curriculum in various science subjects which came up with the unified curriculum of subjects called Integrated Science which was offered at Junior Secondary Schools level. It is worth noting that the teaching of Integrated Science as a subject, after the curriculum reform of 1969 continued until the decision of the Federal Government to introduce the 9-year Basic Education in 2005 (FRN, 2004) for which the Basic Science curriculum was developed.

Integrated Science curriculum is now a revised curriculum for science which is now called Basic Science,it is the grassroots science pupils come in contact with at their first 3 years in secondary school. Basic Science by conception and definition emphasized on the content as well as the process of science, development of mental skill, acquisition of appropriate motor capabilities and the evolution of positive attitude among others. According to Oludipe (2014), Basic Science is the foundation that prepares pupils for future learning and study of science subjects like Chemistry, Physics and Biology at the Senior Secondary

School level. This means, for a student to be able to study single science subjects at the senior class, such a student must perform well in Basic Science at the Junior Secondary School Certificate Examination (JSSCE). In addition, Basic Science lays emphasis on inquiry into nature in the environment through the use of activity based method of teaching. Therefore, the use of guided inquiry/ demonstration method of teaching and learning are applied in the activities prescribed under each topic in the textbook.

Similarly, Bolaji and Adesina (2011), see Basic Science as a grassroots subject that lays the foundation in pupils in the field of science. It is viewed as a course intended to reduce drastically the incidence of drop out from the formal school and ensuring the acquisition of appropriate levels of scientific literacy and life skills for a solid educational foundation. Oludipe (2014) is also of the view that Basic Science plays a vital role in the secondary school curriculum and stands as the foundational stone for students who wish to pursue science related course/career in future. In the teaching and learning process of Basic Science, Oludipe (2014) states that the performance of students depends on methods of teaching (appropriate usage and choice of technique), quality of teachers, availability of resources (textual material, laboratory) few to be mentioned. Bolaji and Adesina (2011) stated that the lingering low performance of junior and senior secondary schools students in Basic science and sciences is of major concern to educational stakeholders. In addition, evidence from Ibe (2008) shows that Basic Science teachers are poorly trained in content knowledge, assessment techniques and pedagogy which contributed to students' low performance. Table 1.1 shows the Basic Science Students Performance Results of KERD in Kano State over a period of 8 years.

Table 1.1: Basic Science Student Performance Result of KERD from 2010 – 2017 in Kano State

Year	Total of nostudents	Pass population	%Pass	Fail population	%Fail
2010	87112	19232	22.08	67880	77.92
2011	80182	32704	40.79	47478	59.21
2012	84392	42795	50.71	41597	49.29
2013	83647	30989	37.05	52658	62.95
2014	89109	32777	36.78	56332	63.22
2015	82300	38300	46.54	44000	53.46
2016	82700	20100	24.30	62600	75.70
2017	86090	18200	21.14	67890	78.86

Source: Kano Education Resource Department (KERD), 2017

Table1.1 indicates students result in Basic Science by percentage. For each of these years over 50% of the student fail yearly except the year 2012 as presented which is below average over the years, disturbed by this development. There is a need to provide an alternative remedy with the use of demonstration method, to find out if this instructional method could minimize errors and improve the performance of Upper Basic Science. Usman (2007) stated that most Basic Science teachers use lecture teaching method which leads to poor performance and inappropriate science process skills acquisition. More so, Usman (2007) said that science taught at the Junior Secondary School is faced with the problem of inadequate instructional materials and lack of competent teachers both in method and content of teaching. Therefore, Basic Science can be seen as the early stage science teaching in which students are required to develop certain scientific skills and attitudes as they work in their everyday activities.There is a need to conduct studies on Basic Science to identify some

of the challenges and errors committed by the students with the view to remediate the identified errors in Basic Science. This study is out to identify and remediate the errors that led to poor performance of Upper Basic Students in Basic Science which, if not identified and remediated, will invariably impair their future performance in science. Error identification is a method commonly used to identify the cause of student errors when they make consistent mistakes. It is a process of reviewing students' work in order to identify patterns of misunderstanding.

According to Melle (1996) errorsare mistakes or incorrect responses made by student to a given stimulus in form of oral or written test, Errors could be procedural or conceptual in nature. Error and mistake according to Salman (2004) are usually used interchangeably as synonymous because they stand in for an incorrect idea, opinion or misguided information, but they differ in terms of level or degree of incorrectness.

Abdulkarim (2011) viewed Error Analysis as the identification, description and explanation of errors either in spoken, written, graphic or pictorial forms. Error analysis may show a teacher the areas where his teaching has not been effective enough and it can provide data for the preparation of teaching materials when extensive error analysis is replicated. Abdulkarim (2011) is of the idea that an error analysis adequately carried out would reveal the types and frequencies of individual weaknesses. Error analysis is quite vital as a method of improving both teaching and students' characteristic mistakes and problem areas or even characteristic mode of thought, knowledge of which is important to teachers. It is expected that when students are aware of the types and frequencies of their errors, they will work hard to correct them. The teacher will also redouble his/her efforts and commitment improving his/her method of preparation in order to make his/her teaching more effective.

The researchers work on errors likeLawal (1995), Mohammed (2011), Agaba, 2014 in Biology, Isa (1990), Salman (2004) in Mathematics, Abdulkarim (2011) in Geography, Melle (1996) in Chemistry and Falalu (2015) have shown that students commit errors in various academic disciplines.Such errors were classified according to their nature, types and their remedy. Newbury (1965) classified errors, involving theoretical examination in chemistry, into the following categories, spelling, grammar, factual statement, mistakes of using equations, result, conclusion and carelessness. Lawal in Agaba (2014) classified error in Practical Biology into five categories; random errors, errors related to sequencing steps within procedures, errors related to conceptual learning, errors related to selection of information or procedures, errors related to recording of works. These Errors are not peculiar to Biology alone, Ajibola (1988) also identified six error-types in mathematics as factual errors, algorithmic errors, diagrammatic error, wrong equation, inferential errors, blunder or carelessness. Errors analysis is the identification of Upper Basic Students' error type frequency and school by school error types with a view to finding its possible causes and remediating them. In this study, identification test was used to identify the students' error as stated byPostelethwaite (1999) that error analysis involves studying students' school work such as homework, class work and diagnostic tests was designed to identify the major errors the students commit and the possible sources of such errors. In addition, Postelethwaite (1999) says that information on errors is obtained using questionnaire for teachers and students about the challenges they had with the subject test or teaching method in order to remediate them.

A remediation method was designed based on the identified errors, error – types and possible reasons that prompt students to committing such errors in Basic Science which

would hopefully lessen the problem that prompts students to commit the often avoidable errors. Thus, to provide remedy on errors committed among Upper Basic Science students taught through the use of demonstration method and topics in Basic Science was applied. Abdulkarim (2011) noted that identified errors may require some short or long -term plan to achieving the intended goal of correction and the plan for achieving the required corrections is the remediation strategy. Also, Abdulkarim (2011) approach resulted to fewer errors because students exposed to practical ways of learning as against lecture method performed better. This implies that the practical based approach enhances the students work. Therefore, remediation is the act or process of correcting something that is undesirable or deficient on students' works both males and females in their institution. For this study demonstration method was applied in remediating identified errors against lecture method.

The results on gender related factor of student academic performance in science. Isa (1990), Mohammed (2011) posited that male students perform better and higher in science than the female students and Lawal (1995), argued that female students perform better than male. Yet others contend that there is no significant difference in academic performance between boys and girls (Nussbaum, 2000; Owolabi and Bamdele, 2000; Bichi, 2002 and Salman 2004). Similarly, James (1998) found that female students performed better than their male counterpart in science when exposed to inquiry methods. There are several science teaching methods; activity, demonstration, field trip, play role, lecture, excursion, multimedia, etc. However, this study adopts demonstration method in order to find out whether gender difference exists in academic performance such that it could be gender related difference in errors commitment. The outcome was used to design a remediation to reduce or minimize errors committed by students. Thus, Basic Science Identification Test

was also designed to determine Students error type frequency, fill the gap on gender and school by school error frequency in remediating identified errors in Basic Science among Upper Basic Science Students in Nasarawa Education Zone, Kano State.

1.1.1 Theoretical Framework

This study on identification and remediation of Errors in Basic Science was guided by theoretical framework of constructivists' view of knowledge proposed by Piaget's (1977) onCognitive Developmental Theory was on four basic concepts: the schemas, assimilation, accommodation and equilibration. The schema is a cognitive structure that enables transition from one cognitive level to another. Assimilation implies taking in a new idea from the environment into one's existing schema. This study employs Piaget's concept on schema and assimilation for the identification of errors in the subject to examine its transition and how its new ideas existence would predict students' performance in Basic Science. One of the reasons for asking questions by teachers is to search for response(s) from the prior knowledge of the students. Therefore, considering demonstration as a method through which science can be taught, for the remediation of the identified errors.Thus, in this study, Piaget (1977) teaching and learning concepts using accommodation which involves modification or change of old information for new knowledge and equilibration is the process of maintaining balance between existing schemas and new knowledge in the environment.The demonstrationmethod serves as a theoretical framework to remediatestudenterrors frequencies and enhance students' performance in Basic Science.

In addition, Piaget's (1977) idea of cognitive developmental theory on the four basic concepts studies were supported by the works of Cherry (2012) that describes schema as both mental and physical actions involved in understanding and knowing. The schema is the

building block of knowledge. When a child‘s schema is capable of explaining what it can perceive around the environment, the child is in a cognitive balance or equilibrium. When the child‘s schema is not capable of explaining what it can perceive, it is in disequilibrium. The child at this stage displays some kinds of misconception and commits errors on some tasks given. However, Piaget’s theory is relevant to this study because when a teacher infuses wrong concept to the learner, error may have developed by the learner on the concept introduced which may affect their understanding of the new concept. On the processes of transition through the cognitive levels, Cherry (2012) identifies assimilation and accommodation as the processes. When a child takes in new information into his existing schema to move to equilibrium, he is assimilating. Changing or altering existing schema in the light of new knowledge or experience is known as accommodation. Striking a balance between assimilation and accommodation is known as the equilibrium. Thus, Piaget (1977) is adoptedinthis study to find out the errors students commit when they are at a disequilibrium cognitive stage in the schema of knowledge in Basic Science. The instructional materials in the remediation method is to reduce the level of disequilibrium so that the learner can emulate them easily or influence the restructuring of the learning cognitive structure to accommodate the learning materials as the process ensures areas where conflicts are resolved.

1.2 Statement of the Problem

Basic science is the first three years’ foundation science at the Upper Basic level of the secondary school meant to prepare students for subsequent learning of science at the senior secondary school level and future courses in science. It is an important basis for the success or failure of the science core subjects at the senior secondary level. Performance of

students in Basic science has been observed by researcher like Idris (2014)and Oludipe (2014) to be poor.The examination report from Kano Educational Resource Department (KERD), 2010-2017 in Table 1.1 indicates students result in Basic Science by percentage. For each of these years over 50% of the student fail yearly except the year 2012.A number of factors has been raised by educators like Idris (2014) and Falalu (2015) to explain this poor state. Prominent among these factors include; the teacher's method of teaching which encourage memorization of the facts of science (Idris, 2014). Also lack of both human and material resources (Oludipe, 2014). Idris (2014) emphasized the fact that students memorize science without really understanding the concept of science. Falalu (2015)reported that the student performance results indicate thatthere was an inverse relationship between frequency of errors and academic achievement scores of subjects. As error increased the achievement score decreased while as errors decreased the achievement score increases. This implies that errors on a subject can affect the students' performance.

This study is conducted in Nasarawa Education zone of Kano State with 28 public secondary schools. Kano state is known for its commercial activities in the sub- Saharan Africa. According to Ibrahim (2003), Kano came into being on April 1st, 1968. It is situated in the north-west zone of Nigeria with a total population of about 10,013,224 based on the 2006 national population census figures and it is made up of forty-four local government areas of which Nasarawa Education zone is part of it, comprising of Fagge and Nasarawa local government areas. The main indigenous language spoken is Hausa while English is the official language in government and business transaction (Education). The average literacy rate is 35%. They are mainly Muslims and few indigenous Christians. Researches carried out

by scholars of other disciplines for students ranging from Upper Basic level to tertiary institution have recorded similar trends in relation to students' performance in science.

For instance, Inekwe (1984) in Error Analysis in the Solution Process of Literal Equations in Mathematics; Falalu (2015) on Identification of Errors in Physics and Efficacy of a Remediation Package andLawal (1995) Error analysis in Practical Biology. Also, Abdulkarim (2011) on Remediation of Errors in the Presentation and Interpretation of Topographical Maps in Geography and Melle (1996) in Chemistry. These researchers concentrated on identifying error- types and determination of possible relation between error frequency and students' performance in their various fields of study. There was no attempt to design a remediation to reduce the frequency and types of errors committed by students more especially in upper Basic Science except for Abdulkarim (2011) and Falalu (2015) who designed remediation package on their field of study. The problem of failure to identify types of errors and misconceptions by Science educators and Basic Science teachers at Upper Basic level and designing its remediation to address the errors could still keep the level of students' understanding of Basic Science concepts at a low level and thus increase the chance of committing errors in Basic Education Certificate Examination (BECE).

1.3 Objectives of the Study

The purpose of the study was to identify and remediate errors in Basic Science among Upper Basic two (2) Students in Nasarawa Education Zone, Kano. Specifically, the objectives of the study are to:

1. identify the types of error committed by Upper Basic twostudents in Basic Science.
2. determine the difference in the errors committed amongUpper Basic schoolsin Basic Science.

3. findout the effect of demonstration teaching method in remediating errors committed in Basic Science among Upper Basic students.
4. findoutif there are difference in the performance of male and female students exposed to demonstration teaching methodin Basic Science.

1.4 Research Questions

This study aims at answering the following research questions:

1. What are the types of errors committed by Upper Basic two (2) students in Basic Science?
2. Is there difference in errors committed in Basic Science amongUpper Basic schools?
3. Is there any difference in the performance of students taught the selected concepts in Basic Science using demonstration teaching method and those taught with lecture method?
4. Is there any difference in the performance of male and female students exposed to demonstration teaching method in Basic Science?

1.5 Null Hypotheses

The following Null hypotheses were formulated and tested at $p \leq 0.05$ level of significance;

HO_1: There is no significant difference in the errors committed in Basic Science amongschools.

HO_2: There is no significant difference in the academic performance of students taught Basic Science using demonstration teaching method and those taught using lecture methods.

HO_3: There is no significant difference in the performanceof male and female students in Basic Science after remediation using demonstration teaching method

1.6 Significance of the Study

The findings of this study helped identify and minimize errors in science teaching and learning at Upper Basic Science in Nasarawa zone, Kano. To produce better and quality students, Basic Science teachers' and curriculum planners link for advancement in the following ways;

(a) School Administration: It stimulate the Basic Science teachers approach towards the use of demonstration, laboratory and field trip skill in their subject, to enhance academic performance of students in Basic Science. This current trend of teaching brings improvement in general performance of students in their schools.

(b) Students: The findings encourage students who have difficulty in learning some difficult topics in Basic Science to device new alternative method through the use of educational resource. The findinghelp increase students' ability to apply scientific knowledge such as scientific process skills to everyday life in personal, community health and agricultural matters.

(c) Teachers: The result help teachers to use the right approach or method when teaching Basic Science, give an assessment of the progress of students and indicate their areas of weakness. Also, help teachers master their fields and topics well in order to build the learners schemas on future science topics.

(d) Professional Bodies: The finding helps Professional bodies, such as Science Teachers Association (STAN) and Mathematic Association of Nigeria (MAN) to be aware of the errors identified in Basic Science among upper Basic students and its

remediation for future curriculum development. It helps to arouse the teachers' and students reasonable and functional scientific attitudes.

