ASSESSMENT OF THE IMPLEMENTATION OF INTEGRATED SCIENCE CURRICULUM IN JUNIOR SECONDARY SCHOOLS IN KADUNA STATE

BY

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M.ED/EDUC/00540/2006-2007

M.ED/EDUC/20251/2012-2013

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AUGUST, 2014

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M.ED THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, AHMADU BELLO UNIVERSITY, ZARIA – NIGERIA. IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTERS DEGREE IN EDUCATION (CURRICULUM AND INSTRUCTION) DEPARTMENT OF EDUCATIONAL FOUNDATIONS AND CURRICULUM, AHMADU BELLO UNIVERSITY, ZARIA – NIGERIA

AUGUST, 2014

Declaration

I wish to declare that this thesis titled "Assessment of the Implementation of Integrated Science Curriculum in Junior Secondary School in Kaduna State" is a product of an original work conducted by me. It has not been presented for the award of any degree in any university. The ideas, observations, comments, suggestions and expressions herein represent my own convictions, except quotations, which have been acknowledged in accordance with conventional academic tradition.

Ishaya Pius **Date**

Certification

This research work entitled "Assessment of the Implementation of Integrated Science Curriculum in Junior Secondary Schools in Kaduna State" by Ishaya Pius, meets the regulations governing the award of a Masters of Education (M.Ed.) in Educational Foundations and Curriculum of Ahmadu Bello University, Zaria, Nigeria and is approved for its contribution to knowledge and literary presentation.

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Dedication

This research work is dedicated to the whole of my Royal Family for their love and the quest of knowledge which made them to sponsor my basic education.

The work is also dedicated to my beloved wife Mrs. Josephine Habiba Pius and my children, Doe P. Pius, Jefferson P. Pius, Wilson B.P. Pius, Thessel P. Pius, Nare R.P. Pius and Patience J. Pius for their prayers and endurance during the programme.

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The authors, whose materials and works were used in the research, deserve commendation and acknowledgement which I did at the reference page.

Finally, my appreciations go to my beloved family, my uncle Dominic D. Sarki, my brothers Grp Capt. O. Enam, Mr. Eric E. Sambo, Fidelis D. Sambo, Mr. Francis Ephraim Rikichi and all my sisters, brothers, friends and relatives, WO2 Adamu and family, and Samuel Ayo who supported in one way or the other throughout the period of study. May God bless you all Amen.

Abstract

The title of this study is: Assessment of the Implementation of Integrated Science Curriculum in Junior Secondary Schools in Kaduna State. The study used the survey method with 130 Integrated Science teachers' respondents as sample size and the questionnaire was used as research instrument. In the data analysis, percentage score was used in analyzing personal data, mean score and t-test were used in answering the research questions while t-test also was used in testing the research hypotheses. The research finding shows that the implementation of the objectives of Integrated Science curriculum has significant impact on the teaching and learning in junior secondary schools. In addition, methods and techniques that aid learning in Integrated Science have tremendous effect on teaching and learning of students in junior secondary schools. Furthermore, teachers' qualification determines the level of achievement of Integrated Science curriculum objectives at junior secondary schools. Also, findings revealed that there is no significant difference between male and female teachers in teaching and learning of Integrated Science at junior secondary schools, while a significant difference exists among teachers of Integrated Science on account of their experience. The study also revealed that there is no significant difference between urban and rural teachers on teaching and learning integrated science. Finally, the study recommended among others that government should provide enough resources, employ qualified and trained teachers, pay teacher remuneration and promote Integrated Science teachers in order to ensure effective implementation of the Integrated Science curriculum and achievement of its objectives.

Operational Definition of Terms/Abbreviations

Adequacy: Adequacy means that thing that is equal to or sufficient for a special requirement.

Component: It refers to an essential part of a thing or that which forms part of a whole.

Knowledge: This refers to facts, information, understanding and skills acquired by a person, through experience or education.

Learning: This is knowledge obtained or gained through importation on study.

Secondary School: This is the second level of education that a student goes through before tertiary level of education.

Resources: These are items such as pictures, newspapers, magazines, textbooks, charts, board etc used by teachers to accomplish their teaching objectives.

Teacher: This refers to a person employed to train others and has undergone training in a relevant area.

Teaching: This is a process of transmitting knowledge and skills to learners.

RD&D – Research Development and Diffusion

SCIS – Science Curriculum Improvement Study

NPE - National Policy on Education

WAEC – West African Examination Council

BSCS – Biological Science Curriculum Studies

NERDC – National Education Research and Development Council

CBA – Chemical Biological Association

CPD – Continuous Professional Development

STAN – Science Teachers Association of Nigeria

PSSC - Physical Science Study Committee

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

There has been growing concern throughout the country over the years about the discouraging state of teaching and learning of Integrated Science. This has arisen mainly as a result of a failure within teaching-learning contexts to illustrate the connections between classrooms Integrated Science and the environment learners come from. It has been argued that junior secondary school (JSS) students must be well grounded in Integrated Science at this level for them to be able to study the core science subjects (Biology, Chemistry, Physics etc). This has resulted in a call by the West African Examination Council (WAEC) for setting up a committee to look into Integrated Science as a subject (Olarewaju, 1994). The committee recommended the following specific methods for teaching Integrated Science:

a) Use of discovery teaching tactics

b) The inclusion of problem solving activities

c) The involvement of students in open ended field or laboratory exercise (Olarewaju, 1994).

The efforts of the committee were expected to bring about a change in focus in the teaching and learning of the subject. For changes to be effectively implemented in Integrated Science education, it is necessary that base line information should be available on a number of important aspects. Such aspects include, for example, how teachers view the subject, issues relating to attitudes towards the subject, Integrated Science anxiety and others. In Nigeria, while research has focused on a number of aspects related to Integrated Science Education, there has been no research focusing on teachers' view of Integrated Science. Hence, this study was

embarked upon in order to know the opinions and comments of science teachers on Integrated Science curriculum implementation.

The views scale used by the researcher to tease out students' views of Integrated Science was adopted from the one used by Arigbabu (2005), developed by Gunstone (1991) and Crawford (1998). The scale is divided into two categories.

Fragmented and cohesive: In fragmented view, Integrated Science was seen to be about principles, formula and scientific calculations, while in cohesive view, it was viewed as a complex, logical system that helped in providing insights for understanding our environment. Of significance here was the fact that fragmented conception was associated with surface approaches while cohesive was associated with deep approaches to learning (Arigbabu, 2005). These categorizations have a bearing on higher order learning skills and outcomes; hence, they are very important for Integrated Science students. To encourage higher order learning skills and to improve teaching and learning of Integrated Science, it is essential that students are discouraged from resorting to unnecessary retention of facts, where the sole aim is to consciously recall information in the memory so as to use it later (Cooper, Fromme, Gordon and Nicholasm, 2002). The aim therefore should be to ensure that learning environments that encourage higher order learning skills are created. It has also been argued that teachers should organize the teaching and learning context in such a way that students are more likely to follow higher order processes (Biggs, 1999).

If teachers are to be entrusted with the role of ensuring that appropriate environments are created for enhancing students higher order learning skills, it is expedient that empirical research finds out the views which Science teachers hold about Integrated Science. This is paramount because educators have to find ways of injecting new knowledge into the system to bring about

improvement and to share that knowledge with future generations of teachers (Hiebert, Gallimore and Stigler, 2002). Such knowledge and information should help provide guidance on necessary changes that could be effected in order to address issues including teaching for higher order learning skills among pre-service teachers.

Furthermore, in order to improve the quality of learning, an important fact is to adopt deeper approaches to study through the creation of a context involving good teaching, clear goals and some independence rather than to focus on discouraging surface approaches (Trigwell and Prosser, 1991; Trigwell and Prosser, 1997). Moreover, teachers' views of Integrated Science together with the teaching context will play an influential role and impact on instructional decisions.

Psychologically, teacher behaviours in the classroom are shaped by internal principles based upon views on Integrated Science teaching. Inexperienced teachers are more likely to pass their past Integrated Science learning experiences to learners; irrespective of the view they hold. In view of this, the purpose of this study was to determine pre-service teachers' views of Integrated Science.

1.2 Statement of the Problem

The current situation of Integrated Science teaching and learning in Nigeria is a concern to all including government and the society at large. Research indicates that many students found Integrated Science to be difficult, boring and not interesting to them (Salau 1995, 1996). Large class sizes, inadequate funding, insufficient resources, poor teaching skills and lack of support for teachers among other factors further limit the quality of Integrated Science teaching and learning in Nigerian Junior Secondary Schools (Okebukola, 1997). To solve these lingering problems, one needs to develop a realistic picture of what is currently happening in the teaching

and learning of science in general and Integrated Science in particular at the Junior Secondary School level in Nigeria and also to identify the factors that are limiting the quality of Integrated Science Education. Furthermore, one needs to develop a reasonable picture for which the nation can strive towards improving Integrated Science teaching and learning within the existing resource limitations.

From the range of evidence in the Integrated Science Education literature, it is very clear that Integrated Science Education in Nigeria is faced with numerous problems that need to be addressed so that the goal of equipping students to live effectively in our modern age of science and technology, as formulated in the Nigeria National Policy on Education (Federal Government of Nigeria) (FGN), 1981, 1998) will not become a day dream. It is, however, believed that if appropriate steps are not taken to address these lingering barriers to the reform, the citizens will not be able to develop scientific literacy necessary for coping in the modern scientific/and technological world. Efforts at developing scientifically literate citizens by improving the quality of science teaching and learning in schools is a laudable reform that should pre-occupy the mind of policy makers and all key stakeholders in science education in Nigeria. It is imperative for the issues involved to be examined empirically in the context of Integrated Science Education in Nigeria.

Gaining the support of key stakeholders in exploring and revealing what is actually happening in Integrated Science teaching and learning in junior secondary schools and formulating a realistic picture of science teaching and learning through which recommendations for filling the gaps between the actual and ideal could be developed, is necessary to improving the quality of Integrated Science Education for Nigerian junior secondary schools students. This is the motivation for conducting this study.

Importantly, the research approach for this study was modeled on a study in Austria by Flanders (1984) and Good Rum (2001) which compared two approaches of Integrated Science teaching and learning in schools.

These are the actual pictures, which describe what is actually happening in schools and the ideal pictures, which defines a realistic quality teaching and learning in Integrated Science in junior secondary schools in Kaduna State, Nigeria. This study applies this established research approach to developing an education system in a developing country.

1.3 Objectives of the Study

The objectives of this study are as follows:

1. To determine the extent of the achievement of the objectives of the Integrated Science curriculum at the junior secondary schools in Kaduna State.
2. To find out whether there are differences in the assessment techniques used between urban and rural school teachers used in the implementation of Integrated Science curriculum at the junior secondary school.
3. To examine the qualification and training received by Integrated Science teachers in the implementation of Integrated Science curriculum at junior secondary schools.
4. To examine the adequacy of the methods and techniques used by Integrated Science teachers for lesson delivery in junior secondary schools.

1.4 Research Questions

The following are the research questions that will guide the present research work.

1. To what extent are the objectives of Integrated Science curriculum being achieved at the junior secondary schools in Kaduna State?
2. Are there differences in the assessment techniques used by Integrated Science teachers in urban and rural schools?

3. What is the relationship between teacher's qualification/training and the implementation of the Integrated Science curriculum in junior secondary schools?
4. How adequate are the methods and techniques used by Integrated Science teachers for lesson delivery in junior secondary schools?

1.5 Research Hypotheses

Based on the research questions, the following null hypotheses were developed:

HO_1: There is no significant difference in the opinion of teachers with regards the achievements of Integrated Science curriculum objectives at the junior secondary schools in Kaduna State.

HO_2: There is no significant difference in the opinion of urban and rural teachers in the assessment techniques used in the implementation of Integrated Science curriculum in junior secondary schools.

HO_3: There is no relationship between teacher's qualification/training and level of implementation of Integrated Science curriculum in junior secondary schools.

HO_4: There is no significant difference in the adequacy of methods of teaching/techniques used by the teachers in the implementation of Integrated Science curriculum and lesson delivery in junior secondary schools.

1.6 Basic Assumptions

The study was conducted based on the following assumptions as a guide:

1. Teachers' view of the adequacy of the objectives of Integrated Science curriculum is crucial in the acquisition of scientific knowledge.
2. Well chosen Integrated Science content is crucial to the realization of the value aspect of the subject.

3. Well chosen resource materials will go a long way in the achievement of the objectives of Integrated Science
4. A good choice of methodology is necessary for the realization of the value component of integrated science.
5. Appropriate choice of Integrated Science evaluation techniques is a necessary factor in determining the extent to which students have inculcated the right type of knowledge.

1.7 Significance of the Study

In an effort to improve the teaching and learning process of Integrated Science in Nigerian secondary schools and to make the learning of the subject matter more attractive to students, this study makes the following contributions to knowledge and education.

Firstly, this study provides Integrated Science and other science educators, science curriculum planners and government with detailed information about the actual picture of Integrated Science and other science teaching, science learning and educational practices in Nigerian schools and provides, cost effective ways of improving the situation. This in turn can help in planning and formulating further policies for science education in Nigeria.

Secondly, this study engaged key stakeholders in all science education in revealing the actual and ideal pictures and gaining their support for recommendations to close gaps. This in essence informs them about the features of quality Integrated Science Education and gains their support for improving the recommendations for the study.

Thirdly, this study provides an opportunity to apply a research design developed in Australia, a developing nation of Africa, and to evaluate the effectiveness of that research design and compare the findings between a developed and a developing country's educational system.

Finally, it is expected that government will further realize that the subject (Integrated Science) is not just a mere addition to the existing school curriculum, but one that is actual for the attainment of the much needed goals for scientific and technological development/advancement.

1.8 Scope and Delimitation of the Study

The study is centered around teachers' views on the teaching of Integrated Science at the junior secondary school (JSS) level. It was limited to the teaching of Integrated Science as a subject. It was further limited to junior secondary schools (JSS) and Integrated Science teachers in Kaduna State. Such limitation was due to reasons such as the scope of the title and the fact that other researchers are working on other aspects of the subject.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter reviewed the relevant or related literature on the views of teachers on the teaching and learning of Integrated Science at the JSS level in Kaduna State. Specifically, the review covered the following aspects; theoretical framework, models of curriculum implementation, the role of teachers in curriculum implementation, role of students in curriculum implementation, participants in curriculum implementation, determinants of curriculum development, concept of Integrated Science, objectives of Integrated Science, the emergence of Integrated Science, the philosophy of Integrated Science, the General Science versus Integrated Science, the supply and qualification of Integrated Science teachers, instructional methods in Integrated Science, concept, approach and empirical studies.

