SOME FACTORS INFLUENCING THE TEACHING AND LEARNING OF INTEGRATED SCIENCE: A CASE STUDY IN ZARIA LOCAL GOVERNMENT

BY

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DECLARATION

I hereby declare that this thesis has been written by me and that it is a record of my own research work. It has not been presented in any previous application for higher degree. All quotations are indicated by quotation marks or indentation, and the sources of information are specifically acknowledged by means of references.

D. I. Adesiyun (Mrs.)

1989

CERTIFICATION

This thesis entitled, **Some** Factors Influencing the Teaching and Learning of Integrated Science: A Case Study in Zaria Local Government" by Deborah Ibiyemi Adesiyun (Mrs.), meets the regulation governing the award of the degree of Masters in Education of the Ahmadu Bello University; Zaria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to my husband and to my children. The journey hasn't been easy but you toiled with me to the end.

ABSTRACT

Integrated Science has been in the Nigerian post-primary institutions of learning for almost two decades now.

In the new policy on education, integrated science is mandatory for the junior secondary school years, and the Federal Ministry of Education has produced a National Integrated Science Core-Curriculum. Both the policy and the national curriculum have assumed that:

(i) there are sufficient numbers of teachers trained to teach the integrated science course,

(ii) the course lays good foundation for the separate sciences of the senior secondary school,

(iii) for those students who do not go on to further science course, the integrated science course is expected to provide good scientific literacy,

(iv) the texts, equipment and other instructional materials required are available to the schools - and so to the teachers and students.

This study investigated some factors that are in control of integrated science teaching and learning in the secondary schools.

The results snow that some of these factors are:

(a) teachers' training background in the basic sciences,

(b) number of periods allocated to integrated science on the school time table,

(c) instructional methodologies of the teachers,

(d) laboratory equipment for integrated science teaching and

(e) availability of integrated science texts to teachers and students.

The results of this study show that majority of the teachers do not have adequate knowledge about the integrated approach of science teaching because they are deficient in one science discipline or the other. It seems clear that the bulk of the solution to the factors affecting integrated science teaching lies in good teacher training, be it at the pre-service or the in-service stage.

The results also show that students are not learning integrated science by experimentation since most of the integrated science lessons are oi' the theory format. A severe lack of equipment, material, or even laboratory have been blamed for this state of affairs.

An improved and deliberate teacher training programme will take care of most of what, at present, constitute problems in the teaching of integrated science.

Government ministries of education and university education faculties jointly should seek some solution such as through lectures, seminars and workshops for science teachers. The objectives of such should be to provide a fuller understanding of the implications, and the appreciation of the advantages of integrated science as well as the effective special teaching approach demanded by the subject.

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ABBREVIATIONS

The meaning of some abbreviations and terms used in this research are as follows:

J.S.S.	-	Junior Secondary School (Forms 1, II and III of Nigerian Secondary School.
N.I.S.P.	-	Nigerian Integrated Science Project.
H.S.C.	-	Higher School Certificate.
N.C.E.	-	Nigeria Certificate in Education.
S.T.A.N.	-	Science Teachers' Association of Nigeria.
S.P.S.S.	-	Statistical Package for the Social Sciences.
UNESCO	-	United Nations Educational Scientific and Cultural Organization.
A.A.A.S.	-	American Association for the Advancement of Science.
ICSU	-	Inter-Union Commission on Science Teaching.

CHAPTER 1

THE PROBLEM

1.1 Introduction

Governments and educators all over the world count on the modification of the school curriculum as a major instrument for improving the quality of education. This has brought about continual curriculum reforms in schools. Nations are also known to modify their school curriculum in order to meet their respective national needs and goals.

The objectives of the integrated science programme have been well documented by Brown (1977). There are three major factors which are responsible for the development of integrated science namely:

(1) concern for the nature of science

(2) the need for scientific literacy and

(3) social concerns

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As regards the concern for the nature of science, the two main views of science are, science as a systematically organized body of knowledge about the world in which we live (i.e. the knowledge content); and science as the method of investigation employed in generating the knowledge (i.e. the processes of science).

There is a controversy as to what the emphasis should be in the teaching of science in the classroom in respect of these two views of science. As a science educator, one cannot separate the knowledge content from the processes, since the processes of science cannot be learned without the knowledge aspect. Young children should not be taught science in discrete compartments or specialized areas. They should rather be taught science as an integrated and unified whole.

If they specialize too early, they may end up being able "to see the trees but failing to see the forest".

The significance of science education as a component of general education and the idea of "education through science" have found widespread acceptance. These have led to the rapid development and popular acceptance of integrated science education at the primary and junior secondary school levels. The courses designed for these levels are based on the extensive use of simple pieces of equipment.