(e) Curriculum Planners: The finding helps curriculum planners in adopting the remediation method for the improvement of teaching and learning in Upper Basic Science. It would minimize most errors committed among students in Basic Science.

1.7 Scope of the Study

The scope of this study is limited to Upper Basic two (2) students ofNasarawaEducation Zone, Kano State.Four (4) Junior Secondary Schools out of 28 public schools in Nasarawa Education Zone, Kano State comprising 2 males and 2 female's schools were randomly selected. Considering that JSS I students were just being admitted and had not done much in Basic Science and the JSS 3 were busy preparing for Basic Education Certificate Examinations (BECE), the researcher opted for Upper Basic 2 students who were better and more appropriate for the study. This level of students wasinvolved for the study because they have been exposed to most concepts in the subject area. The concepts taught in this study is limited to 3 namely; Changes in non-living things, Energy, Changes in living things. They are concepts in Basic Science curriculum which have been reported to be abstract in nature and as such difficult for students to perform (Bolaji and Adesina 2011). A good look at these concepts requires understanding and good use of demonstration method. The schools involved are the same in terms of staff, provision of instructional material, students' enrollment and uniformity in curriculum among others. Nasarawa Education Zone, selected for the study, is multi-ethnic in nature, where students come from different cultural, religious, political and economic groups.

1.8 Basic Assumptions

For the purpose of this research work, the following assumptions were made:

i. The Basic Science students were taught by qualified, competent and experienced teachers as recommended in the National Policy on Education FRN (2004).

ii. Demonstration method of teaching and relevant instructional materialswereadequate for the teaching and learning of Basic Science concepts.

iii. The teachers use Basic Science syllabus to teach.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This study investigated errors committed by Upper Basic students in Basic Science and suggests possible remediation measures. This chapter, reviewed literature related to the study. The review is organized under the following sub-headings:

2.2 Historical Development of Basic Science in Nigeria

2.2.1 Philosophy and Objectives of Basic Science

2.3 Concept of Errors

2.3.1 Types of Errors Committed in Science.

2.4 Methods of Teaching Science at the Upper Basic Level

2.4.1 Demonstration Teaching Method

2.5 Remediation Strategies

2.6 Academic Performance of Students in Basic Science

2.6.1 Academic Performance of Male and Female Students in Science

2.7 Overview of Similar Studies

2.8 Implications of Literature Reviewed for the Present Study

2.2 Historical Development of Basic Science in Nigeria

According to Balogun (1990) in 1969 science was taught in Nigeria schools as Nature Study or Rural Science in an uncoordinated manner with various parts of Nigeria schools operating at different levels. It is on this effect that the Science Teachers Association of Nigeria (STAN) in the review of its country's curriculum between 1969 to 1970 came out with what we have as Integrated Sciencenow known as Basic Science curriculum. This is contained in the Associations Newsletter No. I (NISP Teachers Guide 1; 1970). However, the National Policy on Education (FME, 2014) placed a lot of

emphasis on science and technology, which the Basic Science begin from the Lower and Upper Basic levels as the foundation for all Science in the school curriculum.

The National Council on Education (NCE) at its meeting in Ibadan in December 2005 directed the Nigerian Educational Research and Development council (NERDC) to review and re-structure and re-align the existing curricula for junior secondary to fit into a 9-year Basic Education Program. Thus, Basic Science curriculum is the production of a re-alignment and restructuring of the revised curriculum for Junior Secondary School Integrated Science (NERDC, 2007). Atadoga and Onaolapo (2008) say, that Basic Science deal with all approaches to the teaching and learning of science, that is, it is an interdisciplinary curriculum. Thus, Basic Science is a fundamental science which cuts across subject boundaries that provide meaningful work for the learners of chemical and physical science, technology and other related discipline. It is a subject which offers to the learner's experiences that help them to develop an operational understanding of structure of science that could enrich their life and make them more responsible citizens in the society. Also, Basic Science,according to National Commission for Colleges of Education (NCCE, 1990), is an approach towards the study of environment free from limitation imposed by the separate subjects' disciplines. It lays emphasizes on concept and processes of science and the skills associated with them as stated in the National Policy of Education (FME, 2014). The skill and processes are acquired in the different levels of education in Nigeria contest. The historical background of Basic Science dates back to 1968 to mid 1970 in the life of Science Teachers Association of Nigeria (STAN) that was characterized by numerous activities in the review of science curriculum subject committees which were set up to consider the changing needs of Nigerian pupils and the international trends to propose guidelines for future science teaching. Basic science began with STAN committees working on the separate disciplines of science and then followed

by joint working sections of representatives from the three committees to make attempt at the integration of those disciplines bringing the results to a unified discipline called integrated science. Therefore, Basic science existed for over 40 years as a course that stipulated the use of integrating principles in science, which should:

i. be relevant to students needs and experiences;

ii. stress the fundamental unity of science;

iii. lay adequate foundation subsequent subjection specialist;

iv. add cultural dimension to science education.

The change from Basic Science to Basic Science began in 2007 when the NERDC was mandated to develop curricula for use at all levels of educational system in Nigeria. In line with government declaration for 9 - year basic education program, the NERDC was directed by the National Council on Education (NCE) to restructure the existing primary and junior secondary school curricula to meet the target of the 9 -year basic education in the content of national economic empowerment and development strategy (NEEDS) and the millennium development goals (MDGS). There came Basic Science that was formerly called Integrated Science, (NERDC, 2007).

According to Atanda and Bello (2009) the Basic Science curriculum has changed the Nigerian Education Policyfrom 6 - 3 - 3 - 4 to 9 - 3 - 4. This was intended to reduce drastically the incidence of dropout from the formal school and also ensuring the acquisition of the appropriate levels of: literacy, numeracy, manipulative, communicative and life - long skills for laying a solid educational foundation. Basic science curriculum is a revised curriculum of the former primary and junior secondary integrated science which was spiral in nature and thematic in approach i.e. themes cutting across all the sciences. STAN (2004) stress that “you and your” home is one of the six themes. The contents now include the issues of shaping the development of the nation identified as globalization,

Information Communications Technology (ICT) and entrepreneurship. Therefore, four areas of curriculum innovations were infused in the Basic science curriculum, theyare:

i. Environmental Education (EE)

ii. Drug Abuse Education (DAE)

iii. Population and Family Life Education (POP/FLE)

iv. Sexual Transmitted Infection (STI, HIV/AIDS)

Basic science as a subject had its initial pace through curriculum review on sciences by STAN and is offered at Upper Basic (JSS) level. The curriculum is aimed at exploring and acquainting the young child with the environment and also widening their power of thinking, reasoning for further scientific study and providing the trained manpower in applied science to the nation (National Policy on Education, FME, 2014). Thus, the course plays a vital role in preparing young pupils for higher scientific study and appropriate choice of science related careers and professions. This basic approach leads to the introduction of subject curriculum offered at the junior secondary school known as Basic Science.

Basic Science, is the grass root of science. Ibe (2008) defines Basic Science as a subject which emphasizes organization of learning experiences around common theme and stresses the unification of concepts around common themes thereby removing the subject matter boundaries. Also, Datom (2015), views Basic Science as the subject that emphasizes the acquisition of modern science and such that enable young people to have access to new knowledge of bringing change in their minds and skills in order to behave rationally and creatively towards problem generated by change. A view of literature reveals that a straight forward definition of Basic Science is scantly documented. What one finds widely discussed are qualities and advantages of Basic Science. Brown (1977) suggested four (4) broad features of Basic Science, which are;

i. Unity of all knowledge

ii. The conceptual unity of science i.e. various concepts are merged together to make up the framework and later identified as a simple concept

iii. A unique process of scientific inquiry

iv. An interdisciplinary study which lay emphasis on viewing subjects as topical of the theme level from different points.

Based on these features, it becomes clear that the essence of Basic Science Course is to teach student what science is and how scientists work. UNESCO (1971) further defines Basic Science as 'An approach to the teaching of science in which concept and principles are presented so as to express the fundamental unity of scientific thought and avoid pre-mature or undue stress on the distinctions between the various scientific fields'. In a simple term, Bajah (1983) sees Basic science as only a way of teaching science. When science is taught in such a way as to present scientific ideas as a unified whole, then we say that the ideas have been integrated. Furthermore, NTI (2007) says that Basic Science is the teaching of science as unified knowledge and a process of taking on investigatory look at a natural phenomenon. According to NTI (2007) generally Basic Science is defined as a conceptual unity of science. This definition suggests that there are certain concepts that are common to all the sciences e.g. energy. It is also identified as a unified process of scientific enquiry because scientists go about their work in the same way-they collect and analyze data, make observation, inference and conclusion. Emeke and Odetoyinbo(2003) stress that the emphasis of the Basic Science program is on the development of the spirit of enquiry as opposed to rote learning as well as the development of manipulative skills and scientific attitudes rather than accepting scientific fact as a dogma.

2.2.1 Philosophy and Objectives of Basic Science

The National Policy on Education, (FME, 2014) states that the aim of education is to inculcate in the child, the spirit of inquiry and creativity through the exploration of nature and for its philosophy, different levels and structures, financing, administration and learning. One of the most important features of this policy is the setting out of clear objectives for education at all levels which are related to overall national objectives of building a free, democratic, egalitarian, strong, just and self-reliant Nigerian society full of opportunities for all citizens (FME,2014). Among the set objectives by the National Policy on Education relating to science and technology education are to:

i. diversify its curriculum to cater for differences in talent, opportunities and roles possessed by the students after their secondary education;
ii. equip students to live effectively in our modern age of science and technology;
iii. raise a generation of people who can think for themselves, respect the dignity of labour under our broad and live as good citizens;
iv. inculcate in the child the spirit of inquiry and creativity through exploration of nature and its local environment. These objectives however, can be achieved by exposing the young students to a proper, effective and sound primary and secondary education.

Secondary education is aimed at providing opportunities for the individual to acquire basic skills for successful interaction with the environment. It facilitates the pursuit of a profession or higher education which would make the individual self-reliant and independent economically. National Policy on Education (FRN,2014) states that, secondary education is the form of education students receive after primary education and serve as the foundation of tertiary education for preparing the child for useful living within the society. In this view James, (2000) states that the objectives of the National

Policy on Education will not be achieved as desired, if appropriate teaching techniques and the principle of individual differences which exist among the subjects are not closely monitored. In line with these objectives, Basic Science was considered as a core science subject made compulsory for all students at Upper Basic level of the Nigerian Education system. In an attempt to achieve this, the teacher has some roles to play such as imparting knowledge to the students, training students with some basic skills and providing guidance for effective learning under a designed and approved curriculum in the form of subjects to be offered in secondary schools. Basic Science taken at junior secondary now referred to Upper Basic 1-3 for the Junior Secondary School (JSS) 1-3 which serve as a foundation for subsequent science subject in the senior secondary schools and for the study of other science related disciplines at the higher level of education. These science subjects are taught in schools in parts as Biology, Chemistry, Physics and Geology.

Finally, Basic science is the core and mandatory subject at the JSS level being the bedrock for scientific literacy, technological strength and development of a nation. Its teaching and learning process have to be focused with the teacher as the pivot becoming well conversant in the appropriate choice of the right teaching method. However, the method employed are those expected to bring increase in the understanding of scientific concepts, principles and facts that lead to remediating student's errors in their academic performance. Therefore, this study identified and remediated errors committed in Basic Science among Upper Basic Students.

2.3 The Concept of Errors

Error have been defined by several researchers, Inekwe (1984) defines error as a wrong process carried out by students in problem solving which leads to a wrong solution after one has been taught the right process. Inekwe (1984) also sees a mistake as an

oversight that may lead to an error in problem solving which is not due to one's lack of knowledge of the correct algorithm. Melle (1996) defines error as mistake or incorrect responses made by students that gives stimuli in form of oral or written test. Supporting this, Hornby (2000) states that an error is a mistake especially one that cause problems, affects the result of an activity. Falalu (2015) opined that error as an in correct response made by student to stimulus in form of written test. Mohammed (2000) explains that errors are due to wrong processes which tend to persist. This implies that errors can be identified and corrected by the learner and the learner would need to be assisted to correct the wrong processes usually employed in solving problems. Errors could be conceptual because of learner's interaction with specific phenomena and that conception formed during this process constitute personal explanatory knowledge of the phenomena in question. Where the conception of a learner does not agree with scientific ideas, error or misconception occurs. According to Piaget (1977) concepts formed by the learner usually form the foundation on which new knowledge is anchored. The position of concept in developing knowledge made it necessary for this study to feature some test items in BSEITon misconception of some concepts in Basic Science. The error analysis techniques according to Postelethwaite (1999) involve going through students' test, examination scripts, homework or assignment books and making frequency counts of the errors committed. Information about the most frequent errors committed can be obtained and possible causes of the errors could be identified. Also Postelethwaite (1999) states that causes of errors could be obtained using questionnaire from teachers and students on the problem they have had with the programme, textbooks or teaching strategy. The result may be used to design a remediation to reduce or eliminate the possible errors committed by students. Hence, the study seeks to identify and remediate Errors Committed among Upper Basic Students in Basic Science.

2.3.1 Types of Errors Committed in Science

As part of the federal government policy on education geared towards encouraging the study of science, student in the senior secondary school are expected to offer, at least, one of the three science subjects namely; biology, physics and chemistry. Researchers on student errors have identified and classified errors into different categories. The types of errors committed by students may vary from one student and subject to the other. Lawal (1995) classifies errors in practical biology into five categories.

i. Random errors

ii. Errors related to sequencing steps within procedures

iii. Errors related to conceptual learning

iv. Errors related to selection of information or procedures

v. Errors related to recording of works.

Errors are not peculiar to practical biology alone. Newbury (1965) also classifies error types for written work in chemistry into seven categories which are:

i. Spelling errors e.g. wrong spelling of scientific terms or concepts

ii. Grammar errors e.g. misuse of plural term in place of singular

iii. Factual errors e.g. when facts like laws, theories or definition are wrong

iv. Drawing errors e.g. this could be in form of wrong drawing of graphs or diagrams

v. Wrong equation e.g. which could occur when an equation is used at a wrong place

vi. Wrong result and conclusion which may occur when there is wrong substitution or wrong arithmetic

vii. Carelessness such as disobeying simple mathematical operations

Ajibola (1988) identifies six error-types as follows: factual errors, algorithmic errors, diagrammatic error, wrong equation, inferential errors, blunder or carelessness.

Inekwe (1984) and Isa (1990) report separately but similar categorization of errors namely; wrong operation, error of computation and algorithmic random errors. Falalu (2015) adopted Ajibola (1988) approach with some modification for the theory Physics examination errors.

For this study, a combination of error classification from Lawal (1995) and Newbury (1965) will be adapted for Basic science and these include;

i. Spelling errors e.g. wrong spelling of scientific terms and concepts.

ii. Pictorial error e.g. an image representation as imagination.

iii. Drawing error e.g. to sketch with pencil on paper.

iv. Labelling error e.g. a small ticket, sign or tag of writing added to something.

v. Error related to conceptual learning; wrong definition of concept.

The researchers identified and classified the errors with a view to improving students' academic performance in their various disciplines. However, improvement of students' academic performance may not be attained without providing a remediation method to correct the identified errors to which this study intends to fill the gaps by using demonstration method on the identification and remediation of error committed in Basic Science. It is hoped that this will reduce the problem that prompts students to commit such errors.

2.4 Methods of Teaching Science at the Upper Basic Level

Teaching of science at the Basic levels essentially requires the use of instructional methods that will enhance meaningful learning and acquisition of skills, thus, making science teaching very easy with many activities and concepts involved. Good human resources will produce good learning resources which help learners to improve on their performance and achieve greatly in their learning endeavours. Okebukola (2002) noted that no one method or theory is the best hence new innovations and strategies are also

suggested in teaching. Moreover, the frequencies with which the teacher changes his/her teaching method depends on the concept, skill or attitude to be developed in the students, which depends on these factors to be considered; the age of the students, the topic to be taught, the size of the class, the available resources at the teacher's disposal and the timing of the lesson to be taught.