2.2 Theoretical Framework

In view of the subject matter involved which is education, the research work is predicated on the framework of the constructivist perspectives. Constructivism is a psychological theory of knowledge which argues that human beings construct knowledge and meaning from their experiences. Constructivism is a set of beliefs about knowledge that begins with the assumption that reality exists but cannot be known as a set of truth (Tobin 1993; White, 1999; Siago, 1996; Oludipe and Daniel, 2010. Constructivism is not accepting what one is told but his/her prior knowledge about what he/she is taught and his/her views about it. Active involvement of students is emphasized in constructivism, hence knowledge gained last long in their memory. Constructivism is not a new concept; it has its roots in Philosophy and has been applied to Sociology and Anthropology, as well as Cognitive Psychology and Education. The first

constructivist philosopher, Giambatista Vico, commented in a treatise in 1701 that "one only knows something if one can explain it" (Yeager, 1991). Immanuel Kant further elaborated this idea by asserting that human beings are not passive recipients of information. Learners actively take knowledge, connect it to previously assimilated knowledge and make it theirs by constructing their own interpretation (Check, 1992).

Five basic themes pervade the diversity of theories expressing constructivism. These themes are (1) active agency, (2) order, (3) self, (4) social-symbol relatedness, and (5) lifespan development. With different language and terminological preferences, constructivists have proposed, first, that human experience involves continuous active agency. This distinguishes constructivism from other forms of determinism that cast humans as passive pawns in the play of larger forces. Second, comes the contention that much human capacity is devoted to ordering process – the organizational patterning of experience by means of tacit, emotional meaning-making processes. In a third common contention, constructivists argue that the organization of personal activity is fundamentally self-referent or recursive. This makes the body a fulcrum of experiencing and it honours a deep phenomenological sense of selfhood or personal identity. But the self is not an isolated island of Cartesian mentation.

Persons exist and grow in living webs of relationship. The fourth common theme of construction is that individuals cannot be understood apart from their organic life of this active, meaningful and socially-embedded self. Organization reflects an ongoing developmental learning order and disorder co-existing in lifelong quests for a dynamic balance that is never quite achieved. The existential tone here is unmistakable. Together, then, these five themes convey a constructive view of human experience as one that emphasizes meaningful action by a developing self in complex and unfolding relationships.

Focusing on a more educational description of constructivism, meaning is intimately connected with experience (Mahoney, 2004). According to Mahoney, students come into a classroom with their own experiences and a cognitive structure based on those experiences. These preconceived structures may be valid, invalid or incomplete. The learner will reformulate his/her existing structures only if new information or experiences are connected to knowledge already in memory. Inferences, elaborations and relationship are personally drawn by the students in order for the new idea to become an integrated and useful part of his/her memory. Memorized fact or information that has not been connected with the learner's prior experiences will be quickly forgotten. In short, the learner must actively construct new information into his/her existing mental framework for meaningful learning to occur.

Conventional (lecture) method of teaching is the process of transmission of knowledge from teacher to student (Rhodes and Bellay, 1999). It is essentially a one-way process. The current Nigerian classroom, whether primary, secondary or tertiary institution level tends to resemble a one-person show with a captive but often comates audience. Classes are usually driven by teacher-talk and depend heavily on textbooks for the structure of the course. The idea is there is a fixed world of knowledge that the student must come to know. Information is divided into parts and built into a whole concept. Teachers serve as pipelines and seek to transfer their thoughts and meanings to passive students; thus is little room for students quest in independent thought or interaction between students. The goal of the learners is to regurgitate the accepted explanation or methodology expostulated by the teacher (Caprice, 1994). This teaching method can hinder the development of individual student's active and creative faculty and students who experience only this model of education may not be considered sufficient to meet the needs of a future educated citizenry (Caprice, 1994).

In a constructivist setting, knowledge is not objective; Mathematics and Science are viewed as systems with models that describe how the world might be rather than their validity. There is therefore no accuracy in describing the real which might be biased (Postlewaite, 1993). The role of the teacher is to organize information around conceptual clusters of problems, questions and discrepant situations in order to engage the students in interpretation. Teachers assist the students in developing new insights and connecting them with their previous learning; ideas are presented holistically as broad concepts and then broken down into parts. The activities are student-centered and students are encouraged to make their own questions, carry out their own experiments, make their own analogies and come to their own conclusions.

Cognitive theorists believe the role of the teacher is to provide learners with opportunities and incentives to learn. All learning, except for simple role memorization, requires the learners to actively construct meaning. Students' prior understanding and thoughts about a topic or concept before instruction exert a tremendous influence on instruction. The teacher's primary goal is to generalize what they learn. The change in the learner's cognitive structure or way of viewing and organizing the world and learning in co-operation with others is an important source of motivation, support, modeling and coaching (Feden, 1995).

The constructivist theory of learning supports cognitive pedagogy and tends to oppose that which proposes that human beings have an inmate sense of the world and this domain allows them to move from passive observers to active learners. Carlson (2003) places a strong emphasis on identifying, building upon and modifying the existing knowledge (prior knowledge) that students bring to the classroom, rather than assuming that they will automatically absorb and believe what they read in the textbook and are told in the class. Research (e.g. Caprico, 1994) indicates that better exam grades were obtained by students taught using constructivist

methodology. Supporting this finding, Saigo (1996) and White (1999) concluded that "the constructivist model has been found to slightly influence students' achievement in a positive way".

The constructivist model is capable of getting students more involved in learning. Kurt and Somchai (2004) in their own research on constructivism also found that students used for their study participated more in the classroom activities and gained in content knowledge when a constructivist approach was used. Brad (2000), in his study, found that students in the constructivist instruction showed higher degree of academic achievement than students in the traditional (lecture) instruction in all conditions. In another study by Gatlin (1992) he found that there was no significant difference in students' scores at the post-test between students of the constructivist group and traditional (lecture) group. He reported that the scores of students who received the constructivist approach showed a slight decrease on the delayed post-test, while students who received the constructivist instructional approach have a higher post-test scores. Traditional method, when used over time, encourages students to rely on memorization to pass tests; but after some time however, they often do not remember much of the information learned.

Makonang (2000) corroborated Gratin's findings in his study when he found that there was no significant difference in achievement between students taught using constructivist approach and those taught using traditional (lecture) group. Likewise, Kurt and Somchai (2004) reported that there was no significant difference in achievement between Thailand students exposed to traditionalist (lecture) teaching method and those exposed to constructivist teaching strategy in Vocational Electronics Programs. However, they concluded that the students in the constructivist group had higher scores on the post-test and the delayed post-test, compared to

those in the traditional (lecture) group. This implies that students in the constructivist group retained the concept taught better than their colleagues in the traditional lecture group.

2.3 Curriculum Implementation

Offorma (1994) describes curriculum implementation as the translation of or the putting of curriculum plan into practice. In other words, it is putting the curriculum document into action. This aspect of the curriculum involves the joint efforts of the teacher, learners and school administrators. In other words, curriculum implementation is a phase in the curriculum process. Saylor, Alexander and Lewis (1981:257) define instruction as the actual engagements of learners with planned learning opportunities; curriculum implementation is therefore the stage in the midst of learning activities where teachers and learners are involved in negotiation aimed at promoting learning. The teacher adopts appropriate teaching methods and ensures that materials are actively utilized in the process of interaction with learning activities.

2.4 Models of Curriculum Implementation

The main purpose of this section is to identify some curriculum models and strategies that are relevant in the assessment of the implementation of Integrated Science curriculum in Junior Secondary School curriculum. According to the Oxford Advance Learner's Dictionary (1995), a model is a design of something that is made so that it can be copied in another material; a sample description of a system, used for explaining or calculating something. Every successful implementation depends on its models and strategies; hence, Mkpa (1987) argued that successful implementation of curriculum models must basically take into consideration a well articulated plan of strategy through a policy provision and monitoring.

Curriculum implementation as postulated by Offorma (2005:198) "is the translation of the planned curriculum document". Curriculum implementation is putting into action the planned

curriculum. It is the actual classroom teaching which includes the use of infrastructure, personnel, materials, methods and techniques. There are several models of curriculum implementation; some of them as reported by Ben-Yunusa, (2000:97) include the following:

a) Research development and diffusion (RD&D)

b) Social interaction (SI)

c) Problems solving (PS)

d) Centre periphery (CP)

e) Proliferation of centre models and

f) Shifting centre models

Research Development and Diffusion (RD&D): The RD&D models deal with empirical investigation into needs for a change in the aims, objectives and reasons for change. This assume an orderly translation of knowledge from research to development, diffusion and finally to adoption. It involves getting the curriculum products right and then marketing them to a user such as the school. Thus, Bercher *et al* (1978) supported by Ben-Yunusa (2000) saw RD&D models as delivering the complete package or product to the school or for whom it is intended. An instance of this in Nigeria educational system is the National Policy on Education (NPE) which supports Bercher's opinion in Ben-Yunusa (2000:91) that:

> *"The large groups which consist of teachers and students are passive receivers of the finished product from the central agencies. The developer, in this model; the teachers are not actively involved in the process of initiation of curriculum innovation".*

Thus, the RD&D models depict the process of change in an orderly sequence of identification of a problem and activities in producing solution to a target group. The initiative in

these activities is taken by the researchers, the developers, and the disseminators; the receivers remain essentially passive, Havelock (1971) in Ben-Yunusa (2000:91).

Social Interaction (SI): This is the second model. It is similar to the first where the need and problem of the target population (teacher and his students) is identified by the initiator who is not the one who will implement the curriculum change; but it is he that defines and determines the receivers needs, Ben-Yunusa (2000:42). The change, which consists of solution to the identified problems will get to the point of implementation in the relationship. Formal and informal information are passed from sender to the receiver of the curriculum. The adoption of the curriculum can be said to be through the model (Social Interaction) by members of the adoption group.

The Problem Solving (PS) Model: The receivers, according to Ben-Yunusa, (2000:92) (teachers and his students) are actively involved in the initiation and development of curriculum innovation; through interaction between teachers, learners and learning materials at the local level. The receivers could be individuals or a group which identifies an area of concern. After identifying the problem area, the receiver seeks to effect a change through his effort or assistance of others from outside the system. The same people that are actively involved in curriculum implementation are the ones that initiate and develop the curriculum innovation materials. This reflects the actual needs of the people using the curriculum not the perceived need as proposed by curriculum experts and researchers at the NERDC, WAEC, Ministry of Education and Institute of Education.

Centre Periphery Model: This model depends on either government or an agency. All facilities are centrally controlled by the agency vested with the responsibility for implementation. Its effectiveness depends on communication network, adequate supply of human and material resources and the periphery.

It is important to note that the success of this model would require adequate communication network; adequate supply of material and human resources for the training, and regular monitoring of the programme in schools in order to have required feedback from the periphery.

Proliferation of Centre Model: Schon (1971) opined that in curriculum implementation there should be both primary and secondary implementation centers, the primary centre may be truncated by rejection at any stage. This resembles what is in the National Primary Education Commission document. The commission works with the primary school boards in the states, while each state board coordinates affairs in the various local governments and send feedback to the commission. For this to succeed, it requires that sufficient material and training facilities are made available for the centers, there should also be an effective communication network, adequate finance and effective supervision.

The success of this model also depends on adequate funding, supply of adequate instructional materials and training facilities at the various levels of implementation. Besides, there should be an effective monitoring network and regular supervision of the entire process.

The Shifting Center Model: This involves the implementation of curriculum innovation in a particular place at a time, after which another locality embraces the innovation and implements in its own area. This is said to be the reflection of the Universal Primary Education (UPE) scheme in Nigeria which started in the West in 1954. As it was fading away, the East took it up

in 1959 and finally, it was embraced by the Federal Government of Nigeria in 1973. It is worthy to note that the East and West operated independently before it became a nation wide programme (Ben-Yunusa, 2000:98).

It should, however, be noted that this model could be best practiced when engaging in pilot testing of the implementation strategies to ensure adequacy of the relevant components. But it is generally assumed that this model could be problematic because the entire process could be abandoned by those centres that ate not financially stable to find the various aspects involved in the implementation process.

From the above process, the external change agents in RD&D is concerned with mainly preparing and disseminating package solution. In (Social Interaction) model, the concentration is on identifying and strengthening communication network and promoting the exchange of ideas, while in the Problem Solving (PS) model, it acts as a source consultant working in a non directional relationship with his/her client. Specifically, what the new input will be in problem solving (PS) is determined by the receiver himself/herself whether or not this same input could also satisfy the needs of other receivers (that is mass diffusion).

For this study, Problem Solving (PS) model for curriculum innovation was used. This is because the research (that is the study) tried to appreciate the Integrated Science curriculum implementation by identifying the problems and is actively involved in finding solutions to the problems. However, in Nigeria, the curricula are highly limited to certain areas. The Research Development and Diffusion (RD&D) model is most often used in curriculum implementation due to the centralized system of Nigeria educational system. Teachers are not involved in the curriculum decision making process, they just accept new ideas, practices and material (if provided) from the top and implement (Omulewa and Sarumi, 2002:219).

Obanya's (1982), Odubunmi's (1983) and Mgbodile's (1985) studies were on the learner/teacher characteristics, teacher supply, learner socio-economic background and the impact of these on the implementation of specific curriculum programmes. Specifically, Odubunnu's (1983) study was on the learner/teacher characteristics, teacher supply, learner socio-economic background and the impact of these on the implementation of specific curriculum programmes. He also analyzed the socio-economic background of learners and how this affects their interaction with the curriculum package. Macaulay (1999) identified the problem areas of teachers and learners in the implementation of the curriculum. However, the study accepts Fajejaidaba (1984) opinion that curriculum implementation involves the breaking down of the component parts of an instructional content into hierarchical order which should be imbibed by teachers for easy understanding of what is taught.

A useful finding from the studies above is the comparative perspective which some of them have adopted. Further findings show an interesting revelation of both similarities in the pattern of views and alternative views held by learners from different cultural backgrounds (Ivowi, 1984). All the opinions enunciated by the above authors centered on methods, procedures and problems of implementing the curriculum in a typical learning environment that includes schools in Kaduna State. The opinions further indicate that for Integrated Science curriculum to be effectively implemented, certain factors such as quality of teachers, teaching aids, methods etc, have to be strongly borne in mind since they have great influence on the effective implementation of the curriculum by teachers.

Nigerian scholars writing on curriculum have worked on studies involving actual classroom interaction. The early one, such as that of Oludotun and Ogunniyi (1984) have involved the use of category coding systems for observing teaching/learning situation; the most

controversial category system is that of Flanders, (1984). New studies by Omonogun (1991) evolved the use of several research approaches in the analysis of classroom verbal interaction. These methods involve the use of coding system (ethno-mythology) and participant observation techniques. Their outputs have afforded newer insights into classroom interaction.

Bimbola's (1991) concentrates on contents though credible, but it is not sufficient for the smooth implementation of the curriculum because other factors need to go with the content. On the other hand, Omonogun (1995) highlighted the value of research approaches in analyzing classroom verbal interaction; this also is not enough for effective implementation of the curriculum, and it is just part of it. However, Fajejnidaba's view is highly credible because it coincides with curriculum implementation models and it gives adequate room for monitoring and assessment of teacher's implementation strategies. This further helps in the determination of their teaching effectiveness.

2.5 The Role of Teachers in Curriculum Implementation

Analyzing the role of teachers in curriculum development, Albert (1990) re-echoed the dogma that no educational system can rise above the quality of its teachers. A good teacher is an embodiment of all kinds of skills without which the learners' achievement will be low. The role of the teacher therefore is very important in curriculum evaluation, interpretation and implementation, especially when it comes to measuring the gains in education. One of the primary roles of a teacher in any curriculum interpretation and implementation is that of passing message to the learner. The teacher plays other encompassing roles such as:

a) Participating in curriculum planning, guiding and learning;

b) Organizing students to meet their set objectives, and

c) Understanding and assisting in bridging the gap between theory and practice in education (Barrow, 1996).