The Nigerian government has continued to modify its school science curriculum in order to meet its

need for technological development. Such modifications included integrated science. Other reasons why integrated science was started in Nigeria are that the government desires that its citizens should be scientifically literate. This is particularly important since it is not possible that all the students will specialize in science or science-related subjects later in life.

The present educational system in Nigeria should lay emphasis on science education which would make future leaders think logically, develop the habit of critical analysis and be more receptive to new ideas. Through a well designed science education programme, the dominance of superstitions, taboos and unscientific culture may be significantly reduced. Indeed what science does is to remove the harmful effects, such as fear, by providing demonstrable explanations of observed natural phenomena.

The importance of science and technology in a developing country like Nigeria, cannot be over-emphasized. "Science and Technology have engulfed the whole world to the extent that any nation that fails to

recognize this fact and take appropriate steps to develop her citizens along the right direction is in great danger of going into extinction." (Olarewaju, 1987).

Countries like Britain, North America, Russia and Japan have fashioned out programmes for this purpose, and the effect of this is glaring to people all over the world today. In an attempt to catch the Nigerian students young for science, the integrated science programme was introduced originally for the first two years and now for the first three of the six years in secondary schools.

The National Policy on Education (1981) stipulates that students should spend six years in the primary school, three years in the junior secondary school, three years in the senior secondary school, and four years in the post-secondary institutions.

In this system, popularly referred to as 6-3-3-4, science is first encountered by the child in the primary school. Integrated science is a core subject, meaning that it is compulsory in the junior secondary school. It is necessary to bear in mind the fact that these students are at their impressionable age and thus, the teaching and learning of

integrated science can enhance or mar their interest in the study of science and its allied subjects (Olarewaju, 1987).

At the junior secondary school, integrated science is taught along with other subjects like Maths, Languages, Social Studies and pre-vocational subjects. Students are given a certificate at the end of this initial three years so that those students who do not have the ability to proceed to the senior secondary school can go into apprentice-ship system or some out of school vocational training.

The most significant departure of the intentions of the integrated science curriculum from that of the traditional science courses in our schools is the emphasis that the new integrated science curriculum lays on teaching the pupils what science is and how the scientist works. In its intentions, the integrated science curriculum places emphasis upon school science as "a way of knowing". Rote learning and memorization are de-emphasized in favour of concept formation. Learning situations characterized by the teacher directed telling and drill are to be replaced by individual learning through teacher guided student-centred discovery.

The teachers are asked to accept the position that durable learning in pupils occur only if they can use their knowledge in an explanatory, and interpretive manner. The teachers are told that laboratory exercises simply to demonstrate, visualize and verify complex principles should give way to experiments to raise problems, test inquiry skills and provide discovery opportunities. Classroom instruction is to shift from being an information-giving exclusively by teachers type to information-proecessing by students.

Some states, for example Kaduna, Kano, Sokoto, Bauchi and Plateau have set up special science schools to deliberately promote science and technology at the secondary school level. The establishment of several universities of technology is also a bold attempt by the Federal Government to encourage science and technology. These efforts to popularise science and technology do not come as a surprise because science, maths and technology are extremely important, not only in nation building but also in the improvement of the overall quality of life in the society.

Researchers like Mani, (1981); Odunbunmi (1980); Jegede (1982); Olarewaju and Balogun (1984) have

revealed that most of the teachers were not qualified (because they were not trained) to teach integrated science and the method mostly used was teacher-centred.

While the Federal Government is attempting to run in-service courses (Olarewaju, 1986), researchers like Osondu (1976); Padambo (1978); Odunbunmi and Balogun (1985); Gyuse and Akinmade (1986); Bomide (1983); Odunbunmi (1986) and Olarewaju (1987) among others have conducted studies to improve the various shortcomings of integrated science.

Even though, similar studies have been conducted in various states of Nigeria, none of these investigators studied the factors that control the teaching and learning of integrated science. There is therefore the need for researches on a regular basis to identify these factors and detect any changes in pattern of such factors. There is also the need to explore other avenues of improving the lot of integrated science teaching and learning.

1.2. Statement of the Problem

In Nigeria today, teachers and students are faced with many problems in the teaching and learning of integrated science. Indeed, an earlier study (Mani, 1981) identified the gap between the "intended and practiced forms of the Nigerian Integrated Science Project Curriculum.

Having taught this course for about five years, the researcher identified some factors which are influencing the teaching and learning of integrated science, and wondered if all the aims of the course are being achieved in the post-primary institutions where this course is being offered.