Rao (2003) states that in education, the word 'method' means the mode by which the material is communicated from the teacher to the student. It is the way teachers' impart knowledge and skills while teaching and students comprehend knowledge and acquire the skills in the process of teaching. According to Gbamanja (1991), there is no one method of good teaching. The method to be employed depend on the subject matter, the students, the teacher and the environmental variables. Therefore, it is very important to know the prevailing conditions regarding time, place and human nature in the shape of the learners, teachers, parents, and society generally. Ogunleye (2008) maintains that science teachers are to vary their teaching methods on the demands of the situation they may find themselves. A combination of two or more methods may better achieve the desired effect than a single method. Rao (2003) observes that there are many methods of teaching but science selects a particular method based on the needs of the content, teaching facilities available, and ability of the students and the philosophy of the teacher. Rao (2003) categorizes teaching into three; namely oral methods which include: narration, recitation, lecture and discussion method. Secondly, activity methods which include: demonstration method, activity method, project method, laboratory method, discovery learning/inquiry approach, problem solving method and supervised study. Thirdly, special methods which include: programmed learning, team teaching, computer assisted learning and personalized system of instruction. In addition, Atadoga and Onaolapo (2008) itemize several methods to be employed in teaching Basic Science at the

Upper Basic level in the classroom to present scientific facts, information, principles, skills as well as concepts which include the following: demonstration method, lecture method, laboratory/experimental/activity method, discovery or inquiry method, project method and field trips method.

Atadoga and Onaolapo, (2008) are of the view that laboratory method is based on activities carried out by an individual or a group through the exercise and experimental approach for the purpose of making personal observation of processes, products or events. Laboratory exercises are activities carried out in order to provide practices in design, operating and interpreting experiment. Experiments are operations or procedures employed for the purpose of testing of hypothesis. Laboratory can be indoor or outdoor laboratory. Example of indoor laboratory is where students view micro-organism with microscope and identify part of plant or animal cells while the teacher guides them. In outdoor laboratory students can do activities like planting of beans after being guided by their teacher. The above activities can be effectively used to teach basic science but teachers must ensure that the procedure for the investigation should be very simple and clear. It should be based on the students' background and the availability of materials needed for the work. This method will encourage basic science teachers and lead them to better rotation of information and develop formidable attitudes of students towards science. Also, it will enable them to become familiar with such mental processes and ability for critical thinking.

Dienye and Gbamanja (1990) Identified discovery method as a teaching strategy designed in such a way that students through their own mental processes,can discover a fact, concept and principle. Thus, students then predict the result, make observation and relate the investigation to previous work done by other researchers. On the other hand, inquiry method is a teaching approach whereby students are allowed to formulate the

problem, state the purpose, predict the result, identify procedures and perform the investigation. Adedoyin (1990) sees inquiry as a method of teaching where the learner with minimum guidance from the teacher seeks to discover and create answers to a recognized problem through procedure of making a diligent search. Inquiry is also a term used in science teaching which refers to a way of questioning, seeking knowledge or information, finding a phenomenon that involves investigation, formulating hypothesis, gathering and interpreting data and arriving at a conclusion. Moreover, according to Abdullahi (1982) whether discovery or inquiry, it involves instructed exploration in which a student through his or her mental processes such as observing, measuring, classifying, analyzing, synthesizing and evaluating to draw general conclusion from data which are gathered. Discovery/inquiry method is student-centered and agrees with early psychology like Bruner (1966) says that learning involves active processing of information that is organized and reconstructed in a unique way by each individual. In using this method, the teacher should have the previous knowledge of what the child discovers and ensure that the size of the group is small. The method of discovery in teaching Basic Science increases the students' intellectual ability and potentiality and help in memory processes and the students' ability to organize and carry out investigation. It builds up confidence and motivation for further exploration and self-development among students. Project is another method of teaching in which teachers employ to teach science.

Project method is similar to laboratory method, Sola and Ojo (2007) opine that project method of teaching involves assigning a particular work to students to work on either in group or as individual and to complete it at his/her spare time and report back to the teacher as demanded. The project method provides an excellent opportunity for the complete act of thinking by the students. Rogus (1985) further attributes project method

as a means of teaching the students self-discipline because he/she will define the problem, plan the work, find appropriate resources, carry out those plan and draw conclusion. It is meant to individualize instruction. This requires a bit of originality giving students free hand to look at problems which are of special interest to the final solution to these problem. The method provides for the needs of individual students or sometimes small group or that those with special ability may have opportunities to be fulfilled. However, project method requires great deal of supervision and guidance from the teacher. It is also student-centred method.

Atadoga and Onaolapo (2008) are of the view that another method for teaching Basic Science is the field trip. This takes place outside the classroom like a visit to the airport, a game reserve with the purpose of making relevant observation and gathering specific information on what has been taught in the classroom. The method offers students the opportunity to be actively involved in specific processes such as observation, data collection, classification, making inference, studying relationship, manipulation of object, etc. Complete picture of concept being taught is gained or actualized using this method by the students. Field trip is made to be an important part of an effective science instruction if well planned and plays the same role as laboratory experiment and demonstration because first hand experiences are gained in the process. Abdullahi (2006) states that well-designed, planned and structured field trip can provide an effective instructional experience. By providing an alternative to the normal science classroom setting, it can promote motivation and achievement.

Adamu (2010) states that lecture/chalk and talk method of teaching are the most popular methods of instruction commonly used for science teaching. These methods are traditionally referred to as the didactic approach and are defined as teaching techniques in which one person, usually the teacher, presents a spoken discourse on a particular subject.

Idris (2014) says lecture method of teaching emphasizes talk and chalk in the teaching of science subjects. More than 80% of science information and principles are delivered via lecture method. According to Kelly (2009), the teacher does most of the activities in form of talking and writing on the board while the students listen. The effectiveness of this method is that it requires clear and good command of language, good ability to write, it saves the teacher a lot of challenges in the class, it saves time and energy, it is not expensive as only the chalkboard and chalk are required. It allows easy handling of large class without much stress and easy coverage of syllabus but does not promote meaningful learning. Idris (2014) says it is purely a teacher-centred approach where students are not given opportunity to ask question or give feedback to the teacher Moreover, Atadoga and Onaolapo (2008) say that the lecture method of teaching has the following disadvantage;

i. The different ability groups present in any given class are not taken care of
ii. It encourages only rote learning without necessarily aiding understanding
iii. It is stressful for students sitting for a long period of time only listening and writing, it therefore leads to restlessness and disruption of normal class procedures.

However, on the basis of the short comings and weaknesses, effective teaching method which are student-centered such as constructivist method of teaching like demonstration are used in teaching Basic Science. Adamu (2010) adds that a cursory `look at the secondary schools in Nigeria has shown that many teachers in the system still rely much on the traditional “chalk and talk” method of teaching rather than embracing the use of demonstration teaching method. Thus, Basic Science is an activity based course whose teaching and learning process requires method that concretize concept to the learners. It was on the background that the researcher identified and remediated errors

committed in Basic Science among Upper Basic students using Demonstration Method of Teaching.

2.4.1 The Demonstration Teaching Method

Demonstration according to Rao, (2003) is a process of showing how something works or is used. It is an act to display the working of some experiment. The demonstration method is a natural method of teaching and provides foundation for the initiative behaviour through example. Similarly, demonstration provides foundation for apprenticeship training. When a teacher is showing the presence of carbohydrate in food materials, he is demonstrating. Thus, demonstration is one of the most common methods used by science teachers. Science is based on sensory experience and in learning by observation and experimentation where a student uses his sensory organs. When properly utilized, demonstration method can be effective as well as useful. Demonstration according to Shefton (2001) referred to the method in which the learners are provided with an opportunity to observe for themselves the object or processes that they wish to learn. It can be real-life, make believe situations or models. Sola and Ojo (2007) are of the view that demonstration usually accompanied by thorough explanation via visual aids of teaching based on simple but sound principles and processes that we learn by "doing". The students learn physical and mental skills by performing those skills learnt under teacher's supervision. Aina (2007) states that demonstration involves carrying out science activities, and that demonstration can be carried out by the teacher alone, the teacher with a child, the child who is knowledgeable in the activity and an invited guest.

Atadoga and Onaolapo (2008) says that demonstration method in teaching Basic Science referred to making an exhibition or displaying something during the learning process of Basic Science concept to the students. This method involves the introduction of new skills or ability to learn a better way of doing something usually accompanied

with a lot of explanations showing how something works or operates. It is commonly used in the teaching of Basic Science as apparatus and skills which are vital ingredients in the study of science that are introduced to the students. For instance, the demonstration of the action of unripe orange (acid) on blue moist litmus paper, the use of microscope, dissection of a toad or rabbit or handling equipment and materials to observe scientific phenomena.

Demonstration method is used to show parts of an object taught or making students understanding of some principles in science by showing the presence of carbohydrate in food materials by demonstration. Demonstration can be done by the teacher while students are observing and after which the teacher will allow them to do same. Dienye and Gbamanja (1990) suggest the use of demonstration method in teaching Basic Science and that the following should be taken into account by the teacher:The teacher should make sure that the demonstration method will succeed because when it fails, the students' faith in science will be affected. It should be used to guide thinking of all students into similar mental direction. The object to be used should be visible to all students.However, Dienye and Gbamanja (1990) are of the opinion that demonstration method makes the students to have a good retentive memory and the knowledge gained last longer than when they are simply told. Similarly, interests of the students are motivated when the demonstration method is properly used. In view of this demonstration was applied for this research work. It also economizes materials needed especially when they are in short supply to go round a large number of students and saves time where time is considered as an important factor.

2.5 Strategies for Remediation

Remediation means different things to different experts. Perin (2003) defines remediation as a class or activity intended to meet the needs of students who do not have

the skills, experience or orientation necessary to perform at a level that the institutions or instructors recognize as regular for the students. The American Heritage (2000) defines remediation as an act or process of correcting a fault or deficiency. Also, remediation can be defined as an act or process of remedying or overcoming learning problems.

Remediation of identified errors may require a short or long -term plan to achieving the intended goal of correction. The plan for achieving the required corrections is the remediation strategy. Callaway and Moore (2007) presents an empirical approach to selecting a remediation strategy and opined that the success of a remediation depends on content of remediation and selecting the right strategy at the right time. They presented many competing learning theories upon which some remediation strategies were built upon. Callaway and Moore (2007) proposed that students learn when they experience an impasse, such as getting stuck, they may be correct but uncertain and could have made a known type of error. The teacher in this case shows what is wrong and the reason why the method is wrong. The remediation shows how to solve the problem. The entire task is done and practice tasks are given.

Falalu (2015) view that when students are given an opportunity to give an accountable talk when attempting to solve a given task, valid examples and reasoning strategies of the student could be deduced which could give guide on areas of error. This view could be the reason why some remediation strategies require students to verbalize their problem solving procedures with a view to giving account of every step taken to solve a given problem. Falalu (2015)stated that printed instruction approach usually contains organised textual material of instruction organised in relevant area of difficulty. The structure and format of the text will depend on the nature, scope and theoretical assumptions on which the remediation is designed. After an assessment, the teacher shows the correct way on the board and reason for each step of solving the problem where

student early responses were wrong. The teacher re-teach the subject area where the students have committed errors in. The students are then re tested to see whether the remediation is successful or not. Several studies have been conducted to compare the effectiveness of the methods for remediation of student's errors. The intention of present study is to identify student errors committed in Basic Science, design demonstration remediation package and use re-teaching strategy to administer the remediation package.

2.6 Academic Performance of Students in Basic Science

Performance is defined in different ways by different authors depending on the issues,therefore. Performance means accomplishment or proficiency of achievement in a given skill or body of knowledge. Academic performance according to Amuset (1994) is the knowledge attained or skill developed in the school subject, usually designated by test score or by means assigned by teacher.Academic performance according to Raji (1994) can be considered to mean the successful outcome of accomplished activities to tasks in educational measurement in relation to accepted standards. Bomide and Gyuse (1992) accept as evidence, if cognitive performance such as recalling scientific information, demonstrating ability to comprehend, apply, analyze, synthesize and evaluate any given scientific information. In Basic Science, Omebe and Omiko (2015) observe that field trip, discovery, problem-solving, laboratory methods of teaching Basic Science were used for several years by the Basic Science teachers and yet the results of the students in JSSCE have not been encouraging. Omebe and Omiko (2015) attributes the low academic performance in Basic Science to lack of trained teachers, lack of proper teaching materials, absence of conducive teaching and learning environment, inadequate evaluation and inadequate teaching methods. According to Nworgu (2005) on the Effects of Gender Sensitization Package (GSP) on Students Achievement in Basic Science observes that male students perform significantly better than female ones. Therefore, this

study intends to identify and remediate Errors Committed in Basic Science among Upper Basic Students of Nasarawa Education Zone, Kano. It is also the aim of this study to fill this gap.

2.6.1 Academic Performance of Male and Female Students in Science

In sorting out academic performance of males and female students in science, Westminster Institute of Education (2006),viewing gender issues in the context of education refers to the differences, both real and perceived, between boys and girls and their relative academic achievement and opportunities. Gender according to Bichi (2002) refers to the content of masculinity and femininity found in an individual. Gender in science is the classification of the roles males and females play in science. This is the consequence of gender stereotypes which have classified different roles for male and female in the society. Gender differences do exist in many different areas of education from performance to attitudes, from classroom activities and course enrolment to perceptions about careers. Bichi (2002) and Bunkure (2007) have shown their concern on gender related issues with the view to improve science teaching and learning. Obeka (2009) stated that girls and women over the years have tended not to study science when compared to boys and men. Mari (2001) reveals superiority in performance of female students over their male counterpart in task involving science process skills.

Academic performance is affected by many factors such as interest, motivation, student's ability and the quality of secondary education received, etc. Academic performance according to Raji (1994) can be considered to mean the successful outcome of accomplished activities to tasks in educational measurement in relation to accepted standards. Fafunwa (1997) observes that male students possess more accurate knowledge about natural phenomenon than female. Oraifa (1999) explains the patterns of performance among male and female students in science. The result shows that there is

significant difference in the performance of male and female students in school science in favour of males. Nworgu (2005) on the Effects of Gender Sensitization Package (GSP) on Students Achievement in Integrated Science observes that male students perform significantly better than female students. On the contrary, Bichi (2002) in his findings on the Effect of Gender on Academic Achievement in Evolution concepts among Secondary School Students show that there is no significant difference between the post-test mean scores of male and female student using problem-solving instructional strategy. Also,Usman (2007) reports that there is no difference in the performance of male and female students in Integrated Science practical activities when taught using NISEPT mode of instruction.This study intends to carry out the Identification and Remediation of Errors Committed on gender and academic performance in Basic Science among Upper Basic Students of Nasarawa Education Zone, Kano State.

2.7 Overview of Similar Studies

This section reviewssimilar studies conducted on errors students commit and its remedy were in various academic disciplinessuch as, literatures work on Geography, Biology, Physics and other related subjects in Basic Science. The researcher therefore reviewed the available related studies conducted on identification and remediation of errors with the aim of identifying areas of inadequacy so as to fill the gap in knowledge. As the following literature were reviewed thus; Lawal (1995) researched on Error Analysis in Practical Biology of Senior Secondary School students in Zaria and SabonGariLocal Government Area, Kaduna state. The instrument used was selected questions and possible error types from WAEC practical questions and 317 final year Biology students in Zaria metropolis in 5 schools as the sample of the study. One-way ANOVA and Chi-square were the statistical tools used in analyzing the data collected.