The effective discharge of these functions helps learners to grow in depth and dimension. The role of teachers in the implementation of the curriculum is multifaceted as they assume the position of guidance and counselors and parents substitutes especially at the lower levels of education. They are also involved in directing the students' thought, shaping their ideas and motivating them to aspire to greater heights in life.

Therefore, the most important single determinant of what happens in the classroom is the teacher. However good the lesson notes are, the management of curriculum depends on the sophistication and appropriateness of teaching aids, and the teacher's transactional skills; which are a reflection of his/her training and experience (Onwuka, 1984). The ability to communicate effectively will also depend on the teacher's interpersonal relationship with the students. Such relationship can be cultivated through participation and co-operation.

Effective implementation of the curriculum depends tactfully on effective and efficient planning by the teacher, who decides what the learners will do and how to do it. The malfunction of curriculum implementation easily manifests in indiscipline and disruptive behaviours of learners not concentrating on their studies. To be able to implement the curriculum, the teacher as the most important part of the curriculum must be trained in experimental and manipulative behaviour (Ndubuisi, 1981). This study found out the teacher's role in the implementation of the Integrated Science curriculum. The attempt made has spelt out the role and qualities of the teachers without which curriculum implementation will be seemingly impossible. That not withstanding, it has not discussed other salient areas such as the use of appropriate teaching aids and participation in curriculum planning.

2.6 Role of Students in Curriculum Implementation

On the role of students in curriculum implementation, emphasis is placed on individual student's development, therefore, their needs and interests are considered in the implementation of the curriculum. In this guise, the organization of the curriculum for a group of learners depends on the perceived needs, problems and interests of the learners; the sequence of which depends upon where the learners are and how far they can overcome the problems and situation that may arise from the implementation.

A notable feature of curriculum activities is the interest in students' growth through visible active experience. These are structured with the learners' interest at heart (Tyler, 1989). The curriculum calls for very extensive planning by the teacher if it must be successfully implemented (Onwuka, 1984). It is hoped that this research would alert classroom teachers on the need to make preparation towards the successful implementation of the curriculum. The curriculum also calls for flexibility in advance, bearing in mind that the learners' interest, needs and modes of learning determine how learning takes place and that teaching should transcend from simple to complex or from known to unknown (Urevbu, 1985).

2.7 Participants in Curriculum Implementation

The implementation of the curriculum requires many hands to be on deck if success is to be guaranteed. The participants are both within and outside the system. Participants within the system consist of the head teacher, teacher, learners and the supporting staff. The learners are the focus of any curriculum implementation. Whatever the head teacher, teacher, parents and the government do, the learners provide feedback on the success or otherwise of the curriculum. It is from the learners response that the teachers get to know the effectiveness of his statement of objectives, methods, instructional materials and evaluation procedures.

Although decisions on what to teach, how to teach and the time required teaching may have been taken by policy makers, the implementation of these aspects of the curriculum lies in the hands of the classroom teacher. He is the one to interpret the syllabus, the scheme of work and the lesson plan and presentation. It is for these reasons that the teacher must be given adequate training and support.

The teacher is charged with the responsibilities of monitoring and supervising the implementation of the curriculum at the school and classroom levels. He is to maintain an enabling environment to enable the teachers and learners interact meaningfully. He does this by maintaining good human relations with staff and students, assigns duties and gives assistance to teachers and learners, as well as ensures availability and adequacy of instructional materials and other infrastructural facilities by keeping and maintaining regular line of communication between the school and the supervisory bodies like the ministry, education board, resource centers, research councils and so on.

The Parent-Teacher Association (PTA) is another internal component of the curriculum implementation process. The role of the PTA in curriculum implementation is often understood by most head teachers. In most cases, the role of the PTA is perceived to specifically be on providing money to the head teacher to produce materials for school. While this perception is not disputed, it should be understood that the PTA has a variety of functions to perform in the school for the achievement of educational objectives.

As a body, the PTA influences curriculum implementation in many ways. For instance, it serves as an advisory body to the school, recruitment of additional teachers in very needy subject areas, purchase of books and other instructional materials, providing funds for the execution of projects, soliciting assistance from government and other non-governmental organizations

(NGO's) for the school, awarding scholarships to learners who excel but without financial base and many others. However, it should be understood that these components or agents of curriculum implementation must work in harmony if they are to achieve educational objectives through effective curriculum implementation.

Problems and prospects of curriculum implementation in the process of implementing the school curriculum are problems that are inherent. Some of these include the following:

a) Language of instruction
b) Funding
c) Manpower
d) Leadership

2.7.1 Language of Instruction

Nigeria is a multi linguistic society. This situation has made it difficult for the school to adopt a lingua franca for instruction. It should be noted that language is a basic tool for the communication of learning experience in schools. In Nigeria, English language is a second language as such it is the tool for instruction in schools. The policy of using English language as medium of instruction in schools is a colonial legacy and it has hindered the smooth implementation of school curriculum. For instance, teachers and learners have the problem of understanding the meaning of various concepts they intend to teach and learn.

The National Policy on education has made provision for teaching at the basic education (1-6 years) level to involve the initial use of the local language, while, English is taught as a subject, at a later stage, English would be used as a language of instruction while local language would be taught as a subject. However, the policy tends to be implemented at the wish of the schools.

2.7.2 Funding

The problem of funding curriculum implementation is a serious matter. The success of the entire components of the curriculum in schools depends on adequate funding. For instance, the training of manpower and their remuneration, materials, monitoring and supervision all require adequate and regular funding.

In Nigeria, the policy of funding education is faulty, for instance, the federal government could provide instructional materials and funds for staff development but could not fund recruitment of teachers and other supporting staff; this is a contradiction and misplacement of priority in curriculum implementation. It should be made clear that the success of curriculum implementation depends on proper and adequate funding.

2.7.3 Manpower

The proper implementation of the school curriculum requires specific reference to manpower provision. Education planners lack up to date statistics to guide their projection of manpower needs.

In most of the states in Nigeria, classrooms have shortage of qualified and skilled manpower. In states where the quantity and quality exist, the manpower is not motivated in terms of conditions of service and on the job training. This tends to negatively affect curriculum implementation.

2.7.4 Leadership

This component of curriculum implementation is a major concern because it distorts the entire system of the school. Leadership problem is manifested in the degree of corruption that pervades the society in general and the education sector in particular. In the process of implementing the school curriculum, funds released for such purpose in most cases, do not get to

their destinations. In cases where they do, a large percentage of the fund would have been diverted for purposes they were not meant for.

The leadership would have to present itself as a model that would provide exemplary leadership and ensure smooth and effective implementation of the curriculum. Such a leadership would ensure the timing of the implementation of the curriculum and monitor the evaluation procedures of effective feedback.

It is important at this point to note that these problems should be regarded as challenges to education problems rather than attacks on their personalities. There is no programme implementation exercise that does not have inherent problems, what is required is the will that confront these problems objectively.

2.8 Determinants of Curriculum Implementation

The following are factors that determine to a great extent, how successful or otherwise any given curriculum can be adequately implemented:

1. The society
2. The learner/student
3. The teacher
4. Knowledge of the disciplines
5. Availability of resources
6. Textbooks authors/subject specialist
7. Classroom organization
8. Time allocation
9. Method of teaching
10. Economy or finance

1. The Society

A society is usually perceived as a collection of individuals who have organized themselves into a distinct group in relation to their natural and social environment. Such a group is usually a distinct one with several things which are held in common in order to make everyone belong. Those things which are common to the group and which also ensure togetherness of such a group are the things which make up the culture of the group. Culture therefore, becomes the total shared ways of life of a given people. This comprises their characteristics, habits, ideals, modes of thinking, acting, feelings, child rearing practices, religion, land, language, any customs as well as material products like type of house, cloth and tool, etc.

Different societies have different cultures and a knowledge of that is important for educational programmes to be culturally biased. Since culture preserves a given society by educating the young on its norms and values, it is imperative that educational programmes or curriculum should be culture dependent. Therefore, curriculum designed for any given society should essentially reflect societal needs, goals, value systems, aspirations, expectations, general pattern of life and culture of people.

2. The Learner/Student

The learner is at centre of any educational programme. This being the case, any curriculum planning must give adequate consideration to the learner. The whole idea of curriculum planning and development will be meaningless if the learners who are directly involved in the curriculum implementation processes are not taken into account. A curriculum that is adequately planned, useful and relevant, must clearly reflect the fundamental issue of learners needs, interests, peculiarities, other physical and psychological characteristics etc.

3. The Teacher

A teacher can be considered as the heart beat of the curriculum. For a teacher to be effective and efficient in the performance of his duties, he/she must have good knowledge of the subject matter. Added to a teacher's qualification is his experience and perception of his role in the teaching/learning process. A teacher who cares less about the success of his students is not likely to perform well. Therefore, success or failure of any given curriculum will be determined to a reasonable degree on the commitment and dedication of a teacher to his professional role.

4. Knowledge of the Discipline

The tremendous increase in existing knowledge has great influence on curriculum planning and development. Aspects of knowledge that are most worthy will have to be selected for learners in the school system. For instance, it is an established fact that knowledge in the disciplines, especially in the sciences has given rise to the problem of what to select from the various items of knowledge. At every point in time, selection of the kind of learning that is of most worth should always be considered.

5. Availability of Resources

Availability of human and non-human resources is another major determiner of the curriculum implementation. Human resources include the teacher and any other person or group of persons that have some contributions to the successful implementation of a given curriculum. Non-human resources include; facilities, equipments and materials. In some schools today, there appear to be inadequate resources for use by teachers. In situations where materials are not available in large quantities to meet the demand, implementation of a curriculum that requires the use of the materials will be hampered.

6. Textbooks by Subject Specialists

Textbook authors usually determine the scope of content and the logic of subject matter. They, in addition, determine the authenticity or truthfulness of the information the school system will be exposed to. If, for instance, the information in a textbook is shallow, misleading and not authentic, learners will be exposed to wrong information. It is necessary that authors and specialist make effort to ensure that the most relevant, the most useful and the the most functional information is included in the textbooks. Textbooks should also be reviewed from time to time to reflect any change in knowledge.

7. Classroom Organization

The organization of classes in schools has great effect on the implementation of the curriculum. The school head should ensure that teachers attend their classes punctually. There should also be effective in monitoring what goes on in the classroom for teaching and learning to be meaningful and rewarding.

8. Time Allocation

Time available on the time table for teaching any particular subject is a measure of attention the educational managers attach to that subject. The time allocated to each subject should be adequate for the teacher to carry the learners along. If the time is too short, the teacher may tend to rush through the scheme of work not caring whether he is carrying the students along or not.

9. Method of Teaching

There are so many methods used in transmitting and sharing knowledge with learners. These include lecture, discussion, discovery, inquiring, field trip/excursion, role playing, demonstration, play way etc. No one method has all the essentials and no one method is superior

to another. What dictates the choice of a particular method depends on the nature of the content that is to be taught.

10. Economy or Finance

The economy or state of finance of any country is one or the most significant influencing factors of curriculum implementation. The economic situation or financial standing of any country determines to a very large extent the quality, content and even the method of education of that country. It determines the orientation of the educational philosophy, scope of the educational objectives, the range of school subjects and learning experiences, the mode of evaluation adopted, the quality of infrastructure for implementing the curriculum and the quality of teachers.

In Nigeria, the state of the economy during the era of oil boom greatly affected the curriculum in a positive direction. But presently, lack of funds as a result of the country's dwindling economy is one of the reasons why the federal government cannot expedite action on teachers demands for salary increase thereby leading to incessant strike actions by the teachers.

2.9 Concept of Integrated Science

Defining the concept of Integrated Science is not an easy task; the reason being that various individuals and organizations see the label differently depending on their view, experience and what Integrated Science represents in their environment. Integrated Science was defined by Omulewa and Sarumi (2002) as an approach to the teaching of science in which concepts and principles are presented so as to express the fundamental unity of scientific thought and avoid premature and undue stress on the distinction between the various scientific fields.

Science is generally seen as a product of knowledge as well as a process of generating knowledge. Adding the word "integrated" therefore makes this science, as presented in the

classroom, to mean the teaching of science as unified knowledge and a process of taking an investigatory look at natural phenomena (Omulewa and Sarumi, 2002).

2.10 Philosophy of Integrated Science

The reasons or philosophy for teaching Integrated Science in Nigeria can be discussed from two major sources or stand points. The first is the STAN Integrated Science materials and the other is the National Core-curriculum for Integrated Science.

The Nigerian Integrated Science Project (NISP) derived its philosophy from the teaching of pupils what science is and how scientists work. What this philosophy means is that the learner should be exposed to as many aspects of science as possible. What science is pertains to the subject as a body of knowledge and a way of gathering knowledge. How the scientist works concerns the skills and attitudes he uses in his daily effort to gather knowledge. It also involves the social environment surrounding the scientists and how they interact with it. When it became clear that Integrated Science has become a part of Nigerian education, the Federal Government officially adopted it and developed a core curriculum for the subject. The Federal Government of Nigeria derived the philosophy of Integrated Science from the National Policy on Education. The following steps where used to derive the Integrated Science philosophy:

1. Portions of the National Policy on Education relating to Science Education in general and to Integrated Science in particular were examined. As stated in section 4 of the policy, secondary school education is expected to be a preparation for:
    i. Useful living in the society;
    ii. Higher education, specifically, secondary school education should:

a) Provide an increased number of primary school pupils with the opportunities for education of a higher quality, irrespective of sex or social, religious and ethnic background;

b) Diversify its curriculum to cater for the differences in talent, opportunities and role possessed by, or opened to students after their secondary school course;

c) Equip students to live effectively in a modern age of science and technology; and

d) Raise a generation of people who can think for themselves, respect the views and feelings of others, respect the dignity of labour, and appreciate those values specified under the our broad national aims and live as good citizens.

2. It was felt that if Integrated Science was to be taught in the junior secondary schools it must be tailored to realizing the above broad national objectives for secondary education.
3. Based on 1 and 3 above therefore, the Federal Government fashioned a philosophy for teaching Integrated Science as a course which:
   i. Is relevant to the child's need and experience;
   ii. Stresses the fundamental unity of science;
   iii. Lays adequate foundation for subsequent special study; and
   iv. Adds a cultural dimension to science education.

In addition, the government also gave its own explanation of integration as applied to the science at the JSS. It says that the course must assist the learner to gain:

a) The concept of the fundamental unity of science;

b) The commonality of approach to problems of a scientific nature; and

c) An understanding of the role and function of science in everyday life, and the world in which the child lives.

2.11 Objectives of Integrated Science

According to the Nigerian Integrated Science Project (1979), integrated principles are intended to produce among other things a course which:

i. Is relevant to the child's need and experience;
ii. Stresses the fundamental unity of science;
iii. Lays adequate foundation for subsequent special study; and
iv. Adds a cultural dimension to science education.

Based on these objectives and the facts of Integrated Science discussed earlier, students should be made to master the following skills:

i. Observing carefully and thoroughly;
ii. Reporting completely and accurately what is observed by organizing information acquired by the above processes;
iii. Generating ideas on the basis of acquired information;
iv. Predicting outcomes as a results of these generalization;
v. Designing experiments (including control where necessary to check these directions);
vi. Using models to explain phenomena where appropriate; and
vii. Continuing the process of inquiring when the new data do not confirm with predictions.

2.12 Emergence of Integrated Science

In the mid 1960s, General Science or Elementary Science or Nature or Rural Science was taught in Nigeria. But of course, nowadays the situation has changed and one hears of/or Integrated Science. Even the present primary science has changed in structure and content if not in name; the question is why these changes? As mentioned very briefly in the introduction, a world-wide movement to reform Science Education emerged in the United States of American

and British in the 60s. This was in response to the realization that Science and Technology were intimately related to national development, and that science was not being effectively taught in the schools. While this situation was agitating the minds of the Americans, the USSR was able to launch the first artificial satellite into space in 1957 at a time the United States of America could not do so. This deficiency was traced to the school system with the argument that if science was properly taught at the primary and secondary schools, good scientists and technologists would emerge to boost their scientific and technology development. This movement for reform led to the development of curriculum projects like Biological Sciences Curriculum Study (BSCS), Chemical Bond Approach (CBA), and Physical Science Study Committee (PSSC) which catered for the single science subject. It also led to the development of new science curricula in the primary and junior secondary schools which were termed integrated. Examples of these curricula are the Elementary Study (ESS), and the Science Curriculum Improvement Study (SCIS).

The emergence of Integrated Science in Nigeria came about as a by-product of the review of the secondary school science syllabuses of the West Africa Examinations Council (WAEC) in the 60s. The ripple of the world wide curriculum reform movement had found its way into Nigeria and this led WAEC to review its syllabuses in Physics, Chemistry and Biology. WAEC therefore called on Science Teachers' Association of Nigeria (STAN) to assist in the review in 1968.

In the course of this review through the three Curriculum Development Committees of STAN (for Biology, Chemistry and Physics), a very timely need arose which changed the whole of our science education outlook. The committees felt that their Biology, Chemistry and Physics curricula respectively needed a solid science foundation in the first two years of the then five-year secondary education. Without this foundation, meaningful learning of their Physics,

Chemistry and Biology would not be possible. The experience gathered by the USA (Ford Foundations) which sponsored Aiyetoro Basic Science Programme, led to the birth of the Nigerian Integrated Science Project (NISP) by STAN.

2.13 General Science versus Integrated Science

As mentioned earlier, one might have studied General Science or Rural Science during his primary school days. But what is now being taught, and people being trained to teach, is Integrated Science.

What differentiates Integrated Science from the old General Science? The answer to the question can be obtained by:

i. Recalling experiences during the time of studying General Science.

ii. Interviewing some old persons who studied it or any other form of it.

iii. Comparing the characteristics of General Science gathered with those of Integrated Science now.

	GENERAL SCIENCE	INTEGRATED SCIENCE
1.	Individual subject can be identified in compartments	The traditional boundaries no more (science subject) exist
2.	The course does not have objectives stated	The course is taught towards the realization of certain learning outcomes
3.	It is difficult to observe any logical sequence	Logical sequencing of theme/concept is discernible
4.	No unifying themes	There are unifying themes around which concepts are treated
5.	Seldom contains activities which makes students only passive learners	Has a lot of activities which make students actively involved in learning
6.	The teacher assumes the automatic role of "Mr. Know All"	The teacher is a facilitator of knowledge and guides the class through meaningful interactions

Source: *Module of NCE, National Teachers Institute*

2.14 The Supply and Qualification of Science Teachers

1. Research undertaken by the Welcome Trust suggests that, although primary teachers do not need a strong scientific background to teach science, many lack the scientific background knowledge, confidence and training to effectively teach science. The Integrated Science Education Strategy recommends that all teachers of science – both primary and secondary (including further education) – in the study area have an entitlement for professional development.

2. In 2002, the Set for Success Report highlighted the national teacher recruitment issue for science specialists, with the particular difficulty in recruiting Mathematics, Physics and Chemistry specialists. Mirroring this research, another research was undertaken more recently by NFER on behalf of the DFES into the development of Mathematics and Science teachers found that, amongst science teachers in secondary schools, there is an imbalance in the representative of school science. 44% specialized in Biology, 25% in Chemistry and 19% in Physics. 26% of all 11-16 schools did not have any Physics specialists. Evidence collected during the wide ranging consultation in the study area suggests that schools in the North-East reflect similar patterns.

3. In Double Award Science, only two fifth of those teaching Chemistry had studied Chemistry at degree level or by initial teacher training and only one-third of those teaching the Physics element had specialized at degree level or in initial teachers training. Within the North East, there is a particular problem in recruiting Physics specialists.

4. Non-specialists are more likely to be teaching the low ability groups and groups/courses that do not involve national assessment. They are also found in the lowest attaining schools, serving in socially and economically deprived areas. Receiving less exposure to

specialists can affect pupils' views of the sciences and decisions as to whether they should be continued in the longer-term.

5. There is also a lack of continuing professional development of science teachers. A survey undertaken by the Council for Science and Technology concluded that science teachers were not engaged in a subject-related systematic process of continuous professional development. Teachers generally reported that opportunities to build on their initial training were very limited and faded away sharply after the first induction year of their careers. Since the opening of science learning centre in the North East in January 2005, there has been an increasing take off of subject related professional development within the zone.

6. Most recent research by the Welcome Trust published in January 2006 found that secondary science teachers were particularly keen to update their subject knowledge – 72% wanted more CPD in that area, as against 60% for other subject teachers – while only 35% were satisfied with subject-related courses compared with 48% for secondary school teachers as a whole. The evaluation of the professional development provided by Science Learning Centre in North East has been rated consistently good or very good.

7. Only 52% of secondary heads of science felt that CPD was encouraged by senior management compared to 67% of other heads of department. Even more striking, half of all secondary science teachers had no subject-related professional development in the last five years. Within the North East, it is felt that the non-availability of well qualified teachers is a key constraint in enabling teachers to confidently leave the classroom to undertake professional development. The Integrated Science Education strategy addressed this by recommending that a cadre of specialist science teachers are trained and

then employed within the zone to work within groups of schools and colleges in collaborative partnerships.

Teachers' Expectations and Behaviour

Tobin and Gallagher (1987) found that science teachers rarely, if ever, exhibit behaviour that encourages students to think about the nature of scientific inquiry and the meaning and purpose for their particular investigation during laboratory activities. On the basis of a comprehensive study on implementation of the laboratory in schools in British Columbia, Gardiner and Farrangher (1997) found that although many Biology teachers' articulated philosophies appeared to support an investigation, as well as hands-on-minds-on approach with authentic learning experiences, the classroom practice of those teachers did not generally appear to be consistent with their stated philosophies. As noted in the preceeding section, Hodson's observations of the mismatch between teacher's rhetoric and practice also complicates obtaining valid and reliable information based only upon teachers' self-reports. Several studies (DeCarlo and Rubba, 1994 and Marx et al., 1998) have reported that very often, teachers involved students principally in relatively low-level routine activities in laboratories and that teacher-student integration focused principally on low-level procedural; questions and answers. Marx et al (1998) reported that science teachers often have difficulty helping students ask thoughtful questions, design investigations, and draw conclusions from data. DeCarlo and Rubba (1994) reported similar findings in chemistry laboratory settings. Earlier, Shymansky and Penick (1978) had written to say that:

> *"Teachers are often confused about their role in instruction when students are engaged in hands-in activity. Many teachers are concerned about an adjustment they may have to make in their teaching style to facilitate hands-on programmes as well as how students will react to increased responsibility and freedom".*

Often teachers do not perceive that laboratory activities can serve as a principal means of enabling students to construct meaningful knowledge of science, and they do not engage students in laboratory activities in ways that are likely to promote the development of science concepts. They may not perceive that they can manage laboratory activities in ways that are consistent with contemporary professional standards. In addition, many teachers do not perceive that helping students understand how scientific knowledge is developed and used in a scientific community is an especially important goal of laboratory activities for their students.

As noted in other sections of this review, several researchers have continued to observe that many science teachers do not utilize or manage the unique environment of the school laboratory effectively and conditions that are especially demanding in science laboratories because the teacher is to act as a facilitator who guides inquiry that enables students to construct more scientific concepts. Contemporary teaching standards place a heavy burden on the science teacher. Inquiry-focused teaching now rests on the constructivist notion that learning is a process in which the student actively constructs her or his own ideas that are linked with other ideas in increasingly complex networks. The constructivist model, when practiced, is relatively a radical departure from traditional teaching and learning practice. Teachers are often not well informed about these new models of learning (Cohen, 1990; Polman, 1999) and their implications for classroom teaching and curriculum. While excellent examples of teaching can be observed, the classroom behaviours of many teachers continue to suggest the conventional belief that knowledge is directly transmitted to good students and that it is to be remembered as conveyed.

In addition, many teachers lack experience in assessment methods aimed at determining their students' understanding and performance in the science laboratory (Yung, 2001). As a

result, in many cases, students' final grades do not include a component that directly reflects their performance in laboratory work and their understanding of that work.

Furthermore, Brickhouse and Bodner (1992) had earlier reported that students' concern about their grads has a strong influence on teachers' practice. They specifically suggested that teachers would need to emphasize goals for learning and use teaching techniques that are aligned with students' ability to earn high grades.

The need for meaningful, long-term professional development for science teachers on these issues and for better communications between the science education research community and the community of science teachers is abundantly clear. These important issues are discussed further in the Teacher Education and Professional Development section later in this review.

2.15 Criteria for the Selection of Instructional Methods

Several educationists have advanced criteria for selection of instructional materials. Some of these educationists include

From the criteria given, it would appear that the following are necessary in the selection of instructional methods (Yusuf, 2012) and (Danladi, 2006).

1. Instructional methods should be selected based on the type of instructional objectives that are expected to be achieved. For example, objectives set at the psychomotor and cognitive domains will require learner-centered teaching methods such as discussion, discovery, play way and assignment.
2. Cost implication: Some methods are more expensive than others. The method selected should not be so expensive that both the teacher and the learner cannot meet the cost.
3. The subject to be taught: Demonstration and experimentation methods are appropriate for the sciences.

4. The size and number of students: Discussion method is appropriate for small group of students but inappropriate for a class of more groups of students or more than 500. If the class is large the teacher needs teaching methods that can cater for the interests and needs of the entire pupil in the class.
5. The time available for the teacher to cover the scheme of work or course outline – many teachers opt for lecture method when they have limited time to cover the course outline.
6. The interest of the learner: Interest disposes learners to be attentive during instruction.
7. Media materials available: There are some teaching method that may require instructional materials for effectiveness e.g. a Home Economics teacher cannot embark on using demonstration without the required equipment and ingredients.
8. Other characteristics such as age class intellectual capacity and their background are also to be considered in selection of instructional methods.

Instructional Methods

Instructional methods are usually named after the dominant activity employed in the course of the lesson. Some of these methods include lecture, discussion, demonstration, laboratory/experimental, field trip, assignment, play way, peer teaching, role playing, project, discovery, discussion etc.

Lecture Method

Lecture method can be referred to as techniques that involve the teacher in complete verbal instruction or exposition. The teacher in this method tells his class what he feels they should know. The students listen and take down notes. The students are always passive while the teacher is active. There is only one-way channel of communication from teacher to students.

Seating arrangement is usually centralized and the teacher is the focus of attraction. It is a teacher centered method. It is appropriate for higher level students e.g. tertiary level students.

Advantages

1) It is economical in terms of time effort.
2) It allows the teacher to deal with very large students.

Laboratory/Experimental Method

The laboratory method can be referred to as activity carried out by particular students or a group of students which is more of personal observations of processes, products or events. This method is mostly used in the teaching-learning of science subjects. Laboratory Method is characterized by two procedures. Laboratory exercise which usually consists of activities that are carried out so as to provide practice in designing, operating and interpreting experiments. The other procedure known as experiment consists of operations or procedures used for testing a supposition, confirming the known, and by this a child learns. Furthermore, since freedom and free activity promote learning, a sort of play in teaching will incorporate them. Play has been referred to as any pleasurable activity.

Advantages of Laboratory/Experimental Method

1) The method helps the students to develop manipulative skills
2) It leads to better retention of information and development of favorable attitudes to school subjects.
3) Students are active participants and acquire more knowledge by performing experiments
4) The method makes the students to become familiar with such mental processes as observing, informing, classifying, measuring and data interpretation.

Disadvantages of Laboratory/Experimental Method

1) It is an expensive method because equipment and materials are quite expensive.
2) Danger or accident is inherent.
3) It takes much of the students and the teachers' time

Field Trip

Field trip is an excursion taken outside the classroom for the purpose of making relevant observation and for obtaining some specific information. A well planned field trip affords the students the opportunity to become actively engaged in observing, collecting, classifying studying relationships and manipulating objectives.

Field trip is a very valuable method of teaching as it provides the most realistic means for the study of real things and real processes. It also affords the opportunity for meeting real people or experts in their actual environments, thus enabling the students gain first hand information. It also provides opportunities for them to see and if possible touch and feel what they have heard about. Field trips afford the students the opportunity of employing various senses in the process of learning. This makes topics or concepts and principles taught to become vivid thereby making retention easy.

Field trip can be undertaken to places like an industry, a tourist centre, botanical garden, and centers of social services like post office, water board etc. To utilize field trip as a method of teaching, the teacher should give consideration to whether the trip will:

1) Be of genuine interest to students;
2) Be suitable for their ages and class levels;
3) Be clearly relevant to curriculum goals and objectives; and
4) Fit naturally into the sequence of the students' work.

Advantages of Field Trip

1. It enables the students to have first hand experience of real things. Thus it is considered as providing learning experiences which cannot be brought into the classroom practically.
2. It tends to relate things studied in the classroom with actual activities outside the classroom (that is, the society or community). This makes class work or subject matter instruction more meaningful and enhances students' understanding of subject matter.
3. It affords valuable opportunities to development of interest in some careers.
4. It helps to arouse students' interest and increase their motivation to learn a subject and some other related subjects.
5. It exposes students to what aspect of subjects matter studied in class applies to everyday life.
6. It makes students much more imaginative and inquisitive observers.
7. It enables opportunities for students to interact with experts and this enhances learning.
8. Most field trip experiences make demand of all senses. This makes students to gain complete picture of the concept than from any other mode of teaching science.
9. Teacher-students relationship becomes more cordial and develops more intimately during field trip. This is because close relationship is required during field trip than is usually required by formal classroom and laboratory interactions.

Disadvantages of Field Trip

1. It is time consuming
2. It is difficult to plan and execute
3. There is danger of accident while going or returning from a field trip and even at field trip location.

4. It is not effective and feasible if a school has large number of students
5. It is expensive to execute as it creates extra financial burden both for the school and the students. This is because it involves cost in transportation and feeding.