The result of the study showed that there was a significant difference in error types between schools. The girls committed less error while boys committed more errors. This study weakness was the restrictions to biology practical alone, leaving the theory and use of final year students. Also, did not profer remediation for those errors making the knowledge on error incomplete about Biology. The instruments used by Lawal(1995) were from a reliable source, WAEC, which is one of the authorities loaded with responsibilities of preparing and conducting examinations for Senior Secondary School students in Nigeria and West Africa and gender dimension of errors were addressed as was attempted in this study. This research has similarity in terms of error type identification, but differs on subject, class levels and remediation solutions as the study aims at filling the gap on Basic Science.

Furthermore, Abdulkarim (2011) study on Analysis and Remediation of Errors in the Presentation and Interpretation of Topographical Maps among Senior Secondary School Students in Kaduna State. The design for this study was in two parts; namely: Survey and experimental design. The survey design was used to identify and present the topographic errors while the experimental design was employed to determine the efficacy of the remedial package developed for remediating the errors thus, a total of one hundred (100) subjects were selected for the study. Four intact SS3 classes were selected from each of the two schools from where fifty (50) subjects were randomly sampled using table of random digits. The subjects were split in two groups of twenty-five (25) for treatment. The instrument used for data collection was Error Identification, Presentation and Interpretation (EIPI) which was used as survey design instrument, Topographic Achievement Test (TAT) and Topographic Simulation Package (TSP) was developed by the researcher as a remediation package. The mean scores in the topographic achievement test for control group was 40 and the experimental group was 57.82 after

treatment. The result shows a difference of 30 in the mean scores between the control and experimental groups. With a t-value of -8.55 and a p- value of 0.001 the statistics indicates a level of significance at $p \leq 0.05$. The results show that strategies of teaching in the Topographic Simulation Package (TSP) used for the experimental group is a better instrument of instruction and remediation topographic map reading exercises than the strategies of conventional teaching used for the control group. Abdulkarim (2011) result shows that errors on presentation were highest while interpretation error was least with 15%. Relation between errors of identification was significant and positive. The remediation approach employed shows that it was effective. The study pattern bears relevance on identification and use of a remediation instrument, research designs but its limitation was on an aspect of geography study oftopography, genderand class level to which this work cover.

In addition, Falalu (2015) identifies errors in Physics and efficacy of a Remediation Package among Secondary School Students in Zaria, Kaduna State, Nigeria. Two coeducational schools were selected out of nineteen senior secondary schools in the zone. 122 students, comprising 92 males and 30 females out of 1831 senior secondary school students were used in the study. The study design was in two folds; Diagnostic test for identification errors was surveyed while the remediation part was Quasi experimental in nature. The instruments used were Error Diagnostic Test (EDT), Physics Achievement Test (PAT) and Remediation Package for Identified Errors in Physics (RP).During the diagnostic segment seventeen errors were identified and a Remediation Package for Identified Errors in Physics (RP) was developed based on identified error topics. At the remediation segment, experimental group was exposed to the remediation package using problem solving approach while the control group was taught using lecture method. The research questions were raised and five null hypotheses were developed for testing. Frequencies and percentages of errors and achievement scores were used in answering the

research questions while Chi-square, Pearson Product-Moment Correlation Coefficient and t-test were the statistical tools used for testing the hypothesis at 0.05 level of confidence. After analyzing the data, the following were the major findings; four error-types were identified with factual error having the highest and communicative error having the least frequency. There was significant difference in the frequency of different error-types committed by the SSII students in Physics examination, there was significant difference in the academic achievement of SSII students between those exposed to the Physics remediation package and those taught using lecture methods and there was an inverse relationship between frequency of errors and academic achievement scores of subjects. As errors increased, the achievement score decreased. This shows that the remedial package developed based on diagnosed errors and taught using problem solving method during remediation was effective in reducing error frequency and improving students' academic achievement. Recommendations were made for using the developed package to address similar situations too and Physics teachers should be trained and retrained with use of problem solving teaching strategy and on how to use the remediation package used in the study. Falalu (2015), study shows that the problem-solving remediation package is effective while this study intends to employ demonstration method. The study pattern of identification, remediation instrument and research designs make the work similar and relevant to this work.

Also at the Upper Basic, Datom (2015) studies on Effectiveness of Demonstration and Guided Discovery Methods on Interest and Achievement of Upper Basic Science students in Wukari Educational Zone, Taraba State Nigeria. A quasi- experimental group design involving pre and posttest intact classes were used. The population of the study comprised 5109 Junior Secondary School (JSSII) students of public Schools in Wukari Educational Zone, out of which 159 students were randomly sampled from three Junior

Secondary Schools that were part of the population to form the participants for the research work. Two instruments were used for data collection which were: Basic Science Concept Achievement Test (BSCAT) and Students Interest Scale of Basic Science (SISBS). The instrument BSCAT had a reliability coefficient of 0.75 using Kuder-Richardson K-R 20 method. BSCAT consisted of 50 multiple choice items objective tests. On the other hand, SISBS was found to have a reliability coefficient of 0.78 using Kuder-Richardson K- R 21 method. SISBS was developed based on Likert's 5-points interest scale. The instruments were validated by four experts. An intensive teaching session which lasted for five weeks for both experimental and control groups was undergone. The participants in EG1 were taught nutrition concepts using demonstration method while participants in EG2 were taught the same concept using guided discovery method. The control group was taught the same concept using the lecture method after which posttest was administered to the participants to find out the effects of demonstration and guided discovery teaching methods on interest and achievement of Upper Basic Science students. Three research questions corresponding to three null hypotheses were formulated and tested at $P \leq 0.05$ levels of significance. Analysis of Variance (ANOVA), Scheffe's Post Hoc Tests as well as Kruskal-Wallis interest analysis was used for testing the hypotheses. The analyses of the variables were done using computer statistical software.

Findings from the study showed that out of the three methods of teaching tested, guided discovery method (EG2) performed best, with an F value of 61.15 at $P \leq 0.05$ levels of significance, followed by demonstration method (EG1) and the lecture method (CG) performed low. Also the interest level of participants showed significant difference after exposure to demonstration method while there was no significant difference in interest level of participants after exposure to guided discovery and lecture methods of instruction. Based on these findings, relevant recommendations were made. A major

highlight of the recommendation is that stakeholders in the education sector should make concerted effort to see that government at all levels encourage the use of guided discovery teaching method by sponsoring teachers to attend in-service training so as to be acquainted with this activity–oriented teaching strategy in the teaching and learning of Basic Science in our Junior Secondary Schools. Datom (2015) study on Guided Discovery Method performed best with F value of 61.15 at $p \leq 0.05$ level of significance. This research has similarity in terms of subject area (Basic Science) and demonstration teaching method employed for the study but its study weakness was on error identification and remediation of which the study will fill its gap.

From the literature so far reviewed, it is seen that Datom (2015) researched on Basic Science usingtwo teaching methods (Demonstration method and Guided Discovery Method) of which students taught with Guided Discovery performed best with F value of 61.15 at $p \leq 0.05$ level of significance.On this low performance the researcher used the demonstration teaching method to demonstrate Basic Science concepts when considering science instructions on remediating Errors committed by students in Basic Science; it was considered along with other variables which might influence it. AlsoFalalu (2015), Abdulkarim (2011) and Lawal (1995) did similar studies on error identification and research designs, in their various field.Also the various views expressed, the use of written examination and interview have their strength and weakness. They research in Physics, Geography and Biology at the senior secondary level respectively while this research will be covering the gap at Upper Basic leveland students written examination script was used as instrument in order to find out the errors and if demonstration method of teaching would predict a better performance of students in Basic Science and to prefer possible solutions based on the outcome of the study.

2.8 Implications of the Literature Reviewed for the Study

The review of the related literature indicates that science teaching in Nigeria has been dominated by emphasis on factual knowledgewhich is reflected on examinations. The process of science which requires the students to look for evidence is often neglected. The literature also indicates that after identification, remediation is expected to follow. In this study, therefore, remediation was designed and administered based on the kind of error identified. In addition, Nwafor (2014) states that Basic Science is given great emphasis in the Upper Basic curriculum and suggest that the teaching and learning should involve the use of innovative methods like discovery, problem-solving, demonstration, open ended, field trips and laboratory methods among others of which demonstration method were the focus on this study.

In remediation, teaching and re-teaching method were used and students are taught on topics where errors are identified using demonstration method, exercises and activities. Where there are further challenges, the problem areas are re-taught. The Experimental group was treated with remediation containing printed texts, pictures, charts, labels, exercises and activities while the control group receives lectures without reference to the content of the activities. Present study has reported gender issues, school's errors committed, performance andremediationmethod on errors committed. This approach is different from the methods employed by Inekwe (1984) and Lawal (1995) because itproffers remedy andIdentification of Basic Science errors among Upper Basic Students which are different from errors in practical Biology as addressed by Lawal (1995), Topographic map of Abdulkarim (2011) in Geography and Falalu (2015) in Physic which is in senior level. Considering the cognitive level of Upper Basic Students, printed textual materials were used anddemonstration teachingmethodwas employed during the remediation stage, as they appear quite appropriatein Nasarawa Education Zone, Kano.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This study identified and tried to remedy errors committed in Basic Science among Upper Basic Students in Nasarawa Education Zone of Kano state, Nigeria. The descriptions of the methodology and procedure that was employed to conduct the research are described under the following sub-headings;

3.2 Research Design

3.3 Population of the Study

3.4 Sample and Sampling Technique

3.5 Instrumentation

3.5.1 Topics Selected for the Study

3.5.2 Validity of the Instruments

3.6 Pilot Testing

3.6.1 Reliability of the Instruments

3.6.2 Item Analysis

3.7 Administration of Treatment

3.8 Data Collection Procedure

3.9 Procedure for Data Analysis

3.2 Research Design

The design for the study had two stages.The first wassurvey study for identification of errors committed among upper Basic Students. The second designwasquasi-experimental research for remediation of Basic Science errors which was aimed at reducing those errors identified. Quasi-experimental design whichinvolvedpre-test and post-test for both experimental and control groups, (Kerlinger, 1973). The design wasa form of group comparison to determine the effect of demonstration method. Each group was given a pre-test in order to find out their entry behaviour and performance. The two groups were taught for six weeks in which experimental group were exposed to the treatment for the study in form of developed activities for the treatment in remedying the identified errors committed. Demonstration method was used as treatment forthe experimental group and the control group were taught using lecture method with identical topics. After the treatment, the same pre-test of Basic Science Performance Test was administered to students at the end of the period as post-test in the two groups. This is to ascertain the effects of the treatment on the identified errors committed by the students. The design was in Figure 3.1

$EG \longrightarrow O_1 \longrightarrow X_1 \longrightarrow O_2$

$CG \longrightarrow O_1 \longrightarrow X_0 \longrightarrow O_2$

Figure 3.1 Research Design.

Where:

EG = Experimental group

CG = Control group

O_1 = Pretest

O_2 = Posttest

X_1 = Demonstration Method

X_0 = Lecture Method

3.3 Population of the Study

The target population for this study was8569 students of Upper Basic in the twenty-eight (28) public schools in Nasarawa Education Zone of Kano State. The schools are single sex schools made up of 15 boys' schools with a population of 4519 and 13 girls' schools with its population of 4050 offering Basic Science. Details of their enrollment are given in Table 3.1.

Table 3.1: Population of the Study

S/N	Schools	Type of schools		Total
		Male	Female	
1.	GSCS Airport Road	431	-	431
2.	GSIS Dakata	188	-	188
3.	Kano Teachers College	336	-	336
4.	GASS Giginyu	180	-	180
5.	GSS Hotoro	537	-	537
6.	GSS Kawaji	792	-	792
7.	GSS KauraGoje	155	-	155
8.	GSS Kwakwachi	229	-	229
9.	GSS Gogau	089	-	089
10.	GSS Maikwatashi	200	-	200
11.	GSS MVA Kuka	266	-	266
12.	GSS Stadium	353	-	353
13.	GSS Suntulma	240	-	240
14.	GJSS Danwaire	103	-	103
15.	ADSS Bukavu	420	-	420
16.	ADSS Bukavu	-	573	573
17.	GGSS A'ishaShehu	-	120	120
18.	GGASS Gwagwarwa	-	240	240
19.	GGSS Dakata	-	574	574
20.	GGSS Dangana	-	372	372
21.	GGSS Giginyu	-	356	356
22.	GGSS Hotoro	-	325	325
23.	GGASS Kawaji	-	573	573
24.	GGSS Maikwatashi	-	360	360
25.	GGSS Maryam Abacha	-	230	230
26.	GGASS MasallachiFagge	-	067	067
27.	GGSS Dabo	-	207	207
28.	GGJSS Nomansland	-	053	053
	TOTAL	4519	4050	8569

Source: Nasarawa Education Zone Office, Kano (2017)

3.4 Sample and Sampling Technique

For the purpose of selecting the sample for this study a random sampling technique was used,four schools were selected of which two schools each were randomly selected from fifteen Male and thirteen female schools. The schools were sampled based on yes or no balloting, wrapped papers given to students, those that pick yes were considered and those that pick no were not used in the study. The students were selected purposively through balloting of yes or no based on convenient.In each of the school one armwas purposively selected. A pretest was administered to establish that they are equivalence. After the pretest, the significant difference of the schools was determined using post-test.

In this study, thirty students were purposely selected from each of the classes for the study which was in line with the central limit theorem Tuckman(1975) and Sambo (2005) recommendation that a minimum of 30 students from each school can serve as a sample for a study. Details of the samples are shown in Table 3.2

Table 3.2: Sample for the Study

S/N	Type	Gender	Schools (code)	Population	Sample
1.	Control	Female	School1	200	30
2.	Control	Male	School 2	360	30
3.	Experimental	Female	School 3	353	30
4.	Experimental	Male	School 4	107	30
	Total		**4**	**1020**	**120**

3.5 Instrumentation

Two instrument were used for data collection in this study;

1. Basic Science Error Identification Test (BSEIT) and
2. Basic Science Performance Test (BSPT).

Basic Science Error Identification Test (BSEIT) was usedin the survey to identify the errors Basic Science students committed. The BSEIT comprisesof 20 items in form of writing, drawing, picture and labelling drawn from topics selected in Table 3.3for Basic Science errors identificationas shown in Appendix C. The instrument wasalso used on the four schools selected to determineerrors among them.

Basic Science Performance Test (BSPT) was used to test the performance of students before and after treatment containing 25 test questions which the researcher adapted. They were modified to fit in based on the topics selected "Changes in non-living things, Energy and Changes in living things" In nature of objectives and few writing and drawing as shown in Appendix D. The testwas used as post-test to measure the difference between students' academic performancein the experimental group taught with demonstration method and control group taught with lecture method and the difference in gender performance in Basic Science. BSPT items test was administered by the researcher in person in form of objective and written tests to find its result on the errors identified. The results were subjected to test analysis.

3.5.1 Topics Selected for the Study

Basic Science curriculum for Upper Basic 2 was carefully studied. These topics were selected for the study for the following reasons: -

A. Changes in non-living things

B.Energy

C.Changes in living thing

1. The topics form a good representation of the major areas of Basic Science, i.e. Physics, Chemistry and Biology.

2. These topics are in upper basic 2 syllabi and contain several illustrations that could be taught using various methods.

These topics are selected because they feature in Upper Basic 2 curriculum and can be taught using the demonstration method as well as lecture teaching method. Thus, it is assumed that any significant difference in academic performance between the experimental and control groups can be attributed to the effect of the treatment administered**.**The table of specification for the Basic Science Performance Testwas shown in Table 3.3 while the detail of the Basic Science Performance Test is shown in Appendix H.