Play way Method

This method was evolved on the basis that a child is naturally creative and not just receptive; and that self activity, play, freedom and experiences are important ways learners can learn at the same time.

Advantages of Play way Method

1) It leads to easy coverage of the syllabus or course outline
2) The method encourages the habit of listening and it also makes students develop the habit of writing fast.

Disadvantages of Play way Method

1) It is teacher-centered instead of learner-centred. The students are usually passive and eager to be spoon fed by the teacher.
2) It does recognize individual differences but does not cater for them.
3) It is a fast method of teaching and this places the slow learners at a disadvantage.
4) It is quite time consuming.
5) The method appears to recognize the teacher as an encyclopedia of knowledge.

Demonstration Method

Demonstration is a skill that can be learnt and taught. It involves showing by offering examples of how something works or the steps involved in a process. This method is often used in the sciences, technical and vocational subjects. For instance, one can show students how to set up and use an overhead projector with transparences or slides.

Advantages

1) It is an attention inducer and a powerful motivator especially when used to introduce a lesson (e.g. a lesson on use of projector).
2) With limited time and for a particular topic, demonstration saves time
3) It enables students retain concepts easily because what is demonstrated is not easily forgotten.
4) Demonstration actually allows the teacher to use activities that may be dangerous for students to carry out by themselves.
5) In the sciences, demonstrations by teachers are useful in showing how to use fragile or dangerous equipment so as to prevent breakage and accidents.

Disadvantages

1) It is not student-centered in that students are not given the opportunity to perform activities themselves.
2) Limited time is offered the students to become well acquainted with equipment and materials and also for observing and recording
3) In large classes, students often have difficulties in observing details of the subject demonstrated.

Peer Teaching Method

This is a method of teaching in which some students, the intelligent or good ones, teach their fellow student. In this method, students who will do the teaching are usually given specific topics to prepare and teach. They are thus placed in the position of teachers and hence they do some bit of research to get enough information based on specific objectives. When peer teaching takes place, the classroom teacher may be present to hear the teaching exercise.

Advantages of Peer Teaching Method

1) Students are highly motivated teaching their mates
2) The method has the potential of building self confidence and self assurance in the learners.
3) Students can search for information on their own and this tends to improve their oral communication.

Disadvantages of Peer Teaching Method

1) The class can turn rowdy if not well supervised role play method.
2) It may lead to a situation where the slow learners will develop an inferiority complex.

Role Play Method

The role play method usually involves the children or learners in dramatization of real life situation. It is a process in which problems are dealt with through action. Usually, a problem is identified, acted out, and discussed, with some learners playing roles and others observing. In classroom situation, if a problem area is buying and selling, then it can be role played by having some learners representing traders and other customers. The teacher provides money and various articles for the role playing exercise.

Advantages of Role Play Method

1. Lesson is made practical and real to life.
2. It promotes active learner participation i.e. learners are actively involved.
3. The method provides concrete experience to learners.
4. It helps learners to develop problem solving skills.

Disadvantages of Role Play Method

1. It usually takes time for the learner to get involved in role playing activities. Thus, it is time consuming and requires planning well.
2. The teacher's imagination, skill and organizational competence determine the success of the method.

Project Method

This is a method of teaching whereby learners are involved in a comprehensive study of certain topics. Project by definition refers to a task involving scale exercise given to students which they work on over an extended period of time. There are two main functions that a project may perform. This includes:

i. Help students to learn through problem solving; and
ii. Providing the teacher a basis for assessing students' learning originality and creativity.

Advantages of Project Method

1. It stimulates learning by doing.
2. It encourages discovery learning in children.
3. It makes learning real by presenting a real task for the learners to tackle.
4. The method helps to develop co-operative work attitude.
5. Creativity, freedom of expression and initiative are encouraged through project.
6. It enables students to discover information on their own.

Disadvantages of Project Method

1. The method requires a lot of preparation and it is time consuming.
2. It is not very appropriate for very young children.

3. It places much demand on the teacher in respect of initial preparation, monitoring and evaluation.
4. Some projects may involve much money.

Discovery Method

This is a method of teaching where the classroom teacher provides the learners with the necessary opportunities to discover new facts, new rules, or techniques of solving problems as well as new values for themselves. The discovery method is also called the 'Heuristic method'. This name, as it implies, is a method by which the pupils discover things for themselves. The method uses the fact that a pupil's own experience is the basis of real learning. It is an activity method where pupils are mentally active all the time.

Advantages of Discovery Method

1. The method equips the learner with a vital means of acquiring knowledge on his own through active participation, and develops his mind by using it to solve problems.
2. The method challenges the learners to find out information for himself; this makes instruction student-centered.
3. The method facilitates assimilation and retention of knowledge discovered by student themselves.
4. It helps students to develop manipulative skills as they come into contact with materials and apparatus.
5. Mental adventure, which this method encourages, is very rewarding.
6. It encourages analytic thought.

Disadvantages of Discovery Method

1. The method is slow and time-consuming.
2. The method cannot be used for a large class, in terms of number of students. This is because effective teacher supervision will be difficult to achieve.
3. It places considerable amount of burden on the students since it is student-centered.
4. The method has a very high financial implication; much fund is needed to buy equipment and materials needed in subject areas like Science and Home Economics.

Discussion Method

This is a type of activity which involves breaking the class into small groups for effective talk on a topic, a problem or an issue. It is a thinking together process in which pupils talk freely to the teacher. It is also a student-centered method since students participate actively. The role of the teacher is that of a moderator. There is flow of information from the teacher to the student as well as from students to students. The teacher should not allow individuals to dominate the discussion.

Advantages of Discussion Method

1. It stimulates exchange of ideas and encourages unity of purpose among pupils.
2. It develops leadership and followership skill as group members learn to control the discussion and listen to the opinions of others.
3. It offers encouragement to the shy students who may not be able to contribute to class activity.
4. It stimulates critical thinking.
5. It encourages every member of the class to participate.

6. It is a useful source of feedback to the teacher especially if discussion is formed around previous lesson taught.

Disadvantages of Discussion Method

1. Discussion could be dull if discussants do not have enough experience on the topic.
2. It may be dominated by a few students if not managed.
3. It is time consuming and if frequently used in a class, the possibility of covering the scheme of work will be remote.
4. If the discussion is too long, it could lead to restlessness and frustration on the part of the students.

2.16 Instructional Method in Integrated Science

The general principle underlying science teachings were initially ill-defined, partly because there were no experts to handle Integrated Science. Initially, nature studies and later moral science formed the only aspects of science that is known at this level. Therefore, Science was not one of the subjects formally examined at the Common Entrance Examination. The science teachers were then just teaching science in the best way they knew. The freedom of action to teach using any convenient and known method brought a lot of set backs to the understanding of science by the students.

The different approaches to the teaching of Science include:

a. Talk and chalk method
b. Traditional method
c. Demonstration method
d. Project method
e. Concept approach

f. Telling stories

g. Games method

h. Process approach

Traditional Method

This is a method adopted in many parts of the world. A syllabus is made which lists a large number of scientific topics. These topics are often arranged according to terms or years. The teachers rigidly follow these topics with the aim of teaching through the topics and cover the syllabus. This approach has laid down steps so there is no room for many activities that can make science course interesting.

Science activities are supposed to involve all the students and to make science a lively and doing subject. This approach relies to a large extent on the learning of facts and acceptance of this is proven beyond all doubts. Very little questioning and freedom of thought were allowed and discovery learning was almost unheard of. It has been discovered that, for scientific knowledge to be broaden, children of science at all levels have to be allowed to ask questions. "Why is this happening"? "What caused it"? "Will it happen again"? These are the type of questions expected to be asked by students.

Scientific theories are based on experiment but some of these theories which the early scientists could not explain have been verified. Newton's law of motion did say that the sun revolves around the earth but in the last century, scientists began to get results from experiments that could not be explained by Newton's laws. Einstein explained his result in the Theory of Relativity and later scientists have done experiments and the findings could not be explained again by Einstein's law of relatively.

The traditional approach lay so much emphasis on writing notes on discoveries made by scientists several years back. The approach is based on the assumption that children were preparing for an exam in order to satisfy their curiosity and interest in science as well. In teaching therefore, teachers should try as much as possible to avoid lecturing children; they should also try to keep note taking about things which the children cannot see, touch, hear or smell to a minimum.

Advantages

1. The teacher knows how far he has gone in teaching the syllabus since the syllabus is written out topic by topic.
2. No equipment may be needed because the teacher simply tells the children the fact. It therefore presents science in a cheaper way.
3. The children are able to know a number of facts at the end of the course.

Disadvantages

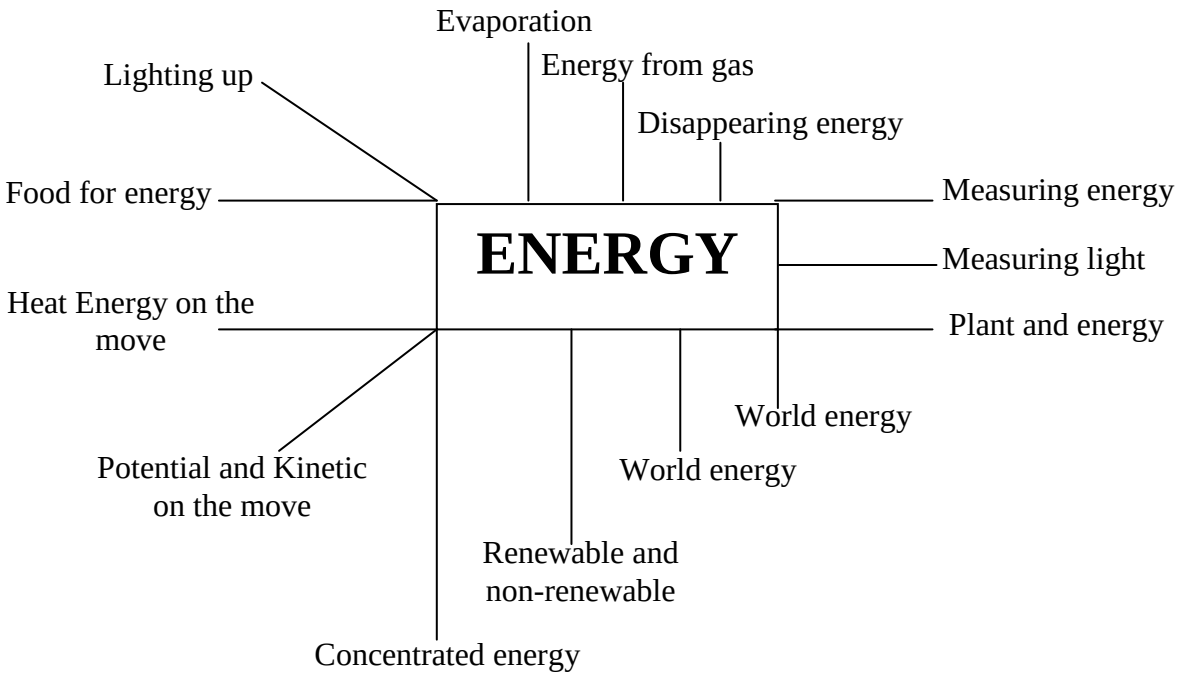
1. A syllabus built on this method stresses the recall of information and students tend to forget things very easily. It eliminates learning by doing.
2. Teachers think that they have to cover the syllabus; therefore, they rush through the topics.

Project Method

In project method, a central theme is chosen, like exploring the environment or seed germination or energy. In energy, there are about eleven sub-themes.

- Evaporation and condensation
- Food for energy
- Heat energy on the move
- Measuring energy in fuels

- Measuring light energy
- Plant and energy
- Renewable and non-renewable energy
- Up and down (concentrated energy)
- World energy sources



To teach science by means of the project approach requires very careful planning. The problem involved in this approach is the organization and control of students to achieve meaningful learning. Objectives and steps that students should follow should be outlined; it is suggested that project method should be employed in the higher classes of JSS. This method is employed by science teachers to meet individual differences in pupils.

Project work requires, to a certain extent, a bit of inquiry so that pupils are given the opportunity to look for problems which are of special interest to them, and answers to the

problems which must also be unknown to the students. Topics for the project work are obtained from many sources including:

1. Interaction with their colleagues.
2. Reading scientific journals.
3. Abstract from papers by scientists and reports on science seminars and workshops.
4. Classroom experience on a particular topic.
5. Science textbooks, field trips and visits to museum and zoos. This helps students to benefit immensely both socially and intellectually.

Advantages

1. The approach tends to be child-centered. This means that the child's natural interests are considered.
2. It is said that because a child follows his own interest, he will learn better.
3. The approach allows easy integration with other subjects.

Disadvantage

1. A teacher has to be exceptionally skilled to teach in this way. It is not easy to organize a large class of pupils so that they will all follow during useful projects.

2.17 The Concept of Approach

Concepts are ideas concerning all kinds of classes and relationships. In building up concepts, a child has to recognize the properties of objects which make them similar to or distinguishable from other objects. So in building up the concept of cockroach, a child will slowly learn to recognize that all animals possessing certain properties are given a particular label.

This is an example of a concept relating to a concrete, physical object. However, in science, we are often concerned with abstract concepts such as weight, area, proportion, or energy. These kinds of concept development are slower than those relating to concrete objects. A child, for instance, only gradually builds up his idea of what is meant by weight. In teaching, weight for example, an introduction to mass will bring confusion to any primary school pupil. Therefore, concept can be introduced and developed step by step, during the later years. Such approach is referred to as a spiral curriculum. The concept that is introduced is examined and re-examined as the children's thinking develops and as they become capable of understanding the more difficult aspects of the concept.

Advantages

1. Concepts can be dealt with spirally, that is to say, an idea can be considered in greater depth as the child gets older.
2. The subject matter of science can be grouped more logically than topics chosen at random.
3. Concepts change more slowly that the detailed subject matter of science.

Disadvantages

1. Many teachers now believe that science should be seen as a whole, the word "integrated" is often used.
2. Even though concepts change slowly, processes do not change.

The Demonstration Method

The method is used when the materials for teaching or performing activities are in short supply. It is also used when the materials are of volatile nature or when the safety of the learners is taken into consideration. The learners are to be shown the activity in front of the class. The

demonstration can either be performed solely by the teacher with the assistance of some selected learners (one or two students). Demonstration can either by a live-talk or live-silent one or one in which films or taped materials are made use of.

Discussion Method

The method involves the discussion of a science topic, issue or concept by groups of pupils or the entire classroom. The discussion method could be teacher centered, task-centered or learner centered. In approach, the teacher merely moderates the discussion as if it were a debating session. This kind of method is particularly useful where science topics that have special significance for the day-to-day occurrence in the society are being taught. It is equally helpful when results of science activities are being discussed. The level of learners that can benefit from this method will be from the upper primary.

Discovery Method

The method arose out of the recent works of Armstrong and others, as well as some psychologists notably Jerome Brunner and Robert Gagde. The proponents of this approach believe that it is mainly through the exercise of problem solving and effort leading to discovery that students learn about scientific concepts. Two basic requirements necessary for the successful use of this approach are:

1. The provision of a suitable broad amount of background information.
2. The provision of a well-structured procedure for the students to follow.