Table 3.3: Table of Specification according to Bloom's Taxonomy for BSPT

Content	Weight %	Knowledge 14%	Comprehension 20%	Application 24%	Analysis 14%	Synthesis 14%	Evaluation 14%	Total 100%
Changes in non-living things	36	2	1	2	2	1	1	9
Energy	28	1	1	2	1	1	1	7
Living things	36	1	3	2	1	1	1	9
Total	100	4	5	6	4	3	3	25

Source: Researcher's Field Work (2017)

3.5.2 Validation of Research Instruments

The contents of the BSEIT and BSPT were validated by a panel of experts which included; three senior lecturers with minimum PhD qualification from Science Education Section of Faculty of Education and one senior lecturer from Biology and English Language departmentAhmadu Bello University, Zaria and two Basic Science teachers in Kano state who translated the curriculum of Basic Science at the classroom level. These experts critically examined and assessed all the items of the instruments for the purpose of (a) face validity (b) appropriateness of the items in terms of reading difficulty for the groups (c) clarity of the statement in the instrument and learning materials (d) checked possible errors in the instrument.

The suggestions given by the experts were used in reconstructing test items which measured student's response to Basic Science Errors Identification Test. Initially,BSEIT were 25 questions but only 20 was retained and 5 questions dropped after validation, while 2 were reframed that was question 1 and 6. While Basic Science Performance Test were 30 questions but 25 was retained. Their constructive criticisms and feedback lead to the finalquestions of BSEIT and BSPT as shown on Appendix C and D.

3.6 Pilot Testing

A pilot testing was conducted involving students of Kano Teachers College and Army Day Secondary School Bukavu which are part of the population but not involved as sample. The twenty (20) items of BSEIT was used for errors identification and twenty-five (25) items of BSPT questionnaire were administered to thirty (30) students to test the performance of students with the assistance of the Basic Science Teachers in the school. Thus the concepts incorporated in the test were maintained in the main study. Errors identified in Basic Science Error Identification Test for the pilot study includes:

a. Spelling errors e.g. wrong spelling of scientific terms and concepts.
b. Pictorial error e.g. an image representation as imagination.
c. Drawing error e.g. to sketch with pencil on paper.
d. Labelling error e.g. a small ticket, sign or tag of writing added to something.
e. Error related to conceptual learning; wrong definition of concept.

The data collected from the pilot testing was analyzed to determine the test reliability coefficient of the instrument of the study. Also the pilot testingwas done to:

i. find out the characteristics of items through item analysis;
ii. determine the appropriateness of the topics and length of time required to take the test;

iii. determine the appropriateness of the wording and identify errors students commit;

iv. find out the reliability of test items.

3.6.1 Reliability of Research Instruments

The study employed test-retest method to determine the reliability of the instruments. The reliability coefficient was established as 0.87. According to Sambo (2005) this value is recommended as good characteristics of reliable instrument. The reliability test showed that conceptual, spelling, drawing, labeling and pictorial errors were foundand the topics are suitable for the study.

3.6.2 Item Analysis

Facility index (FI)

This is the measure of appropriateness or otherwise of a test item. That is, whether an item is too difficult or too easy for the subjects. It was calculated by dividing the number of students that got an item correct with the total number of students that participated in the test.

Mathematically, Facility Index (FI) = R / T. Where:

R= Number of correct responses,

T= Total number of respondents.

According to James (2000), an item difficulty is more than 0.70 value, such an item is easybut if the difficulty value is below 0.30, it become difficult of the item. For the purpose of this study, the values were used after the pilot test. The details of the scores were presented in Appendix H.

Discriminating Index (DI)

This refers to how well an item assessment differentiates between high and low scorers. The following steps were taken after the pilot test to compute the discrimination index for each item in the test. The steps are as follows:

i. Ranking order of the scores on the test from the highest to the lowest was done

ii. Identification of the high and low scoring groups was made.

iii. Determination of the 50% each of the high and the low groups passing an item was also made.

iv. Computation of the item discrimination index was made by subtracting the percentage of those with correct answers in the lower scoring group from those in the high scoring group and then divided by half the number of the students that sat for the test.

Thus, the discriminating index of the BSPT was determined using the formula given by James (2000) as:

Discriminating index (DI) = $\frac{G_U - G_L}{\frac{1}{2}T}$ Where:

DI= Discriminating index

G_U= Number among upper 50% above of respondents who scored the item correctly

G_L= Number among the 50% below of the respondents who scored the item correctly

T= Total number of respondents in the upper and lower group

Thus, the discriminating index with the range of 0.30-0.70 was moderate and was used for this study during pilot test, which was in line with the recommendation of James (2000). After the pilot test the researcher restricted some of the BSPT test items that were bad from the items. 25 BSPT test items were left and were used for the study proper. The details of the values obtained during the items analysis were presented in appendix H.

3.7 Administration of Treatment

The experimental groupswere taught by the researcher using demonstration method.While the control groupswere also taught using lecture method. The experimental group was taught selected Basic Science concepts, this involves exposing the students to practical demonstration, use of pictorial materials to real learning as well as foster students' interaction with their environment and teacher. The control group was taught the same basic science concepts using lecture method. Lesson plans for the treatment and control group are the same in terms of contents, basic instructional objectives, and length of time for teaching and mode of evaluation except for the activities in the experimental group.

The researcher, during the activities with the experimental groupswas a guide to students in cross-checking and assessing their activities throughout the treatment period. At the end of the six (6) weeks teaching, the researcher administered the post-test to the participants in the two groups using Basic Science Performance Test (BSPT). The scripts from both pre-test and post-test of the two groups were marked and scored using the marking guide. Thesteps for the demonstration method adapted from Kim and Kelly (2010) used is show in figure 3.2;

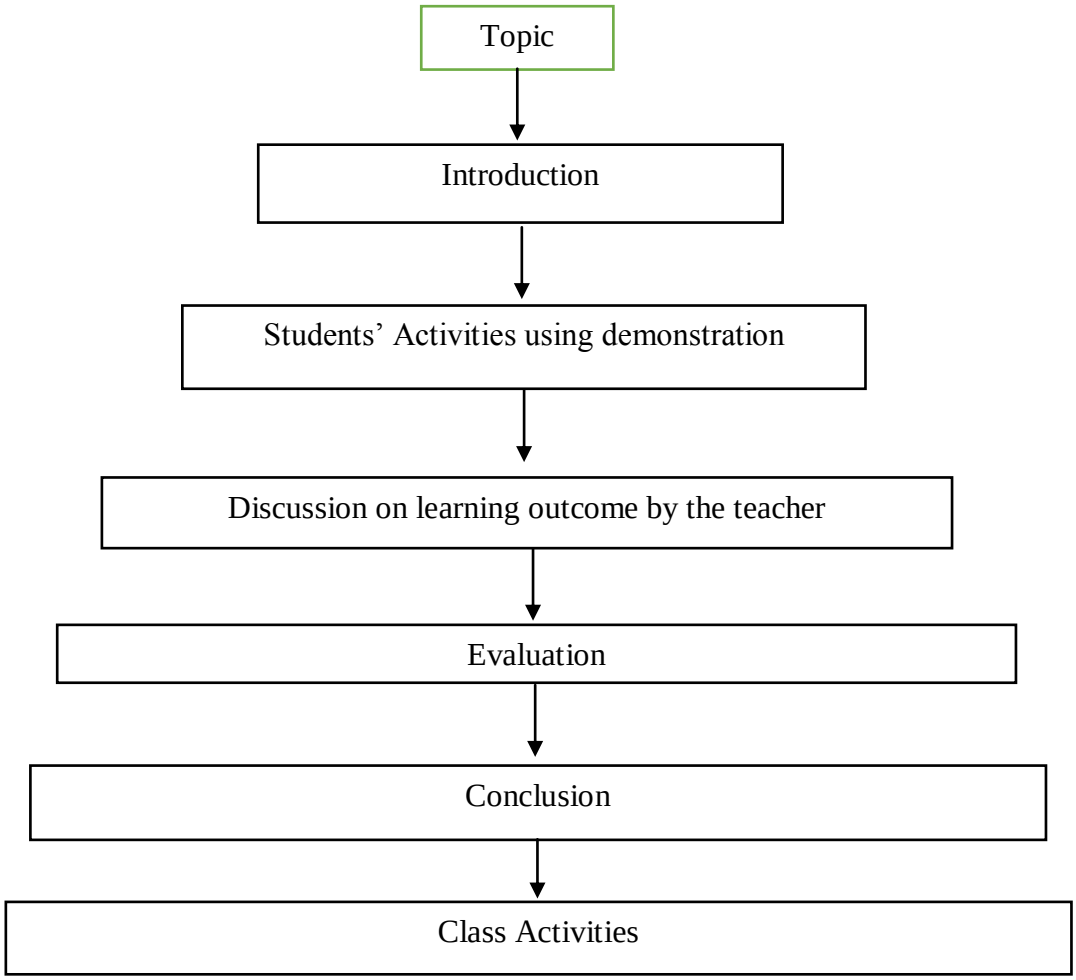


Figure 3.2: Flowchart of Demonstration Remediation Package
Source: Adapted from Kim and Kelly (2010)

STEPS FOR DEMONSTRATION REMEDIATION METHOD

Topic

Step 1: Introduction

Step 2: Students Activities on activity sheet.

i. Charts / Pictures

ii. Drawing and labelling

iii. Demonstration

Step 3: Discussion on learning outcome, the teacher leads the students

Step 4: Evaluation, the teacher asked students questions based on the stated objectives

Conclusion

Class activities

3.8 Data Collection Procedure

The Basic Science Error Identification Test wasadministered to identify errors committed by Upper Basic 2 Students with a view to prepare its remediation which may reduce the students' error in Basic Science. While Basic Science Performance Test was administered to the students as post-test to both groups after 6 weeks of teaching. The scripts were collected, marked by the researcher with a maximum score of 100 marks and recorded according to the experimental and control groups, male and female.The scores obtained from BSEIT in the survey, BSPT pre-test and post-test in the study provided data for testing the hypotheses.

Data were collected and compared based on the error types, gender, schools as stated in the research hypothesis.

3.9 Procedure for Data Analysis

Descriptive statistics in the form offrequency, percentage, mean and standard deviation were used to answer the research questions while ANOVA and t-test wereused to test the null hypothesis at $P \leq 0.05$ level of significance. In this study, the null hypothesis statedare;

HO_1: There is no significant difference in the errors committed in Basic Science among schools.

This hypothesis was tested using ANOVA at $p \leq 0.05$ level of significance.

HO_2**:**There is no significant difference in the academic performance of students taught Basic Science using demonstration teaching method and those taught using lecture methods.

For this hypothesis, t-test was usedat $P \leq 0.05$ level of significance.

HO_3: There is no significant difference in the performanceof male and female students in Basic Science after remediation using demonstration teaching method

This hypothesis was tested using t-test at $P \leq 0.05$ level of significance, was set for retaining or rejecting null hypothesis.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter contains the presentation of results and discussion from the study on the Identification and Remediation of Errors in Basic Science amongUpper Basic Students in Nasarawa Education Zone, Kano. For the survey part of data collection, BSEIT was used to identify errors committed by Upper Basic students. Frequency was used in answering research question one and two, but research question one has no null hypothesis.Mean and standard deviation were used in answering research question three and four.The Statistical Package for Social Science(SPSS) Version 20 IBM was used for analysis. The research hypotheses were tested by inferential statistics of ANOVA and the t-test statistics. The hypotheses were tested at $p \leq 0.05$ alpha level of significance. This chapter is discussed under the following sub-sections;

4.2 Answering the Research Questions

4.3 Test of Null Hypotheses

4.4 Summary of the Findings

4.5 Discussion of the Findings

4.2 Answering the Research Questions

Research Question One:

What are the types of errors committed by Upper Basic 2 Students in the Basic Science?

Research Question one has no hypothesis

The BSEIT Table 4.1 show the frequencies of the different types of errors.Five types of errors were committed by the upper Basic Students in the identification test duringsurvey study.

To answer this research question one, data from survey studywas analysed using descriptive statistic of frequency and percentage. The summary is in Table 4.1

Table 4.1: Types of Errors Identified in Basic Science

Types of Errors	Frequency	Percentage
Conceptual Error	140	23.85%
Drawing Error	125	21.29%
Labelling Error	95	16.18%
Pictorial Error	92	15.67%
Spelling Error	135	23.00%

Table 4.1 shows the types and frequency of errors committed by Upper Basic Students in the Basic Science. It showed that Conceptual error occurred a total of 140 while Drawing error occurred a total of 125 as against Labelling error which occurred 95 times while Pictorial error occurred a total of 92 and total of 135 of the errors were spelling error. It showed that conceptual error is the most occurring type of errors while pictorial erroris the least occurring types of errors. The conceptual error and spelling error that were more could be due to misunderstanding of the concept and inappropriate teaching method.

Research Question Two:

Is there difference in errors committed in Basic Science amongUpper Basic schools?

To answer Research Question two, data from the identified errors of different schools were analysed using descriptive statistics of frequency. The summary is in Table 4.2.

Table 4.2: Frequency of the errors committed among Upper Basic schools

School Type	Conceptual Error	Spelling Error	Drawing Error	Labelling Error	Pictorial Error
School 1	24	26	15	28	16
School 2	27	26	25	29	28
School 3	26	27	20	29	27
School 4	26	28	28	26	29

Table 4.2 shows the frequency of the different errortypes committed by the students based on the schools. Table 4.2 revealed that school2had more conceptual errors,while school 1 had lower frequency of 24, implying that school 1 had less errors compared to their counterparts in conceptual error. The frequency of spelling errors in school 1 and 2 are same while School 4 ishigh in spelling errors.Drawing errors is more in school 4 and less in school 1 with frequency value of 28 and 15 which is lower. Labelling errors are high in school 2and 3 with its frequency as 29 which is slightly higher than school 1. School4 committed more pictorial errors when compared to their counterparts in school 1, while school 2 and 3 were slightly different.This therefore shows that there are differences of error committed. However, the differences are not much between the schools except for drawing and pictorial error which are low compared to that of other schools.

Null Hypothesis One

There is no significant difference in thetypes of errors committed in Basic Science amongUpper Basic schools.

To test hypothesis one, data on types of error identified among schools were used. The summary is in Table 4.3.

Table 4.3: Summary of ANOVA on the type of error committed in Basic Science amongUpper Basic schools

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Remark
CorrectedModel	507.750[a]	3	169.250	2.447	.101	
Intercept	17228.450	1	17228.450	249.056	.000	
School	507.750	3	169.250	2.447	.101	NS
Error	1106.800	16	69.175			
Total	18843.000	20				
Corrected Total	1614.550	19				

Not significant, p> 0.05.

Table 4.3 shows the Summary of ANOVA on the type of error committed in Basic Science by students among schools. Table 4.3 revealed that type of error committed in Basic Science among schools is not statistically significant0.101 >p.value. Consequently, the null hypothesis which states that thereis no significant difference in thetypes of errors committed in Basic Science by students among the schoolswas therefore retained. This implies that the slight difference in the mean score among the schools could be by chance or error.

Research Question Three

Is there any difference in the performance of students taught the selected concepts in Basic Science using demonstration teaching method and those taught with lecture method?

To answer research question three data from post-test was analysed using descriptive statisticsdata on error committed by students were analysed using mean, standard deviation and mean difference. The summary is in Table 4.4.

Table 4.4: Summary of Mean and Standard Deviation on the Academic Performance of Students in Experimental and Control Groups

Group	N	Mean	Std. Deviation	Mean Difference
Experimental	60	87.78	11.87	51.55
Control	60	36.23	15.78	

Table 4.4 shows the mean of experimental and control group to be 87.78 and 36.23 respectively with a mean difference of 51.55 in favour of the experimental group. This implies that difference existed on the academic performance of students. The demonstration method has a positive effect on Upper Basic 2 students taught Basic Science concepts as the experimental group outperformed students taught using the lecture method (control group). To test if the difference is significant, hypothesis two was formulated.

Null Hypothesis Two

There is no significant difference on the academic performance of students taught Basic Science using demonstration method and students taught using lecture method in Nasarawa, Kano.

To test for difference in the academic performance t-test was carried out as shown in Table 4.5.

Table 4.5: Summary of t-test for Difference in Academic Performance between Basic Science Students taught using Demonstration and Lecture Method

Groups	N	Mean	STD	t	Df	p-value	Remark
Experimental	60	87.78	11.87	20.22	118	0.000	S
Control	60	36.23	15.78				

S: Significant, $p \leq 0.05$, NS: Not significant, $p > 0.05$

Table 4.5 shows the summary of t-test of students' post-test performance scores in Basic Science by treatment (Experimental and Control). The table revealed t-value of 20.22, df of 118 and p-value of 0.00. The null Hypothesis which states that there is no significant difference on the academic performance of students taught Basic Science using demonstration method andstudentstaught using lecture method in Nasarawa, Kanois therefore rejected. This implies that the treatment (demonstration method) has a significant effect on the performance of students.

Research Question Four

Is there any difference in the performance of male and female students exposed to demonstration teaching method in Basic Science?

To answer research question four, data on error committed by male and female students were analysed using mean, standard deviation and mean difference, the summary is in Table 4.6

Table 4.6: Comparison on difference of Errors Committed in Basic Science by Male and Female Upper Basic 2 Students

	Gender	N	Mean	Std. Deviation	Std. Error Mean	Mean Difference
Errors	**Male**	60	27.90	10.32	3.26	2.90
	Female	60	30.80	8.26	2.61	

Table 4.6 shows that male students have a mean of 27.90 while their female counterparts have a mean of 30.80 with a mean difference of 2.9 in favour of the males. This implies that the females committed more errors in basic science. In order to test if the difference is significant or it is by chance or by error, the data were subjected to t-test and this was used to test the hypothesis three thus:

Null Hypothesis Three

There is no significant difference in the types of errors committed by male and female Upper Basic students in the Basic Science.

In order to test hypothesis three, the t-test was used at 0.05 level of significance as shown in Table 4.7.

Table 4.7: t-test for difference in Errors Committed by Male and Female Students in Basic Science

Gender	N	Mean	Std. Dev.	Std. Error	Df	t-value	p-value	Remark
Male	60	27.90	10.322	3.264	58	2.55	0.48	NS
Female	60	30.80	8.257	2.611				

Table 4.7 reveals the difference in errors committed by male and female students in Basic Science. Table 4.7 revealed the p-value of 0.48 which is greater than the 0.05 level of significance indicating that there is no significant difference between the errors committed by male and female students in basic science. Therefore, the hypothesis which states that there is no significant difference in the types of errors, committedby male and female students in the selected Basic Science concepts is therefore retained. This implies that gender does not affect the kind of error committed by the students in Basic Science.

4.3 Summary of the Findings

The following findings were established

1. Five types of errors were identified in the survey on the errors committed by Upper Basic students as identified in the Basic Sciences. The result from the frequency showed that conceptual errors had the major occurring errors while pictorial errorhad the least occurring types of errors.
2. There was no significant differences in the types of errors committed in Basic Science among schools (p = 0.101).

3. Significant differences exist on the academic performance of students taught Basic Science using demonstration method and students taught using lecture method in favour of the experimental group (p = 0.000).
4. There was nosignificant difference in the types of errors committed by male and female students in the Basic Science (p = 0.48).

4.4 Discussion of the Results

Table 4.1 shows the frequency and percentage of errors committed by Upper Basic Students in the Basic Science. The Conceptual errors occurred a total of 140 while Drawing errors occurred a total of 125 as against Labelling errors which occurred 95 while Pictorial errors occurred total of 92 and total of 135 of the errors were spelling errors. The result showed that conceptual errors had the major occurring errors while pictorial errorhad the least occurring types of errors.This finding is in agreement with that ofFalalu (2015) who reported that factual error is the highest in frequency which may be referred to as conceptual error and diagrammatic error having the least (pictorial, labelling and drawing). The identified errors could be due to misunderstanding of the concept, incorrect usage of term or concept which could be linked to the method of teaching and qualified Basic Science teachers.

Table 4.3showsthat there were no significant differences in the types of errors committed in Basic Science among schools.The statistics Comparing errors among schools found that school1 had few errors in drawing and pictorial errors compared to schools 2, 3 and 4 with frequency of 15 and 16 difference of 25 and29 respectively implying that schools 2, 3 and 4 committed more errors when compared to school 1 although school 1 in comparison with school 2, 3 and 4 had slightlyfrequency difference.Therewere no significant differences in the types of errors committed in Basic

Science among schools.This finding is in agreement with that of Lawal (1995)and Abdulkarim (2011) which showed that errors existed among schoolsas in result of the schools used in the study. This error results could be linked to their environment, teaching experience and lack of teaching aids.

Table 4.5 shows that significant differences existed on the academic performance of students taught Basic Science using demonstration method and students taught using lecture method with p = 0.000. The finding is in agreement with that of Aboh (2015), who pointed out that demonstration techniques can improved the reading ability of remedial readers to read group of words. Falalu (2015) in agreement states that there was an inverse relationship between frequency of errors and academic achievement scores of subjects. As error increased the achievement score decreased. This shows that the remedial method developed based on diagnosed errors and taught using problem solving method during remediation was effective in reducing error frequency and improving students' academic achievement. This is evident when you compare the pretest scores of the experimental group before the treatment and their post test scores after the administration of treatment using demonstration techniques. This could be linked to the teaching method and qualification of teachers in the subject area.

Table 4.7shows that there was nosignificant difference in the types of errors committed by male and female students in the Basic Science. There is a slight difference in the mean of males andfemale students' (27.90 and 30.80) respectively which was found not to be significant after been subjected to hypothesis test. Thus, the finding is not in conformity with Falalu (2015) who reported that the females performed poorly than male students in physics due to the abstract nature of the subject. This is also in disagreement with that of Lawal (1995) who confirms that females committed less errors to their counterparts but in conformity with Bichi (2002) and Salman (2004) whostated in

their finding on gender and science that there is no significant difference. This can be due to teaching experience, qualification as well as the fact that they might not have been taught the subject properly.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the research problem, research questions and hypotheses, procedure of the research as well as the major findings from the study. Conclusion and recommendations were made based on the findings of the study.

- Summary
- Major Findings
- Conclusion
- Recommendations
- Contributions to Knowledge
- Limitations of the Study
- Suggestions for Further Study

5.2 Summary

This study aims at identifying and determining the remediating outcome of errors in Basic Science among Upper Basic 2 Students in Nasarawa Education Zone, Kano in order to minimize committing such errors in future. The study is in two parts: identifying the types of errors committed by the students, and the design of a remediation method. From twenty-eight (28) public schools with the population of 8569 Upper Basic Students. A sample size of 120 randomly selected Upper Basic 2 Students participated in the study. Sixty students were in the control group and sixty in the experimental group. The sample comprised males and female students. The research design was survey study for identification and Quasi-experimental involving pretest posttest approach. Four research questions and three null hypotheses were stated for answering and testing respectively. A Basic Science Error Identification Test (BSEIT) was used to identify errors committed

among Upper Basic students at the school level. Based on the identified errors, a remediation method for correcting the identified errors was developed. The remediation method was administered for six weeks on the experimental group using demonstration-teaching method while the control group was taught with lecture method.

5.3 Summary of Major Findings

1. A significant difference existed in errors committed as well as frequency of the errors and their percentage. Conceptual errors occurred 140 times, spelling errors135 and drawing errors 125 which are the most occurring type of errors while labeling errors which occurred 95 times and pictorial errors of 92 are the least occurring types of errors in Basic Science.
2. There was no significant difference in the types of errors committed in Basic Science among schools, null hypotheses one was therefore retained.
3. There is significant difference on the academic performance of students taught Basic Science using demonstration method and students taught using lecture method in Nasarawa Kano. Null hypothesis three hereby rejected.With mean difference of 51.55 in favour of the experimental group taught Basic Scienceshowingthe effectiveness of demonstration method on academic performance of students.
4. There was no significant difference in the types of errors committed by male and female students in BasicScience, null hypotheses two was therefore retained.

5.4 Conclusion

Based on the findings from the study, the following basic conclusions weremade:

1. The conceptual errors had the highest occurrence of 140 while pictorial errors had the least occurrence of 92 and five errors were identified. Significant difference was observed in the frequency of error-types identified
2. Errors of the schools 1was lower than the errors committed by the schools 2, 3 and 4 in drawing and pictorial errors. Among the school'sconceptual errors, drawing errors, labelling errors, pictorial errors or spelling errors wereslightly different and the remediation method is effective in improving students' performance from after error result in Basic Science.
3. Students taught with demonstration method had higher academic performance than those taught with lecture method in Basic science.
4. The male students are more prone to committing conceptual and spelling errors than the female students who are more prone in committing the labeling, drawing and pictorial errors than their male counterparts.

5.5 Contributions to Knowledge

The study has contributed to knowledge in the following ways:

1. The Basic Science Error Identification Test (BSEIT) shows errors were found in Basic Sciencewhich addresses students' challenges on academic performance in Basic Science.
2. The demonstration teaching method was found to be effective and gender friendly. Therefore, it could be used for addressing identified errors for male and female in Basic Science and perhaps Science students generally at the lower Basic and secondary schools.

3. The Basic Science Error Identification Test (BSEIT) developed can be used by other researchers for the purpose of identified students' problems associated with teaching and learning difficulties in secondary school Basic Science.

5.6 Recommendations

From the findings of the study the following recommendations were made;

1. The demonstration teaching method should be encouraged in Basic Science teaching to minimize errors committed by students. Science teachers are encouraged to identify their students' errors after instructions to identify errors and use effective remediation ways to correct them. This will help improve students' performance in Basic Science.
2. Teachers should be sent on workshops, in-school trainings and seminars where guidance on how to use the modern teaching methods such as demonstration method for interaction on effective measure on improving student's errors on their subject areas. Science teachers should regularly evaluate the teaching and learning in an effort to incorporate, develop a remediation method for the error.
3. The conceptual and spelling errors in Basic Science should be improve in our schools to help the students' ability in overcoming most of the errors,even when interpreting or explaining concepts in mother tongue while drawing and labeling should be encouraged in class works and examination in schools.
4. Curriculum planners and textbook publishers should adopt the demonstration teaching method in textbooks containing pictures, drawings, labeling and spelling exercises as employed from the identified errors and remedy for possible improvement in academic performance in Basic Science.

5.7 Limitations of the Study

The study was limitedto Upper Basic 2 Basic Science excluding other Upper Basic classes and 120 students which takes about 50% of overall assessment at public examinations of the subject. This restriction may have an effect on the generalization scope of the findings in present research.

5.8 Suggestion for Further Studies

1. The present study restricted participation of subjects at ordinary level (JSS) only. It is recommended that similar studies should be replicated at colleges, university levels, other local government areas, states and the nation as a whole in order to obtain a more comprehensive and generalize outcome on study.
2. It is suggested that similar study should be conducted on Lower Basic Science Levels so as to have a combined effect outcome for better and wider generalization.
3. The present remediation method was restricted to Upper Basic Students level only. It is therefore recommended for further studies on other science subjects at different levels and different topics so as to obtain a wider base for generalization and contribution to knowledge on impact of remediation on attainment in science.

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APPENDIX A
LETTER TO THE VALIDATORS

DEPARTMENT OF SCIENCE EDUCATION
Faculty of Education
AHMADU BELLO UNIVERSITY, ZARIA
E-mail: Scienceeduc@abu.edu.ng
Vice-chancellor: **Professor Abdullahi Mustapha** *B.Sc (Hons) Pharm (A.B.U), Ph.D (London), FPSN*
Head of Department: **Dr. Mamman Musa,** *B.Ed , M.Ed, Ph.D (ABU)FMAN, FANE, DAC*

Date:

_____

_____

_____

_____

Dear Sir/Madam

VALIDATING RESEARCH INSTRUMENT

This is to introduce the bearer Okereke, Chinyere Emily with registration number Med/EDUC/35124/12-13, as one of our M.ED Science Education student.

The above postgraduate student is about to go for pilot testing and pre-data seminar. She has an instrument to validate on a study topic:

Identification and Remediation of Errors in Basic Science among Upper Basic Students in Nasarawa Education Zone, Kano State.

The instrument is attached herewith. Kindly study the instrument and validate it accordingly. The objectives of the study, the research questions and corresponding hypotheses are attached herewith for your reference.

Thank you.

Yours faithfully,

Dr. S.S.Bichi

Student Supervisor

APPENDIX B
INTRODUCTION LETTER

DEPARTMENT OF SCIENCE EDUCATION
FACULTY OF EDUCATION

AHMADU BELLO UNIVERSITY, ZARIA

Dear Respondent(s),

I wish to request your support in collecting necessary data on the research titled "Identification and Remediation of Errors in Basic Science among Upper Basic Students in Nasarawa Education Zone Kano State, Nigeria".

This research is an academic exercise therefore your sincere responds will enable me to an extent in identification of errors in teaching and learning of Basic Science in our schools.

Thank you,

Yours sincerely

OKEREKE, Chinyere Emily

MED/EDUC/35124/12-13

APPENDIXC
BASIC SCIENCE ERROR IDENTIFICATION TEST (BSEIT)

INSTRUCTIONS: Answer all questions, underline answers in bracket, draw and label with pencil.

1. What do you understand by the word growth in fig.1 and 2?

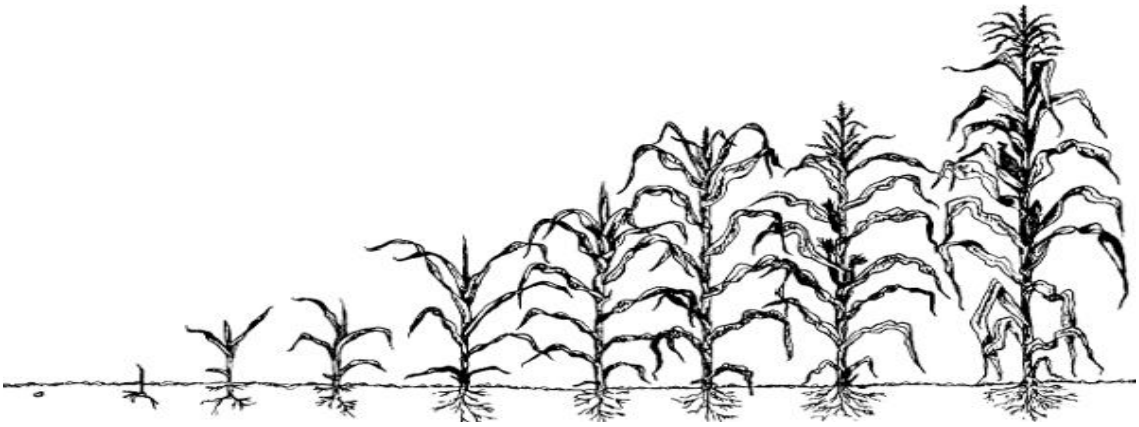


Fig. 1

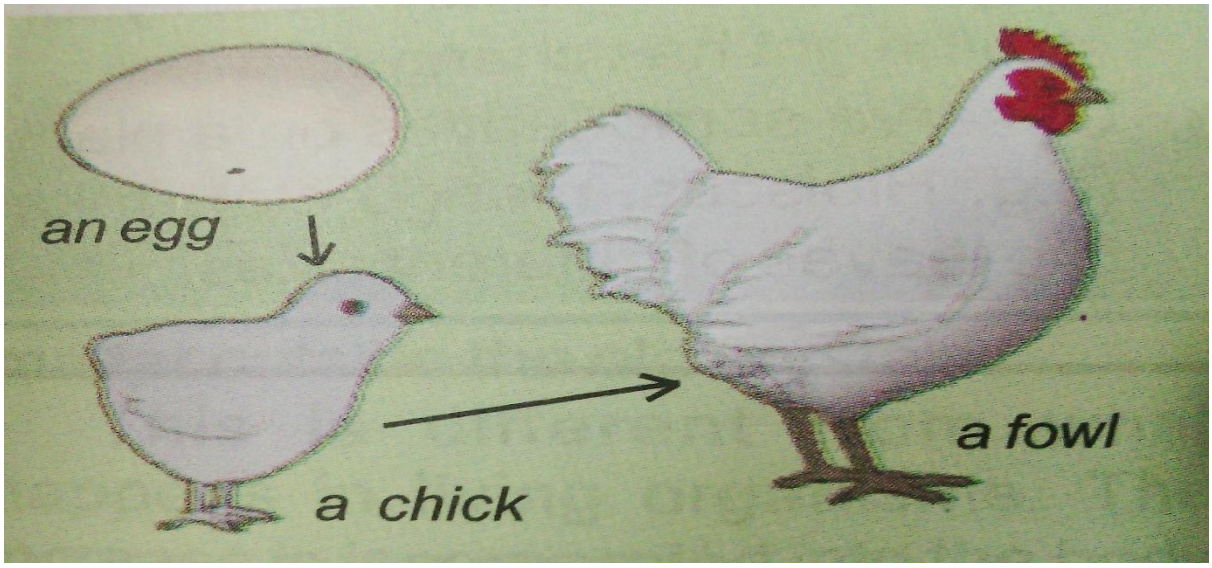


Fig 2

2. Write down the secondary developmental features of male and female.

3. What is the developmental stage in Fig 3?

4. How many changes occur in non-living thing?

5. Draw and label a leaf.

6. What makes you to work and not get tired**?**

7. What is the S.I. unit of energy?



FIG3

8. A man raised a drum of oil 4kg to a height of 5m, if he holds the drum at that point forsome time. What is his potential energy? Hint ($g = 10ms^2$), ($P = mgh$).