The discovery approach helps to develop in the students an interest in observation (as a positive attitude to inquiry) and skills of experimenting, investigating and data gathering.

Chalk and Talk Method

This method consists of two approaches, the first approach is the oral (lecture) in which the teacher does most of the talking and uses the chalkboard sparingly while the learners remain passive listeners. This is often called the chalk and talk method. The other approach involves the use of textbooks, science fiction, science magazines etc to teach a concept usually in place of learner teacher interaction. Learners merely read and in most cases commit to memory without proper understanding of what they are supposed to be learning. Although this method enables the teacher to cover a good part of the syllabus within a short period, students cannot meaningfully learn science in this way. The students succeed in learning by note, but will often miss the essential parts of science teaching especially those on how scientists work.

Telling Stories

Children like to listen to interesting stories. Stories can be used in science to convey ideas and concepts and to teach how they are communicating; communication is an important scientific process. Telling a story is a good way of catching children's attention. However, in telling stories the following points must be considered.

1. Make sure that the story has a scientific message which the child can understand and it should be relevant to the rest of the lesson.
2. The point of the story must be understood.
3. Make sure that the children are comfortable and can see the story teller.
4. Make a chart or charts to illustrate the story if necessary. It may take some time but charts could always be re-used.

Games Method

There are certain scientific processes in games. These include:

1. a) Observation game (which includes spy) e.g. a child may lead and keep an object from other students. He then goes ahead to say he spies a little object which name starts with 'g,' others will respond until "grape" is mentioned.

   b) Sound Around: The children sit quietly and listen to all the sounds they can hear and later on write them down. The teacher has to assist them if they cannot readily get the answer.

2. a) Leaf matching: as the name suggests, leaf matching means matching leaves from different trees. These leaves will be given to the learners and the first child that comes with a complete leaf is the winner.

   b) Property matching like shapes and colours. To play this game at least two sets of the property (in pieces) are needed.

3. Counting Games: There are many counting games like pick-a-match marbles, hide it in the problem bag boxes and tins, etc. In the marble games, children make small clay beads. They use a chalk to draw a ring. Inside the ring one uses a large clay ball to knock as many of the small clay beads out. The child who knocks out most is the winner.

4. Shadow Games: Shadow games are useful resources for teaching science to young children. They can help to develop children's ideas of space and time.

5. Sink and Float Game: A bottle can be made to float when placed gently on the surface of water. Children can then put buttons into the bottle top until it sinks. The student that puts the largest number of buttons before it sinks is the winner.

A game often, but not always, introduces competition. There are advantages and disadvantages in this. But mostly, children enjoy games. A game adds to the interest of a lesson. Games usually have rules and as children grow up they like to learn these rules and keep them.

You can often teach a game in your science lesson. The children can then play the games in their lesson or break periods. The following points should be considered about games:

1. They should be simple to play.
2. They should be enjoyable for the children.
3. They should have simple rules.
4. The scientific processes in the games should be taught of.

The researcher suggests that of all the methods used in teaching and learning of Integrated Science, the laboratory/experimental method is the best method to be used in the teaching and learning of Integrated Science in the Junior Secondary School level. This is because individual students are given the chance to carry out their activities involved in the teaching and learning process of the content or subject matter.

2.18 Review of Empirical Studies

This chapter will not close without a review of related studies conducted in the area of this research, as this will throw more light on the phenomenon under study. Below is the review.

Oludipe and Daniel (2009) in their study on Nigerian Science Teachers' view of Integrated Science and those of students in Integrated Science major and non-integrated science. In the study, 187 student-teachers who enrolled in a university of education in Southwest Nigeria who studied Integrated Science at the Junior Secondary School (JSS) level and offered Physics, Chemistry and Biology at 100 and 200 levels in the university were used. The findings of the study revealed that, contrary to generally held opinion about non-integrated science, majority of

the participants held cohesive view of Integrated Science, while gender was also found not to affect their views about Integrated Science. This study is relevant to the current research because the participants/respondents used by the research are similar to those used by the current research.

Oludipe and Daniel (2010) in their study on the effect of constructivist based teaching strategy on academic performance of students in Integrated Science at the junior secondary school level revealed that the strategy enhanced students' academic performance. In view of this, the study examined the effectiveness of constructivist based teaching on academic performance in Integrated Science by junior secondary school students in Southwest Nigeria. Quasi-experimental research design was used to achieve the purpose of the study. Participants consisted of 120 Junior Secondary School students, randomly selected from four out of the 25 co-educational Junior Secondary School in Ijebu Ode Local Government Area of Ogun State, Southwest Nigeria. The findings revealed that constructivist instructed students had higher scores on the post-test compared to those exposed to conventional (lecture) method of teaching. The research concluded that if Integrated Science teachers could incorporate constructivist based teaching strategy into their teaching methods, there would be improvement in academic performance of Junior Secondary Schools students, in integrated science. Finally, the researchers recommended that Integrated Science teachers should incorporate constructivist based teaching strategy in their methods of teaching. The research is relevant to the present study because it deals with the appropriate method to be used in teaching/learning process of Integrated Science which is the concern of the present research work.

Edokpayi, (2011) in another study revealed that the academic achievement of students in Integrated Science in Junior Secondary School Certificate Examination (JSCE) was a poor

predicator of later achievement in Chemistry at the Senior Secondary School Certificate Examination (SSCE). It was recommended that more qualified and competent teachers should be trained and employed to teach Integrated Science in Junior Secondary Schools and classroom teachers should try as much as possible to relate the concept of Integrated Science to Chemistry and other basic sciences. The study is also important and relevant to this research work because it was on Integrated Science students' achievement as a predicator of their later achievement in Chemistry and other basic sciences. Furthermore, Integrated Science is the bed rock of other related science subjects in Science Education.

The 1982 paper was written near the end of the past two decades, a time when the Piagetian Theory (Karplus, 1977) had served as a principal model for interpreting the nature of science-learning and for developing science teaching strategies and curriculum implementation. In reviewing the literature, Hofstein and Lunetta (1982) said that it was difficult to identify a simple relationship between students' science achievement and their work with materials in the laboratory. During the 1980s, the centrality of Piagetian models diminished and attention was increasingly focused on a developing constructivist view of learning.

Several studies had shown that students and their teacher were preoccupied with technical and manipulative details which consumed most of their time and energy. Such preoccupation seriously limits the time they can devote to meaningful, conceptually driven inquiry. In support of this, Woolnough (1991) wrote that the potential contribution of laboratory experiences to assist students in constructing powerful concepts has generally been much more limited than it could have been. Such comments have often been made throughout the past 20 years.

Tobin (1990) wrote that "laboratory activities appear as a way of allowing students to learn with understanding and, at the same time, engage in a process of constructing knowledge

by studying science" (p. 405). This important assertion may be valid, but current research also suggests that helping students achieve desired learning outcomes is a very complex process.

According to Gunstone (1991), using the laboratory to have students restructure their knowledge may seem reasonable but this idea is also naïve since developing scientific ideas from practical experiences is a very complex process. Earlier, Gunstone and Champagne (1990) had suggested that meaningful learning in the laboratory situation occurs if students are given sufficient time and opportunities for interaction and reflection. Gunstone further said that students generally did not have time or opportunity to interact and reflect on central ideas in the laboratory since they were usually involved in technical activities with few opportunities to express their interpretation and beliefs about the meaning of their inquiry. In other words, they normally had few opportunities to carry out cognitive activities. Baird (1990) suggested that these meta-cognitive skills are "learning outcomes associated with certain actions taken consciously by the learner during a specific learning episode" (p. 184). Meta-cognition involves elaboration and application of one's learning, which can result in enhanced understanding.

Gunstone concluded by saying, the challenge is to help learners take control of their own learning in the search for understanding. In the process, it is vital to provide opportunities that encourage learners to ask questions, suggest hypotheses, and design invigorations – "Minds-on as well as hands-on". There is a need to provide students with frequent opportunities for feedback, reflection, and modification of their ideas (Barron et al., 1998). As Tobin (1990) and Polman (1999) have noted, in general, research has not provided evidence that such opportunities exist in most schools in the United States, or, for that matter, in other countries.

A constructivist model currently serves as a theoretical organizer for many science educators who are trying to understand cognition in science (Lunetta, 1998) i.e. learners

construct their ideas and understanding on the basis of series of personal experiences. Learning is an active, interpretative, interactive process (Tobin, 1990). Moreover, there is a growing sense that learning is contextualized and that learners construct knowledge by solving genuine and meaningful problems (Brown, Collins, and Duguid, 1989; Polman, 1999; Roth, 1995; Wenger, 1998 and Williams and Hmelo, 1998). Experiences in the school laboratory can provide such opportunities for students if the expectations of teachers enable them to engage intellectually with meaningful investigative experiences upon which they can construct scientific concepts within a community of learners in their classroom (Polman, 1999).

A social constructivist framework has special potential for guiding teaching laboratory. Millar and Driver (1987) were among those who recommended the use of extended reflective investigation to promote the construction of more meaningful scientific concepts based upon the unique knowledge brought to the science classroom by individual learners. The assumption is that when students interact with problems that they perceive to be meaningful and connected to their experiences; and when teachers are guided by what they know about learning, the students can begin to develop more scientific concepts in dialogue with peer investigators.

Research has also suggested that while laboratory investigations offer important opportunities to connect science concepts and theories discussed in the classroom and in textbooks with observations of phenomena and system, laboratory inquiry alone is not sufficient to enable students to construct the complex conceptual understanding of the contemporary scientific community. “If students’ understanding is to be changed towards those of accepted science, then intervention and negotiation with an authority, usually a teacher, is essential” (Driver, 1995). Van Der Berg, Katu, and Lunetta (1994) reported that hands-on activities with introductory electricity material in clinical studies with individual students, facilitated their

understanding of relationships among circuit elements as variables. The activities provided clear tests of the validity of the subject's ideas. Frequently, they led to cognitive conflict. However, the carefully selected practical activities alone were not sufficient to enable the subject to develop a fully scientific model of a circuit system.

The findings suggested that greater engagement with conceptual organizers such as analogies and concept maps could have resulted in the development of more scientific concepts in basic electricity. Dupin and Joshua (1987) have reported similar findings. When laboratory experiences are integrated with other meta-cognitive learning experiences such as "predict-explain-observe" demonstrations, etc (White and Gunstone, 1992); and when they incorporate the manipulation of ideas instead of simple materials and procedures, they can promote the learning of science.

Pursuing that theme in designing project based science; and connecting learners through guided inquiry, Polman (1999) conducted an extended case study of a teacher who created a collaborative learning community and provided his high school students with opportunities to "learn by doing" authentic science in a science classroom. The teacher was guided by constructivist pedagogy giving special attention to collaborative visualization. Polman's analysis provided detailed information about the teacher's strategies and behaviors while implementing a project-based science model. Polman discussed the teacher's efforts to organize the support his students in various stage of inquiry learning would need, such as in asking researchable questions and in gathering, analyzing and presenting data to construct and justify scientific response to those questions.

Polman also discussed the difficulty and complexity of changing practices by describing conflicts that emerged when the teacher, who was the subject of the study, challenged

conventional approaches to teaching and learning science. He demonstrated how the structural and cultural realities of the school complicated the enactment of pedagogical innovation in general and the project based science model, in particular. Polman suggested that teachers who wish to foster science learning through projects and inquiry must play a complex role in discourse with their students.

While there have been substantial developments in scholarship that can guide the development of teaching and curriculum, scholarship has had only marginal impact on schools (Williams and Hmelo, 1998:266).

Although several decades of research have given a strong theoretical basis about the nature of learning and the value of problem-based methods, this information has had relatively small impact on education practices. It is not known, as yet, whether a widely accepted theory of instruction or carefully thought out manageable methods of implementation consistent with constructivist theory is available.

To acquire a more valid understanding of these important issues, science educators need to conduct more intensive, focused research to examine the effects of special school laboratory experiences and associated contexts on students' learning. The research should examine the teachers' and students' views of purpose, teacher and student behaviour, and the resulting views and understandings (conceptual and procedural) that the students construct. Research and development project like those conducted by Polman (1999) and Krajcik et al. (2000) offer examples of what is needed.

2.19 Summary

The study examined the assessment of the implementation of Integrated Science curriculum in Junior Secondary Schools in Kaduna State. The researcher reviewed the following concepts in relation to the study; theoretical framework, curriculum implementation, models of curriculum implementation, the role of teachers in curriculum implementation, the role of students in curriculum implementation, determinants of curriculum development, concept of Integrated Science, objectives of Integrated Science, the emergence of Integrated Science, the philosophy of Integrated Science, General Science versus Integrated Science, the supply and qualification of Integrated Science teachers, teachers expectations and behaviors, criteria for the selection of instructional methods, instructional methods in Integrated Science, review of empirical studies and summary of the chapter.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter, as in any other research work, explains the method adopted in the research. The sequence of the presentation are: the research design, the population of the study, the sample and sampling procedure, the research instrumentation, validity and liability of the instrument and finally, the method of data analysis.

3.2 Research Design

The research designed adopted in this study was the survey method. The above has been useful in assessing teachers' views on the effectiveness of teaching and learning of Integrated Science in Junior Secondary School level in Kaduna State. The survey research design according to Welberge and Bowen (1977) is appropriate for any study that involves a large population of respondents.

3.3 Population of the Study

The target population of the study covers all the Integrated Science teachers of the study area totaling one hundred and fifty teachers, spread across fifty five (55) public junior secondary schools and sixty three (63) private junior secondary schools in Kaduna State. It is important to note that the choice of this target population for the research is purposive. This is because they constitute a better source for obtaining the necessary and accurate data needed for the research.

3.4 Sample and Sampling Techniques

A sample of one hundred and fifty Integrated Science and other science teachers (Biology, Chemistry and Physics) were selected. There are one hundred and fourteen (114) female teachers (76%) and thirty six (36) male teachers representing 24%. The researcher used

simple random techniques of balloting to select the respondents. The researcher thus used the stratified random technique of balloting in order to give male and female teachers equal chance of being selected as samples. Therefore, a sample of one hundred and fifty (150) Integrated Science teachers were selected bearing in mind Morgan and Krejie (1971) table for determining sample size for a given population.

3.5 Instruments used in Data Collection

The research instrument for this study was a questionnaire. Akande (2001) defines a questionnaire as "a self reporting research method used in writing highly structured items or questions". Ogunleye (2001) defines it as "an instrument used for getting answers to a set of questions by using a format which the respondents fills by himself". Hence, one set of questionnaire was developed and used for this study titled "Questionnaire for Views of Teachers on the Effectiveness of Teaching and Learning Integrated Science at the Junior Secondary School level in Kaduna State".

The questionnaire was structured into two parts, section one (A) solicited for biographical or personal information of respondents, while section two (B) had items on the views of teachers on the effectiveness of teaching and learning Integrated Science subject in Kaduna State. The questionnaire covered objectives of Integrated Science, qualification of Integrated Science teachers, Integrated Science resources, methods of teaching Integrated Science and evaluation process used to determine the achievement of students.

Responses to the items on the questionnaire were on four (4) point Likert Scale of Strongly Agree (SA) 4, Agree (A) 3, Disagree (D) 2, Strongly Disagree (SD) 1. The respondents were expected to choose one of the options.