9. Draw and label the three (3) states of matter.

10. List 2 examples each of the changes in non-living things.

11. Name 2 similarities of the developmental features in Fig. 3.

12. The 2 difference between physical and chemical change are.

13. What type of change occur in each state of matter.

14. _____ and _____ can be refered to the two changes that occurs in non-living things.
15. From the picture in Fig. 3, list 2 permanent developmental changes in living things.
16. Name 2 growth changes in Fig. 4.

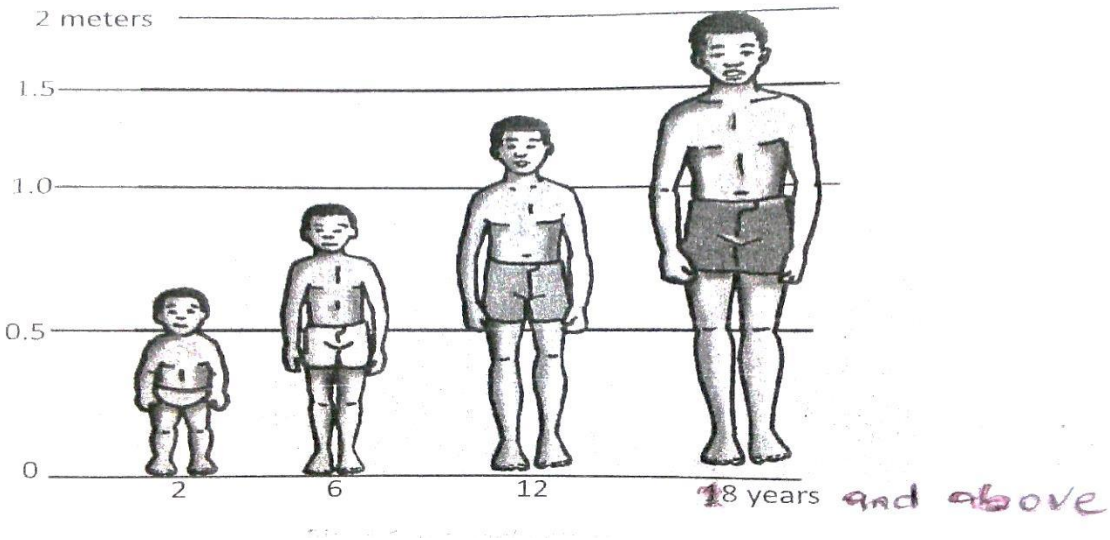


FIG. 4

17. When you sit on a chair, you use energy. (Agree, disagree, not sure).
18. You use energy to run. (Agree, disagree, not sure).
19. Which of these shapes would contain more water?

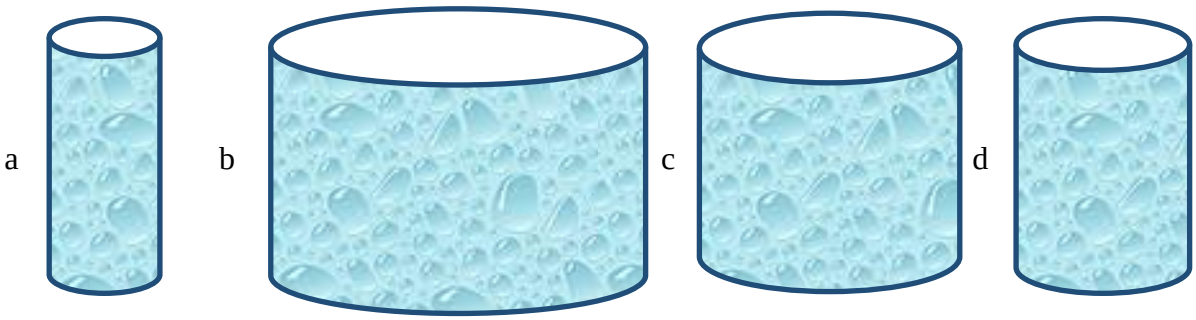


FIG. 5

20. With the aid of a diagram explain Evaporation in liquid.

MARKING SCHEME (5 MARKS)

1. Growth is the irreversible increase in height, weight and size due to the addition, division and multiplication of cells.

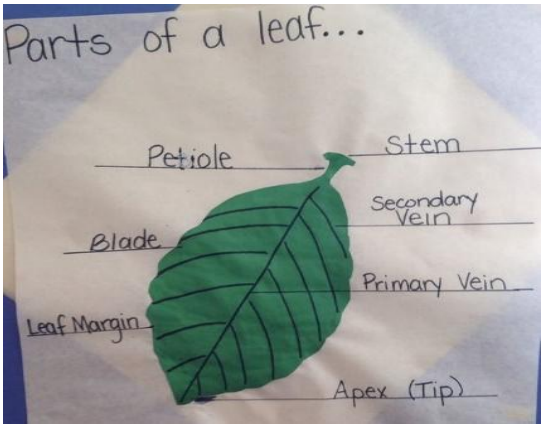
2. (a) female (b) male

Breast development	Pubic hair
Rigid and firm body	Broad shoulder
Hips and thigh	Broad chest
Pubic hair	Muscles
Armpit hair	Armpit hair

3. Adulthood (20 years and above).

4. 2 namely chemical and physical change.

5.



6. Energy

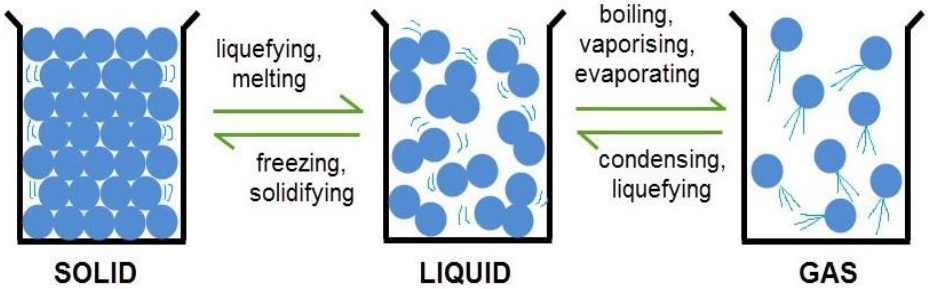
7. Joules

8. P.E = mgh, where; m = 4kg, g = 10m/s^2, h = 5m.

P.E = 4 x 10 x 5

P.E = 200J.

9.



10. Examples of physical changes are;

i. dissolving of salt in water.

ii. Heating of water to gas (evaporation).

iii. Sublimation of solid to gas (camphor).

Examples of chemical changes

i. Burning of paper and wood

ii. Digestion of food

iii. Decay of substances e.g. leaves, flesh

11. Pubic hairs and armpit hair.

12. A physical change is one which is easily reversible and no new substance is formed while a chemical change is one which is not easily reversible and a new substance is formed.

13. Temporary change

14. Temporary change and permanent change.

15. Broad shoulder and Hip.

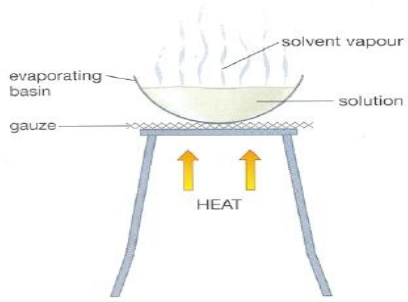
16. Height and Size.

17. Potential energy.

18. Kinetic energy.

19. b.

20. With the aid of a diagram explain Evaporation in liquid.



APPENDIX D

BASIC SCIENCE PERFORMANCE TEST (BSPT)

SECTION A: PERSONAL DATA

1. Name of school……....
2. Gender: Male ( ) Female ( )

SECTION B:

Instruction: Answer all questions

1. Which of the following is not a temporary change?
   a. Burning of wood
   b. Dissolution of salt in water
   c. Melting of ice to water
   d. Melting of candle wax
2. Which of these is not a permanent change?
   a. Freezing of water to ice
   b. Yellowing of leaves of plants
   c. Rusting of iron
   d. Fermentation process
3. Adolescence age is between
   a. 11 - 20 years
   b. 2 - 11 years
   c. 20 - 40 years
   d. 40 years and above
4. All these are examples of chemical changes, except
   a. Rusting of iron
   b. Burning of wood
   c. Dissolution of metals in acids
   d. Addition of water to common salt
5. _____ is the energy possessed by a moving body
   a. Potential energy
   b. Kinetic energy
   c. Solar energy
   d. Sound energy

6. Calculate the weight of an object of mass 15kg taking g to be 10m/s
   a. 100N
   b. 97N
   c. 150N
   d. 120N
7. Which of the following is not a form of energy?
   a. Electrical
   b. Mechanical
   c. Surgical
   d. Solar
8. A body of mass 30g is suspended at a height of 12m from the ground. What is the potential energy of the body at this height? ($g=10ms^2$)
   (a) 0.36J
   (b) 3.6J
   (c) 36J
   (d) 360J
9. The scientist who carried out early studies on energy was _____
   (a) J.Dalton
   (b) Peterson
   (c) P.Joules
   (d) G.Mendel
10. An example of a physical change is _____
   (a) Burning of magnesium in air
   (b) Explosion of hydrogen in air
   (c) Melting of ice to water
   (d) Rusting of iron
11. The energy produced when a person rubs his palms against each other is _____
   (a) Chemical
   (b) Heat
   (c) Kinetic
   (d) Potential
12. Puberty stage in girls indicates _____

(a) Conception

(b) Courtship

(c) Maturity

(d) Menopause

13. Which of these changes is Irreversible?

(a) Boiling of water

(b) Burning of paper

(c) Melting of candle wax

(d) Melting of ice

14. The following factors are responsible for human growth EXCEPT.

(a) Heredity

(b) Exercise

(c) Food

(d) Intelligence

15. A physical change can as well be referred to as _____

(a) Chemical

(b) stone

(c) Permanent

(d) Temporary

16. A change in matter that results to no new substance formation is _____

(a) Chemical

(b) Mechanical

(c) Permanent

(d) Physical

17. The process whereby solid changes directly to gas is _____

(a) Condensation

(b) Sublimation

(c) Evaporation

(d) Melting

18. The following are signs of puberty in boys EXCEPT_____

(a) Deep voice

(b) Broad shoulder

(c) Facial hair

(d) Matured uterus

19. A secondary sexual character that occurs in girls is _____

(a) Enlargement of testes

(b) Development of breasts

(c) Growth of facial hairs

(d) Muscular development

20. Which of the following statements are false?

(a) Growth is quantitative

(b) Growth is both quantitative and qualitative

(c) Development continues throughout life time

(d) Adult hood is characterized by decline in reproductive capacity.

SECTION C

21. Draw and label a leaf.

22. From the picture in Fig. 1, list 2 permanent developmental changes in living things.



Fig. 1

23.What do you understand by the word growth in Fig 2

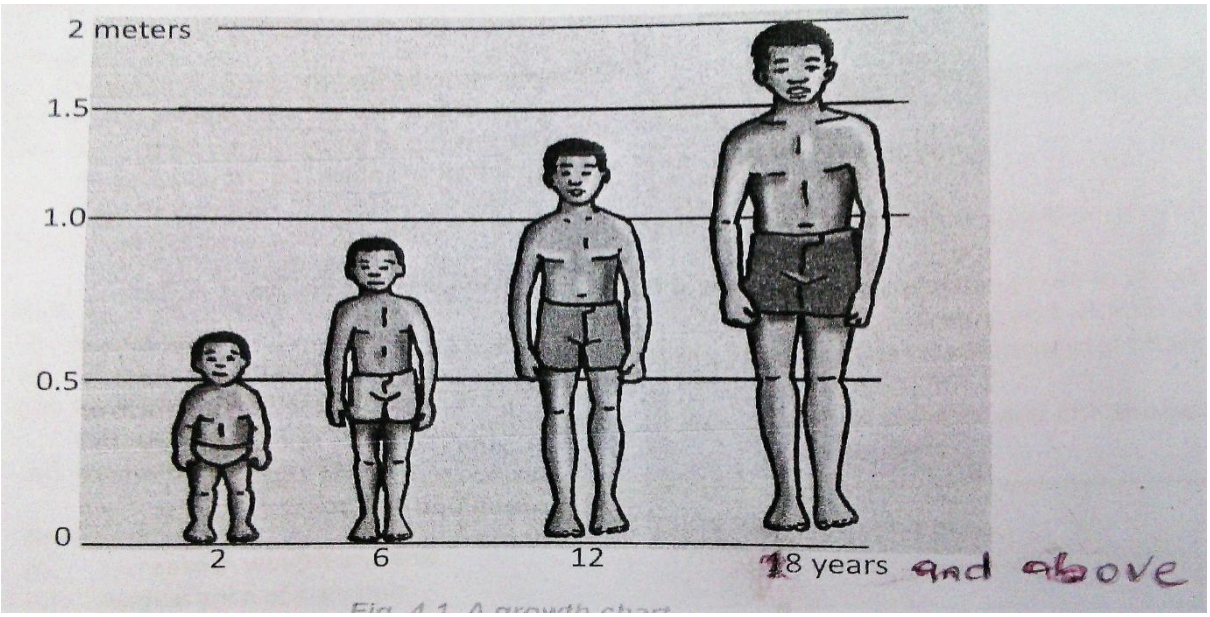


FIG. 2

24. List two difference between changes in non-living things.

25. What makes you to work and not get tired**?**

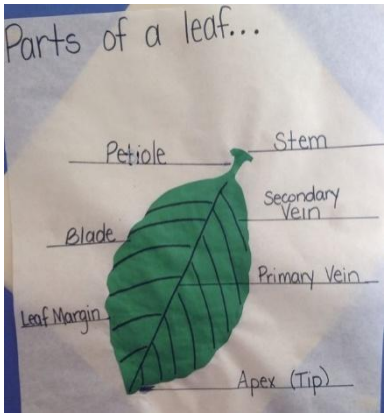
MARKING SCHEME for (BSPT)
(Section B 2.5mk and section C 10mk).