3.6.1 Validity of the Instrument

After constructing the questionnaire, it was subjected to several stages of scrutiny to ensure that the instrument measured what it was supposed to measure. For example, the items were scrutinized by experts in the field of Integrated Science evaluation and measurement, and curriculum and instruction. The items were then taken to the researcher's supervisors who made some recommendations for adjustments. They were further taken to a statistician for vetting before the final draft was made. The decision of the researcher to employ experts was based on the remarks of Kerlingers (1973) and Bodunde (2004), that validation by specialists is an effective method of content validation of research instruments.

3.6.2 Pilot Study and Reliability Test

To test for reliability, the researcher conducted a pilot test in some Junior Secondary Schools in Giwa Local Government Area of Kaduna State. The pilot test involved the administration of the instrument to twenty (20) randomly selected Integrated Science teachers from both public and private schools to establish its reliability. The sample used for the test was exempted from the main study. The test and retest method was used to establish a reliability coefficient of 0.55 and the result remained the same even now.

3.7 Method of Data Analysis

The rating scale of the items on the questionnaire was done by assigning numerical values as follows SA = 4 points, A = 3 points, D = 2 points, SA = 1 point. The simple percentage was used to analyze the bio-data, while the statistical mean was used to answer the research questions. The following formula was used to calculate the mean score.

$x = \frac{\Sigma fx}{N}$ $where\ x\ means\ "means",$

$\Sigma = summation, F = frequency\ and$

$x = variables\ of\ the\ study\ and\ n = sample\ size.$

The decision rule was 3.0 cut off point.

The hypotheses were tested using t-test to test level of significant difference. The null hypotheses were rejected or retained at 0.05 level of significance.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION OF RESULTS

4.1 Introduction

This study titled "Assessment of Implementation of the Integrated Science Curriculum in JSS in Kaduna State" was conducted using one hundred and fifty (150) teachers as respondents. Out of the 150 Integrated Science teachers served with the questionnaire, only 130 returned their questionnaire representing 86.67%. The analyses were presented under descriptive analysis and the research hypotheses were tested at 0.05 level of significance.

Demographic Data

Table 1: Distribution of Respondents by Location

Location	Frequency	Percentage
Urban	90	69.2%
Rural	40	30.8%
Total	130	100%

From Table 1, the result shows that 90 of the respondents representing 69.2% were drawn from urban areas while 40 others representing 30.8% were from rural areas.

Table 2: Distribution of Respondents by Teaching Qualification

Education Qualification	Frequency	Percentage
NCE	60	46.2%
B.Ed	30	23.1%
B.Sc	40	30.8%
Total	130	100%

Table 2 is on the educational qualification of the respondents. The table showed that 60 (46.2%) of the respondents have NCE, 30 (23.12%) are B.Ed holders while the remaining 40 (30.8%) have B.Sc degree.

Table 3: Distribution of Respondents by Teaching Experience

Teaching Experience	Frequency	Percentage
1-3 years	20	15.4%
4-7 years	20	15.4%
8-12 years	40	30.8%
13-17 years	5	3.8%
Above 17 years	45	34.6%
Total	130	100%

Table 3 is on the teaching experience of respondents. Result showed that 20 respondents representing 15.4% , and another 20 respondents representing 15.4% have 1-3 years or 4-7 years teaching experience respectively; while 40 others representing 30.8% have between 8-12 years working experience. There are 5 others representing 3.8% who have between 13-17 years. The majority of respondents, 45 representing 34.6% have a teaching experience of 17 years and above.

4.2 Answering of Research Questions

Research Question 1: To what extent are the objectives of Integrated Science curriculum being achieved by teachers in junior secondary schools in Kaduna State?

Table 4: Level of Achievement of Lesson Objectives of Integrated Science Curriculum in Junior Secondary Schools Levels

S/No	Teachers' views on the achievement of objectives of Integrated Science in junior secondary schools	Response Categories				Mean	S.D	S.E
		SA	A	D	SD			
1.	Teacher's views of Integrated Science influences his/her statement of objectives	50	10	25	45	2.5000	1.31332	.11519
2.	Effective and psychomotor objectives have been neglected mostly due to wrong views of teachers of Integrated Science	60	15	25	30	2.8011	1.24574	.10926
3.	Science disciplines constitute the most important base from which Integrated Science draws its content due to teachers view	55	25	10	40	2.7308	1.29273	.11338
4.	Integrated approach to Integrated Science opens vast areas of significant learning structure for students in order to achieve more knowledge on science education	70	5	30	40	2.9231	1.24275	.10900
5.	Without thorough views of Integrated Science content, the teacher cannot successfully carry out instruction in order to attain significant learning of Integrated Science	80	10	20	25	3.1538	1.77111	.10271
6.	The content of Integrated Science is better organized in a spiral form	65	13	10	40	2.8077	1.33583	.11716

It is shown from table 4 above that the level of achievement of the objectives of Integrated Science curriculum in junior secondary school in Kaduna State is very low as the highest mean response of 3.1958 was an indication that the lesson objectives are not fully achieved in relation to the content of the subject matter in junior secondary schools.

The second highest mean response of 2.9321 was that teachers are not fully supervised for proper implementation of the objectives and thus, do not use integrated approach to teaching of Integrated Science in junior secondary schools.

The third highest mean on this item, 2.8077 is for teachers' views as expressed by them, showing that the affective and psychomotor domain of lesson objectives are being neglected by teachers of Integrated Science and that contents of Integrated Science are better organized in a spiral form respectively.

The fourth highest mean response of 2.500 showed that teachers' statement of objectives were sometimes vague and ambiguous.

Research Question 2: How appropriate are the assessment techniques of the urban and rural school teachers in the Integrated Science curriculum implementation in junior secondary schools in Kaduna State?

Table 5: Opinion of Urban and Rural Teachers about the Assessment Techniques used in the Implementation of Integrated Science Curriculum

S/No	Opinion on the assessment techniques of the Urban and Rural School Teachers in the Integrated Science Curriculum Implementation in junior Secondary Schools	Response Categories				Mean	S.D	S.E
		SA	A	D	SD			
1.	It is important that the teacher determines his/her methods of evaluation at the same time as he/she establishes objectives and teaching procedures	62	15	23	30	2.8385	1.25014	.10964
2.	If a teacher waits until the end of a topic to evaluate, it may be almost impossible to re-teach effectively work that needs to be repeated	55	20	15	40	2.6923	1.29905	.11393
3.	If a teacher uses only a few instruments to perform evaluation, some of the skills,	68	12	20	30	2.9077	1.26642	.11107

	attitudes and knowledge may not be appraised							
4.	Constant evaluation should be made to ensure that the teacher can make necessary adjustment to the goals and teaching procedures	80	10	20	20	3.1538	1.17111	.10271
5.	Integrated Science has the potentials for preparing students for scientific knowledge in their lives	70	10	20	30	2.9231	1.27356	.11170
6.	It is the responsibility of the school tom teach the learner the rules and regulations governing sciences	30	12	3	85	1.9000	1.29309	.11431

Table 5 above revealed the responses of urban and rural teachers on the appropriate assessment techniques being employed by teachers in the teaching and learning of Integrated Science in junior secondary schools. The table showed that the highest mean responses are 3.1538 and 2.9923 respectively. The average means responses were 2.9077 and 2.8385 respectively showing that 77 and 80 agreed with the items while 53 and 50 disagreed respectively with the items.

Research Question 3: What is the relationship between teachers' qualification/training and the level of implementation of Integrated Science curriculum in junior secondary schools in Kaduna State?

Table 6: Relationship between Teachers' Qualification/Training and the Level of Implementation of Integrated Science Curriculum in Junior Secondary Schools

S/No	Relationship between teachers' qualification/training and the level of implementation of the Integrated Science curriculum in junior secondary school	**Response Categories**				**Mean**	**S.D**	**S.E**
		SA	**A**	**D**	**SD**			
1.	Teachers of Integrated Science who are opportuned to attend training and workshops perform better in class teaching	90	10	2	28	3.8154	1.26849	.11125

	in junior secondary school							
2.	Well qualified teachers are normally recruited to teach Integrated Science in junior secondary school	80	5	15	30	3.0385	1.29042	.11318
3.	Teachers cannot improvise instructional materials due to lack of professional competence in Integrated Science in junior secondary school	70	10	20	30	3.0000	1.26990	.11138
4.	Most of the teachers in Integrated Science are not qualified to implement the curriculum in junior secondary school	61	19	20	30	2.8769	1.18125	.10360

From the result of table 6 above, the highest mean response of 3.8154 showed that teachers who were opportuned to attend training and workshops performed better in class teaching as 100 of the respondents agreed to the item while 30 of the remaining respondents disagreed to this assertion. The second highest response of 3.0315 on the qualification/training and level of implementation of Integrated Science curriculum were those who believe that well qualified teachers are normally recruited to teach the subject as details revealed that 85 respondents agreed to the statement, while 45 of the remaining responses with a mean 3.0000 showed that teachers cannot improvise instructional materials due to lack of professional training. On competence in Integrated Science, the result showed that 80 respondents agreed to this item while 50 of the remaining disagreed. The last mean response of 2.8769 also showed that most teachers of Integrated Science are not qualified to implement the curriculum of junior secondary schools as indicated by respondents who agreed while 50 of the remaining respondents disagreed.

Research Question 4: How adequate are the methods and techniques used by Integrated Science teachers for lesson delivery in junior secondary schools in Kaduna State?

Table 7: Methods of Teaching/Techniques used by the Teachers in the Implementation of Integrated Science Curriculum in Junior Secondary Schools

S/No	Adequacy of methods and techniques used by Integrated Science teachers for lesson delivery in junior secondary school	Response Categories				Mean	S.D	S.E
		SA	A	D	SD			
1.	Teacher's views of Integrated Science influences his choice of strategy to be used when teaching	65	10	25	30	2.8462	1.26652	.11108
2.	It is important for the teacher to change his/her techniques and methods as the topic changes for acquisition of more knowledge in Integrated Science	68	2	25	35	2.7923	1.32768	.11645
3.	To transmit knowledge, concepts, skills, values and attitudes for integrated science, all the following strategies are suitable at the junior secondary school level	50	25	25	30	2.7308	1.19941	.10520
4.	For the teacher to adopt the appropriate method of teaching Integrated Science he/she should be conversant with intended goals and objectives	90	10	5	25	3.2692	1.19941	.10520
5.	Values and attitudes of learning Integrated Science appear generally difficult to measure due to negative views of Integrated Science by the teacher	35	15	20	60	2.1923	1.27648	.11195

Table 7 above showed that the highest mean score on the item is 3.2692 which indicate that 100 respondents agreed while 30 respondents disagreed. It is believed that for a teacher to adopt the appropriate methods for the implementation of Integrated Science curriculum, he/she should be conversant with the intended goals and objectives of the subject. The second highest mean response of 2.8462 on teachers' views of the influence of Integrated Science on a teacher's choice of strategy to be used when implementing the curriculum revealed that 75 respondents agreed with the item while 55 respondents disagreed with the assertion of the study. The third mean response of 2.7923 showed that it is important for teachers to change their techniques and methods as the topic changes for acquisition of more knowledge in Integrated Science. Details showed that 70 respondents agreed while the remaining 60 respondents disagreed with the item. The fourth mean response of 2.7308 indicated that to transmit concepts, skills, values and attitudes in Integrated Science, laboratory method/strategy is most appropriate in the junior secondary schools. Hence 75 respondents agreed while 55 of the remaining respondents disagreed with the item.

However, some of the respondents believed that values and attitudes of learning Integrated Science appear generally difficult to measure due to negative views by Integrated Science teachers. Hence, 50 respondents reacted positively while the remaining 80 respondents showed a negative attitude and reacted negatively to the items.

4.3 Testing of Research Hypotheses

Hypothesis One: This null hypothesis states that there is no significant difference in the opinion of teachers with regards to the achievement of Integrated Science curriculum objectives at the junior secondary school level in Kaduna State.

Table 8: Opinion of teachers with regards to the achievement of Integrated Science curriculum objectives at the junior secondary schools

	Sex	N	Mean	S.D	S.E	Df	t-cal	t-cri	Sig (p)
Views of teachers on the teaching of Integrated Science at JSS	Male	30	55.2000	25.703	4.692	128	1.44	19	.150
	Female	100	62.9000	25.518	2.551				

Details of the independent t-test statistics showed that there is no significant difference between male and female teachers in the level of achievement of Integrated Science curriculum objectives in junior secondary schools.

This is because the t-calculated value of 1.44 is less than the t-critical value of 1.96 while the calculated sig (p) value of .150 is greater than the 0.05 level of tolerance.

Therefore, the null hypothesis is hereby accepted and retained.

Hypothesis 2: The null hypothesis states that there is no significant difference in the opinion of urban and rural teachers on the assessment techniques used in the implementation of Integrated Science curriculum in junior secondary schools in Kaduna State.

Table 9: Opinion of urban and rural teachers in the assessment techniques used in the implementation of Integrated Science curriculum in junior secondary schools

	Location	N	Mean	S.D	S.E	Df	t-cal	t-cri	Sig (p)
Views of teachers on the teaching of Integrated Science at JSS	Urban	90	69.3333	25.816	2.72126	128	0.218	1.96	.066
	Rural	40	42.650	12.365	1.955				

The independent t-test statistic showed that there is no significant difference between urban and rural teachers in their evaluation strategies in the teaching and learning of Integrated Science in JSS. This is because the calculated t-value of 0.218 is less than 1.96 of critical while calculated significance (p) value of 0.066 is grater than 0.05 level of tolerance. Hence the null hypothesis is accepted and retained.

Hypothesis 3: The null hypothesis states that there is no significant relationship between teacher's qualification and level of implementation of Integrated Science curriculum in junior secondary schools.

Table 10a: Analysis of Variance (ANOVA) on the teaching of Integrated Science on account of their academic qualification

Variation	Sum of squares	Df	Mean squares	F	Sig. (p)
Between groups	72391.606	2	36195.805	364.703	
Within groups	12604.425	127	99.247		.000
Total	84996.031	129			

Result in table 10a on the analysis of variance (ANOVA) shows that, there is no significant difference among the teachers of Integrated Science on account of their teaching

qualifications. This is because the calculated sig (p) value of 0.000 is less than the 0.05 level of tolerance. Hence, the null hypothesis is hereby accepted.

Table 10b: Post-Hoc multiple comparison test on the differences among respondents on account of their qualification

(I) Teaching Qualification	(J) Teaching Qualification	Mean Difference (I-J)	Std. Error	Sig.
NCE	B.ED	-52.05000*	2.22764	0.000
	B.Sc	-42.99167*	2.03355	0.000
B.ED	NCE	52.05000*	2.22764	0.000
	B.Sc	9.05853	2.40612	0.000
B.Sc	NCE	42.99167*	2.03355	0.000
	B.ED	-9.05833*	2.40912	0.000

** The mean difference is significant at the 0.05 level*

According to the above table, significant difference exists between NCE teachers and B.ED teachers and between NCE and B.Sc teachers in their views on the teaching of Integrated Science in junior secondary schools in favour of NCE and B.ED.