Section B

1. A
2. A
3. A
4. D
5. B
6. C
7. C
8. B
9. C
10. C
11. B
12. C
13. B
14. D
15. D
16. D
17. B
18. D
19. B
20. B

Section C

21. Draw and label a leaf.



22.

Broad shoulder
Hip.

23. Growth is an irreversible increase in height, weight and size due to the addition, division and multiplication of cells.

24.

Physical change	chemical change
i. No new substance is formed	New substance is formed
ii. It is reversible	It is non reversible

25. Energy.

APPENDIX E
LESSON PLAN FOR THE CONTROL GROUP

Week 1

Class	JSS 2
Subject	Basic Science
Duration	80mins
Age	11-16 years old
Methodology	Lecture method
Topic	Changes in living things

Teaching aid; Textbook, notebook and pen

Behavioural objectives: - by the end of the lesson the students will be able to;

i. Define growth and development
ii. Mention the growth changes in an organism.
iii. Describe the transition stages from infancy to adulthood as developmental changes.

Previous knowledge - the students have been taught changes in matter. They see change as shift from what used to be obtainable. The students noticed that a baby does not remain the same size after birth and a maize seed also increases in size.

Introduction;

All living things are constantly undergoing one type of change or the other. This is because their bodies are made of living matter called cells, which increases in number through self-division. The teacher will ask the students question on the notable changes on an infant when feed with breast milk.

Lesson presentation – the teacher presents the lesson step by step.

Step I: the teacher outlines the stages of change,

Baby - age 0 – 2 years old

Childhood - age 2 – 11year old

Adolescence - age 11- 18 years old

Adulthood - age 18 and above.

Step II: the teacher defines growth and development.

Step III: the teacher will explain the growth and developmental changes in living things.

i. Increase in height or length.
ii. Increase in weight.
iii. Increase in the number of parts.
iv. Increase in size.

Evaluation, the teacher will ask the students to explain in their own word what they understood as growth and developments.

Conclusion, the teacher summarizes the lesson by saying that changes recognized above in an organism shows that they are alive and doing well.

Class Activity;

1. The body of a living thing is made up of living matter called ----------
2. Childhood is characterized by ----------.
3. Give 2 example of reproductive organ in development stage.
   ---------- and ----------

Week 2

Class	JSS 2
Subject	Basic Science
Duration	40 mins
Age	11 – 16 years old
Methodology	lecture method
Topic	changes in living things
Sub – topic	growth and development
Teaching aids;	textbook

Behavioural objective - at the end of the lesson the students should be able to;

i. Identify the characteristic features of the different developmental stages.
ii. Group the growth and development to either temporary or permanent changes.

Previous knowledge – the student were taught changes in living things.

Introduction;

Since growth has to do with notable change in height, weight (size) and development is the changes from infancy to adulthood.

Presentation; the teacher presents the lesson step by step.

Step I: The teacher explains each of the characteristic features of developmental stages i.e. childhood – adolescence – adulthood.

Step II: The teacher explains temporary and permanent changes in growth and development.

Step III: The teacher will throw more light with examples on temporary changes, such as; sweating, bedwetting, rise in body temperature, etc.

Step IV: The teacher will position the students of different sizes with developed features on them and explain more on the topic.

Conclusion; The teacher will summarize the topic in full and write note on the black board.

Evaluation; The teacher will evaluate the lesson by giving the students the following questions,

i. List any 2 growth changes in living things.
ii. List 2 examples of developmental changes in; (a) infant (b) adolescent.

Week 3

Class	JSS 2
Subject	Basic Science
Duration	80 mins
Age	11 – 16 years old
Methodology	lecture method
Topic	changes in non-living things

Behavioural objective – at the end of the lesson the students will be able to;

i. Describe change in non- living things.
ii. Group changes in substance into physical and chemical changes.
iii. State the characteristic of physical and chemical changes in non-living things.

Previous knowledge – The students were taught that matter can be a living or non-living things. They have learnt in JSS 1 that matter exists in three state; solid, liquid and gaseous state.

Introduction

The teacher will introduce the lesson by asking the students to identify the non-living things in the environment.

Presentation; The teacher will present the lesson step by step.

Step I: The teacher will mention and describe non-living things in the environment.

Step II: The teacher will discuss on the effect of heat on sugar solution, heating of salt and heating of paraffin wax (candle), green leaves turns yellow, etc.

Step IV: The teacher will explain on the above mentioned changes which are physical and chemical changes, also, the teacher will ask the students to mention or list those changes seen as temporary and permanent changes.

Step IV: The teacher from the explanation will mention the characteristics of physical and chemical changes in the non- living things.

Conclusion: The teacher will conclude the lesson by summarizing the above step.

Evaluation: The teacher will allow the students to write out the observation and submit.

Week 4

Class	JSS 2
Subject	Basic Science
Duration	80 mins
Age	11 – 16 years old
Methodology	lecture method
Topic	Energy, Work and Power

Behavioural objective – at the end of the lesson the students should be able to;

i. Explain the concept of energy, work and power.
ii. Use the formula; power = work done/time

Teaching aids; textbook

Previous knowledge – The students can walk, eat, run, carry heavy load. They have known work, energy and power to mean same.

Introduction

The teacher will introduce the lesson by asking the students to describe work and energy in their own understanding.

Presentation; The teacher will present the lesson step by step.

Step I: The teacher explain the concept energy, work and power.

(a) Energy is the ability to do work.
(b) Work is simply defined as a product of distance moved and the force applied in the direction of movement.
(c) Power is defined as the rate of doing work.

Step II: The teacher will explain the use of formula and their units.

Step III: The teacher explain the calculations in the concepts such as

(a) What is the power of a child that has done work of 50J in 10s?

Solution; P = w/t

Where, w = 50J and t = 10s

P =50/10 = 5watts.

Conclusion, the teacher summarizes and write note on the black board for the students to write down on their note book.

Evaluation, the teacher will allow the students to ask questions on areas they do not understand and then explain to them for better clarity

Week 5

Class	JSS 2
Subject	Basic Science
Duration	80 mins
Age	11 – 16 years old
Methodology	lecture method
Topic	Potential Energy and Kinetic Energy

Behavioural objective – at the end of the lesson the student should be able to;

i. Explain the terms potential and kinetic energy.
ii. State the energy transfer that occurs when work is done.

Teaching aids; textbook

Previous knowledge – the students have seen mango on the tree when it's unripe while it falls when it is ripe, car in motion and car off motion (car at rest) or a person sitting and walking.

Introduction

The teacher will introduce the lesson by asking the students to define work and energy in their own words.

Presentation; The teacher will present the lesson step by step.

Step I: The teacher explains the meaning of potential energy and kinetic energy.

Step II: The teacher also states the mathematical calculation; their formula and S.I. unit.

Step III: The teacher will give details on energy transfer that occur when work is done. For example, when a ball is at rest (position) is potential energy as the ball is kicked (moving) it changes to kinetic energy.

Conclusion, the teacher concludes and write note on the black board.

Evaluation, the teacher will explain more clearly on the topic and allow the students to list things around them that are either on rest or in motion.

APPENDIX F
LESSON PLAN FOR EXPERIMENTAL GROUP

Week 1

Class	JSS 2
Subject	Basic Science
Duration	80mins
Age	11-16 years old
Methodology	demonstration method
Topic	Changes in living things

Teaching aids; a chart, pictures of animal, plants,

Behavioural objectives - at the end of the lesson the students will be able to;

i. Define growth and development.
ii. Mention the growth changes in an organism.
iii. Describe the transition stages from infancy to adulthood as developmental changes.

Previous knowledge - the students have been taught changes in matter. They see change as shift from what used to be obtainable. The students noticed that a baby does not remain the same size after birth and a maize seed also increases in size.

Introduction;

All living things are constantly undergoing one type of change or the other. This is because their bodies are made of living matter called cells, which increases in number through self-division. The teacher using a chart asked the students question on the notable changes on an infant when feed with breast milk.

Lesson presentation – the teacher presents the lesson step by step.

Step I: the teacher using pictures of human, animal, plant and students outlined the stages of change in living things.

Baby - age 0 – 2 years old

Childhood - age 2 – 11year old

Adolescence - age 11- 18 years old

Adulthood - age 18 and above.

Step II: the students defines growth and development from the chart. The students measured the height and weight of boys and girls between 11 to 15 years old.

Step III: the teacher leads the students in demonstration on the growth and developmental changes in living things. Such as;

i. Increase in height or length.
ii. Increase in weight.
iii. Increase in the number of parts.
iv. Increase in size.

Evaluation, the teacher asked the students to explain in their own word what they understood as growth and developments based on the stated behavioural objective.

Conclusion, the teacher summarizes the lesson,students were asked to imagine when they were infants and write down those changes that has occurred in their body.

Class Activity;

1. Childhood is characterized by ----------.
2. The adolescence age is between ----------

Week 2

Class	JSS 2
Subject	Basic Science
Duration	40 mins
Age	11 – 16 years old
Methodology	demonstration method
Topic	changes in living things
Sub – topic	growth and development
Teaching aids;	textbook, pictures of human, plants, animals.

Behavioural objective - at the end of the lesson the students should be able to;

i. Identify the characteristic features of the different developmental stages.
ii. Group the growth and development to either temporary or permanent changes.

Previous knowledge – the student were taught changes in living things.

Introduction;

Changes in living things are very noticeable for human beings, since growth has to do with notable change in height, weight (size) and development is the changes from infancy to adulthood.

Presentation; the teacher presents the lesson step by step.

Step I: The studentsexplains each of the characteristic features of developmental stages using their body i.e. childhood – adolescence – adulthood.

Step II: The studentsexplains temporary and permanent changes in growth and development.

Step III: The teacher throws more light with examples on temporary changes, such as; sweating, bedwetting, rise in body temperature, etc.

Step IV: The teacher positions the students of different sizes with developed features on them and demonstratesphysically on the growth and development.

Conclusion; The teacher summarize the topic in full and write note on the black board.

Evaluation; The teacher evaluate the lesson by giving the students the following questions,

i. List 2 growth changes in living things.
ii. List 2 examples each of developmental changes in; (a) infant (b) adolescent.

Week 3

Class	JSS 2
Subject	Basic Science
Duration	80 mins
Age	11 – 16 years old
Methodology	Demonstration method
Topic	Changes in non-living things

Teaching aids; wood, paper, common salt, sugar, candle stick, stirring rod, ice-block, water, leaves, matches, Bunsen burner, tripod stand, beakers, crucible etc.

Behavioural objective – at the end of the lesson the students will be able to;

i. Describe change in non- living things.
ii. Group changes in substance into physical and chemical changes.
iii. State the characteristic of physical and chemical changes in non-living things.

Previous knowledge – The students were taught that matter can be a living or non-living things. They have learnt in JSS 1 that matter exists in three state; solid, liquid and gaseous state.

Introduction

The teacher introduced the lesson by asking the students to identify the non-living things in the classroom and their environment.

Presentation; The teacher presents the lesson step by step.

Step I: The students mention and describe non-living things in the environment.

Step II: The studentsdissolved sugar, salt and discuss on the effect of heat on sugar solution, heating of salt and heating of paraffin wax (candle), green leaves turns yellow, etc.

Step IV: The student burnt paper and woodon a crucible, looked carefully and further mentioned changes which are physical and chemical, while, the teacher asked the students to mention those changes seen as temporary and permanent changes.

Step IV: The teacher on the explanation mentioned the characteristics of physical and chemical changes in the non- living things.

Conclusion: The teacher conclude the lesson by summarizing the changes in non-living things. The activities that can lead to changes in non-living things, this involves application of heat, pressure, air, removal of heat, mixing, etc.

Evaluation: The teacher asked the students to write out the observation and submit

Week 4

Class	JSS 2
Subject	Basic Science
Duration	80 mins
Age	11 – 16 years old
Methodology	demonstration method
Topic	Energy.
Teaching aids;	jogging and jumping exercise, pictures, charts, wheel barrow, bucket with water, ball, school bag etc.

Behavioural objective – at the end of the lesson the students should be able to;

i. Explain the concept of energy, work and power.
ii. Use the formula; power = work done/time

Previous knowledge – The students can walk, eat, run, carry heavy load. They have known work, energy and power to mean same.

Introduction

The teacher introduced the lesson by asking the students to demonstrate work and energy in their own way. A bicycle, car and man cannot do work unless it has energy.

Presentation; the teacher presented the lesson step by step.

Step I: The studentscarried wheel barrow and bucket of water in pairs to demonstrate the concept energy, work and power.

A. Energy is the ability to do work.
B. Work is simply defined as a product of distance moved and the force applied in the direction of movement.
C. Power is defined as the rate of doing work.

Step II: The teacher explained the use of formula and their units to students.

Step III: The students explained the calculations in the concepts such as

(b) What is the power of a child that has done work of 50J in 10s?

Solution; P = w/t

Where, w = 50J and t = 10s

P =50/10 = 5watts.

Conclusion, the teacher summarizes and write note on the black board for the students to write down on their note book.

Evaluation, the teacher allows the students to ask questions on areas they do not understand and then explain to them for better clarity.

Class activities

3. What is the SI unit of work and energy?
4. Define power.

Week 5

Class	JSS 2
Subject	Basic Science
Duration	80 mins
Age	11 – 16 years old
Methodology	demonstration method
Topic	Potential Energy and Kinetic Energy

Behavioural objective – at the end of the lesson the student should be able to;

i. Explain the terms potential and kinetic energy.
ii. State the energy transfer that occurs when work is done.

Teaching aids; pictures, ball, stone, book etc.

Previous knowledge – the students have seen mango on the tree while it's unripe and it falls when it is ripe, car in motion and car off motion (car at rest) or a person sitting and walking.

Introduction

The teacher introduced the lesson by throwing a ball up and lifting a stone on the desk.

Presentation; the teacher presented the lesson step by step.

Step I: The students explained potential energy and kinetic energy.

Step II: The studentslearnt the mathematical calculation, formula and S.I. unit of potential and kinetic energy.

Step III: The studentsgave details on energy transfer that occur when work is done by listing the appliances in their environment. For example, when a ball is at rest (position) is potential energy as the ball is kicked (moving) it changes to kinetic energy.

Conclusion, the teacher concluded and write note on the black board.

Evaluation, the teacher explained more clearly on the topic and allow the students to list things around them that are either on rest or in motion.

APPENDIX G
RELIABILITY OF THE INSTRUMENT

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	30	100.0
	Excluded[a]	0	.0
	Total	30	100.0

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

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.878	.878	2

Item Statistics

	Mean	Std. Deviation	N
BSEIT	17.6667	15.68732	30
BSPT	32.9667	15.59284	30

Inter-Item Correlation Matrix

	BSEIT	BSPT
BSEIT	1.000	.783
BSPT	.783	1.000

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
BSEIT	32.9667	243.137	.783	.613	.
BSPT	17.6667	246.092	.783	.613	.

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
50.6333	872.171	29.53255	2

APPENDIX H
FACILITY AND DISCRIMINATION INDEX

ITEM NO	FI= $\frac{U+L}{N}$	DI = $\frac{R_u - R_l}{\frac{1}{2}N}$
1	0.7	0.5
2	0.1*	0.2*
3	0.6	0.5
4	0.3	0.3
5	0.5	0.4
6	0.4	0.4
7	0.2*	0.1*
8	0.2*	0.1*
9	0.2*	0.1*
10	0.7	0.5
11	0.5	0.6
12	0.6	0.5
13	0.6	0.5
14	0.5	0.6
15	0.4	0.5
16	0.4	0.5
17	0.3	0.5
18	0.4	0.5
19	0.4	0.5
20	0.4	0.5
21	0.4	0.5
22	0.5	0.4
23	0.4	0.4
24	0.4	0.5
25	0.4	0.5
26	0.3	0.4
27	0.9*	0.8*
28	0.4	0.5
29	0.5	0.6
30	0.5	0.5