Also, significant difference exists between B.ED and NCE and between B.ED and B.Sc teachers on their views on the teaching of Integrated Science in junior secondary schools in favour of NCE and B.ED.

There was also significant different exists between B.Sc and B.ED teachers' views on the teaching of Integrated Science in junior secondary schools in favour of B.ED.

Hypothesis 4: This null hypothesis states that there is no significant difference in the method of teaching/techniques used by teachers in the implementation of Integrated Science curriculum in junior secondary schools in Kaduna State.

Table 11: Difference in the methods of teaching/techniques used by the teachers in the implementation of Integrated Science curriculum in junior secondary schools

Variation	Sum of squares	Df	Mean squares	F	Sig. (p)
Between groups	78485.831	4	19621	376.745	.068
Within groups	6510.200	125	52.082		.000
Total	**84996.031**	**129**			

From the above analysis of variance statistics as in the table above, result indicates that there is no significant difference among the respondents in their views of the teaching methods/techniques used by teachers in the implementation of the curriculum on account of their views of teaching methods/techniques. This is because the calculated p (Sig) value of 0.068 is less than the alpha level of 0.05.

4.4 Summary of Major Findings

Based on the outcome of this research, the following is a summary of major findings: There is a significant difference between male and female Integrated Science teachers in their views on the achievement of the lesson objectives of Integrated Science curriculum in junior secondary schools in Kaduna State.

There is no significant difference between urban and rural Integrated Science teachers with regard to their views on the appropriateness of the assessment techniques employed by teachers in the implementation of the curriculum of junior secondary school.

The educational qualification of teachers has a significant effect on the implementation of Integrated Science curriculum in junior secondary schools in Kaduna State.

Majority of the teachers believed that for the teachers to adopt the appropriate method of teaching integrated science, they should be conversant with intended goals and objectives.

Both urban and rural school teachers believed that without a thorough understanding of Integrated Science, the teachers cannot successfully carry out instruction in order to attain significant learning of the subject.

4.5 Discussion of the Findings

The findings of this study titled "Assessment of the Implementation of Integrated Science Curriculum in JSS in Kaduna State" made use of descriptive statistics in analyzing the bio data of 130 sample respondents; it answered four (4) research questions and tested four (4) research hypotheses in order to solve the research problem.

The results obtained from respondents showed that on the location of the junior secondary schools, the study covered all the public junior secondary schools that offer Integrated Science at this level. Result revealed that ninety (90) of the teachers were from schools located in urban areas while the rural areas had 40 respondents sampled for the study. The respondents sampled in this study were not grouped or categorized into aged level.

The result obtained also indicated the teaching qualifications of the teachers or respondents to be mostly, NCE holders, followed by the B.Sc and the B.Sc.Ed. degree holders. However, all these qualifications are classified into either trained or untrained, depending on whether the teacher had the professional training in education or not. The trained teachers included NCE, B.Sc.Ed and B.Ed, while the untrained ones comprised B.Sc holders.

The respondents have varying years of teaching experience as details of the analysis indicated that 45 of them had 17 years and above teaching experience while 40 of them had between 8-12 years; another 20 had teaching experience of between 1-5 years and 5 others had 13-17 years of teaching experience.

Integrated Science as a subject in the school curriculum has objectives which are intended to be achieved through the teacher. The level of achieving the objectives of Integrated Science in teaching and learning among teachers varies because the result of the hypotheses tested showed that significant difference existed among teachers of Integrated Science at the junior secondary school level with regard to achieving stated objectives. According to the respondents' views, government does not provide enough teaching resources for the effective teaching and learning of Integrated Science. Such resources required include relevant instructional materials, conducive school environment etc, all required for the achievement of the objectives of the subject.

In fact, the respondents agreed that laboratory activities/strategies are the most widely employed teaching methods used in teaching/learning Integrated Science curriculum at junior secondary school level. Laboratory activity is linked to the curriculum content of JSS level, bearing in mind the age of the learners, their practical experience, and creativity. Laboratory activity is the best method for teaching and this explains why sixty four 64 of the respondents agreed to this method as a strategy for integrated science.

Another popular teaching method for Integrated Science is the use of inquiry method by the teachers as attested to by forty (40) of the respondents. Few of the Integrated Science teachers used other methods of teaching and learning the subject.

In any educational set up, the teacher is the focus of knowledge dissemination, as he is responsible to pass educational information to the learners. This is why the importance of teacher qualification in the teaching and learning of Integrated Science cannot be overemphasized. The finding in relation to teacher qualification indicated that 87 of the teachers in this study attested to the view that training/capacity building through workshops, seminars etc assist to better

improve the teachers' capacity and enable them to perform better in class teaching/learning process. The teachers further opined that lack of professional competence by some Integrated Science teachers is a reason for their inability to improve instructional resources. Some teachers who have educational qualification like B.Sc. are still not qualified to teach the Integrated Science curriculum in junior secondary schools because they are not properly trained in the act of teaching.

Training of teachers is very paramount in the realization of objectives of Integrated Science curriculum. Trained teachers have been taught the rudiments of teaching besides the specialized academic qualification. The trained teachers have different techniques for different classes at the JSS level. They know the right instructional materials, the right evaluation strategies and general principles of inculcating knowledge to the students. However, the untrained teachers on the other hand lack all these basic technicalities necessary for dissemination of information which explains why the training of teachers had significant effect or impact on the achievement level of Integrated Science curriculum.

Both groups of respondents from rural and urban locations strongly believe that the use of evaluation strategies to realize the effectiveness of teaching and learning is very crucial for the technological development of the society. Majority of the respondents, irrespective of their locations, agreed that constant evaluation of schools be carried out to ensure that teachers make necessary adjustment to the goals of teaching and learning procedures. This is why the respondents are of the firm conviction that Integrated Science suffer from lack of appropriate use of evaluation procedures by teachers in junior secondary schools.

In the same vein, results of the research hypotheses showed interesting outcomes just like the research questions. The result of hypothesis 1 revealed that there is no significant difference

in the opinion of teachers in the effective teaching and learning of the subject at the junior secondary school level. For instance, majority of the respondents agreed that government does not provide enough resources for effective teaching to take place in Integrated Science just as teachers are not fully supervised for proper teaching and learning. They argued that hardly is supervision conducted twice in any school within the state. This has a negative effect on students who want to study science related courses at the senior secondary school level.

Result of hypothesis 2 revealed that there is a significant difference in the effectiveness of evaluation strategies used in the teaching and learning of Integrated Science at the junior secondary school level. Those evaluation strategies will normally allow the teacher to make necessary adjustment of the goals of teaching/learning procedures where ever necessary in the schools. The outcome of the hypothesis tested revealed that Integrated Science suffer from lack of appropriate use of evaluation procedures by teachers in the schools because teachers are not made to determine their methods of evaluation in Integrated Science in line with established objectives and teaching procedures in most urban and rural schools.

It was again revealed that there was no significant difference among the respondents in the teaching and learning of Integrated Science on account of their years of teaching experience. Also, using the analysis of variance, the study revealed that there is no significant difference among the teachers on the teaching and learning of Integrated Science on account of their teaching qualification.

Integrated Science teachers cannot conveniently teach without relevant use of instructional materials which has significant impact on the realization of Integrated Science curriculum objectives for scientific development and advancement in the society. One would wonder, how Integrated Science curriculum objectives be achieved without instructional

materials and infrastructural facilities like equipments for practical and laboratories. How could the objectives of the curriculum be achieved without suitable textbooks? Teaching aids such as audio-visual aids and electricity also play significant role on the achievement of the objectives of the curriculum of Integrated Science in schools; and these too are not available. With relevant up to date Integrated Science textbooks, audio-visual aids, constant power supply, charts and other instructional materials made sufficiently available in schools, high level of Integrated Science curriculum objectives will be achieved as instructional materials are relevant to enhancing effective teaching and learning process. The study serves as an encouragement to require the interest of Integrated Science educators to contribute to knowledge by making the teachers subject to research.

The researcher also made use of observation in fact finding for the study. During the observation by the researcher of some teachers in their various classes, it was discovered that they seemed to have a similar problem the same problems in teaching/learning process in integrated science. The method of teaching used by the majority of the teachers of Integrated Science teachers was still mainly the traditional lecture method. This has negatively affected the transmission of knowledge and skills to the learners.

Also, it was observed that, most of the teachers handling the subject at the junior secondary schools were NCE holders who lacked professional competence/skills in handling the subject matter for effective and efficient learning of the subject at that level of education.

It was also observed by the researcher that there are adequate text materials for the teaching and learning of Integrated Science in junior secondary schools but some of the teachers lacked suitable methods of teaching; they therefore they read directly from the textbooks with little explanation.

Another thing observed by the researcher was that teachers did not make use of instructional materials in the course of their teaching/. This was due to lack of the instructional resources. This has an adverse effect on students' learning of the subject and does not encourage the development of interest in other science related courses in the senior secondary school level. In the area of evaluation, the researcher observed that most teachers lacked competent skills in evaluation in their teaching/as most evaluation questions at the end of the lesson were centered on the cognitive aspect with the affective and psychomotor aspects being neglected.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the study, conclusion and offer recommendations.

5.2 Summary

This study is on the assessment of the implementation of Integrated Science curriculum in junior secondary schools in Kaduna State. The population of the study comprised of 150 sampled Integrated Science teachers within the junior secondary schools in the state, selected from all the inspectorate divisions. Four research questions were answered and four research hypotheses were tested. Chapter one was the introduction and general background of the study including statement of the problem, objective of the study, research questions and its hypotheses. Other areas covered by the chapter are significance of the study, basic assumptions and delimitation of the study.

Chapter two dealt with review of related literature which focused on the theoretical framework, model of curriculum implementation, role of students in curriculum implementation, participants in curriculum implementation, determinants of curriculum development, concept of Integrated Science, emergence of Integrated Science, philosophy of Integrated Science, General Science versus Integrated Science, supply and qualification of science teachers, criteria for the selection of instructional methods, instructional methods in Integrated Science, concept approach and empirical studies.

Chapter three discussed research design and method, population of the study, sample and sampling techniques, instrument used for data collection, validity of the instrument, pilot study and reliability test and, method of data analysis.

Chapter four was the analysis and presentation of data which included analysis of personal variables, answering of research questions and testing of hypotheses, as well as the summary of findings, and discussion of findings were all presented. The final chapter, i.e. five dealt with the summary, conclusion and recommendations of the study. The researcher also made suggestions for further research in the area.

5.3 Conclusion

Based on the findings of the study, the following conclusion can be deduced.

There is no significant difference in the opinion of teachers with regard to the achievement of Integrated Science curriculum objectives at the junior secondary schools. Also, there is no significant difference in the opinion of urban and rural teachers with regard to the assessment techniques used in the implementation of Integrated Science curriculum in junior secondary schools.

Trained teachers are better in the implementation of Integrated Science curriculum than untrained ones at junior secondary schools level.

Finally, it can be further concluded that there are no significant differences in the methods/techniques of teaching used by the teachers in the implementation of Integrated Science curriculum in junior secondary schools in Kaduna State.

5.4 Recommendations

Based on the findings and conclusion from the study, the following recommendations are made in order to provide better implementation of the Integrated Science curriculum in junior secondary schools level in Kaduna State.

1. The teachers should be well trained and qualified in order to achieve maximum teaching and learning of Integrated Science curriculum at the junior secondary schools.

2. Laboratory exercise should be intensified in the implementation of Integrated Science curriculum in junior secondary schools.
3. There should be regular supervision and assessment of the Integrated Science teachers teaching in all schools in order to enhance their performance in effective implementation of the curriculum.
4. Teachers of Integrated Science should be motivated through sponsorship to attend workshops and seminars to enhance effective implementation of the curriculum at the junior secondary schools.
5. NCE teachers who excel in the teaching and learning of Integrated Science curriculum should be given automatic scholarship for further studies in institutions of their choice.
6. Massive recruitment and training of teachers in Integrated Science should be embarked upon. This will go a long way in solving the problem of inadequate professional teachers in the subject area.

5.5 Suggestions for Further Studies/Research

The following are suggested for further research:

1. A study could be undertaken to examine the relationship between Integrated Science teacher's qualification and students' academic performance.
2. Another research could examine the performance of students in Integrated Science in more states in Nigeria.
3. A comparative study of Integrated Science students' performance across states or zones of Nigeria could be undertaken.

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APPENDIX

AHMADU BELLO UNIVERSITY, ZARIA
POST GRADUATE SCHOOL

QUESTIONNAIRE FOR TEACHERS

Sir,

This questionnaire is about a study being undertaken by the researcher to ascertain the Assessment of the Implementation of Integrated Science Curriculum in Junior Secondary Schools in Kaduna State. For this reason sir, you are kindly requested to respond to questions raised in this questionnaire by choosing from the alternative answers. You are assured that your response will be treated with all confidentialities.

Use the key below as your guide: SA = Strongly Agreed, A = Agree, D = Disagree, SD = Strongly Disagree

PART A: PERSONAL DATA

1. Name of School:
2. Sex: Male [ ] Female [ ]
3. Location of School: Urban [ ] Rural [ ]
4. Age: (A) under 20 years [ ] (B) 21-30 years [ ] (C) 31-40 years [ ] (D) 41 years above [ ]
5. Teaching Qualification

   (A) NCE [ ] (B) B.Ed [ ] (C) BA.Ed [ ] (D) B.Sc [ ] (E) B.Sc [ ] (F) MA/M.Sc [ ] (G) Ph.D [ ] (H) Others [ ]
6. Teaching Experience in Years

   (A) 1 – 3 [ ] (B) 4-7 [ ] (C) 8-12 [ ] (D) 13-17 [ ] (E) 17 and above
7. Do you belong to the Science Teachers Association of Nigeria (STAN)?

   Yes [ ] No [ ]

8. Teachers' opinions of Integrated Science influence his/her statement of objectives.

   (A) SA [ ] (B) A [ ] (C) D [ ] (D) SD

9. Have you being opportuned to attend any Science Teachers Association of Nigeria conference, workshop or seminars?

   Yes [ ] No [ ]

10. How many types times you attended such conference, workshops or seminars?

    (A) Once [ ] (B) Twice [ ] (C) Thrice [ ] (D) Four times [ ] (E) None [ ]

SECTION 'B'

Give your opinion on the following sub-headings on your point Likert's Rating Scale showing as Strongly Agree (SA) (4), Agree (A) (3), Disagree (D) (2), Strongly Disagree (SD) (1).

		SA	A	D	SD
11.	Teachers' views on the achievement of the objectives of Integrated Science in Junior Secondary Schools				
12.	Teachers' views of Integrated Science influences his/her statement of objectives				
13.	Affective and psychomotor have been neglected mostly due to wrong views of teachers of Integrated Science				
14.	Science discipline constitute the most important base from which Integrated Science drew its content due to teachers' views				
15.	Integrated approach to Integrated Science opens vast areas of significant learning structure for students in order to attain significant learning of Integrated Science				
16.	Without thorough views of Integrated Science content, the teacher cannot successfully carryout instruction in order to attain significant learning of Integrated Science				
17.	The content of Integrated Science be better organized in a spiral form				