This study specifically sought to find answers to the following questions:-

(1) How do integrated science teachers rate the course in terms of

(i) students' understanding of the textbooks,

(ii) the language of the textbook,

(iii) their ability in coping with the demands of the course,

(iv) the methodology of the book and the instructional methodology,

(v) the availability of materials for teaching the course,

(vi) teacher's training for integrated science,

(vii) teacher's knowledge of the course content which may be wide in scope including aspects of technology and social sciences,

(viii) size of the class being taught by each teacher,

(ix) degree of participation of classroom teachers directly in the curriculum.

(2) Are the periods allocated for teaching a class in a week on the time table adequate?

(3) Do students carry out activities in the laboratories by themselves?

(4) Have the students developed a positive attitude towards integrated science and science as a whole, as a result of the course?

(5) To what extent has the failure to achieve the objectives of the course been the result of non-availability of materials and infrastructural support?

1.3 Basic Assumptions

The basic assumptions on which this research was based are that:

(1) The educational training background of the teachers will contribute a lot to the way they teach the integrated science course.

(2) The non-availability of science laboratories and equipment could hamper the success of the Nigerian Integrated Science Project.

(3) The Nigerian Integrated Science Project could be evaluated through a study of the views of teachers and students of integrated science.

(4) Students understand the questionnaire items as explained to them. So they respond from position of knowledge, not of ignorance or misunderstanding.

1.4 The Hypotheses

The following null hypotheses were tested:

(1) Background in the basic sciences does not significantly affect the level of ease of teaching integrated science.

(2) The number of periods allocated to teaching integrated science in a week does not significantly affect the coverage of the subject syllabus by the teachers.

(3) There is no relationship between possession of integrated science texts by the students and their attitude towards the subject.

(4) The instructional methodologies of the teachers do not promote the students' understanding of integrated science.

(5) Availability of science laboratories and equipment to the integrated science class in a school does not significantly affect students' activities in the subject.

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1.5 Significance of the Study

The Nigerian integrated science teacher is faced with a number of problems which militate against his effective performance. These include that of large classes, ill-equipped laboratory, lack of adequate science background necessary to teach the course etc.

Asonibare (1984) identified the issue of large number of students in a class as a cause of stress management.

Bajah (1983) and Arogundade (1983) identified the lack of facilities for teaching integrated science in the schools as a problem facing the teacher.

More tragic still is that most schools leave this crucial course (integrated science) in the hands of inexperienced or untrained teachers. Some of these teachers have very little interest in integrated science teaching.

Jegede (1982) carried out an evaluation of Nigerian Integrated Science Project and reported among others that none of the teachers was qualified or trained to teach integrated science. He also said that teachers were not comfortable teaching the

aspects of integrated science they did not know.

Ogunniyi (1983) said that:

> "An untrained teacher, because of his lack of experience neither understands the nature of the learner nor that of the instructional process. It is common to see such a teacher lecturing or dictating notes (if he has any at all). He is neither aware of the level of his language nor of the mood of his pupils. He is surprised that after alot of exertion, many of his pupils do not follow his lesson. He easily gets irritated, frustrated and confused."

Without well trained integrated science teachers, that is, teachers who are aware of the logic of the programme, success will be hard to come by.

If the structure of teaching and learning of integrated science is alien to its structure, then the outcome (as is commonly found in schools) will inevitably be a corruption of the intentions of the programme (Ogunniyi, 1983).

The mode of teaching the integrated science course at present does not reveal the revisionary

character of the programme. Lessons are hardly planned to illustrate science as a dynamically changing enquiry.

The researcher's experience with the teaching of the STAN Nigerian Integrated Science Project in secondary schools has exposed a very weak point in this area. Teachers of Biology handle the Biology aspect. The same thing applies to teachers of Physics and Chemistry. As it is always the case with high specialization in a particular science subject, such teachers intentionally avoid areas not related to their subjects. Their minds are so set on their subjects alone that they cannot pay attention to something that requires only their awareness and necessarily additional preparation in the content area.

With quite a number of problems of integrated science teaching highlighted above, it has become necessary for the researcher to explore some other means of improving the situation with the hope that her findings and suggestions for improvement, together with those of previous researchers will be looked into seriously and implemented.

1.6 Scope of the Study

The search for answers to the questions highlighted in this chapter was limited to final year students of the Junior Secondary School (J.S.S.) in and around Zaria for the obvious reason that they must have been taught integrated science for at least two years prior to their participation in the study. Teachers teaching the subject at the time of the study were also used.

CHAPTER 2

THE REVIEW OF RELATED LITERATURE

2.1 Introduction

The criticisms which have been meted to integrated science principally derive from the inaccurate view of what integrated science is. Critics are quick to dismiss integrated science as a recast of the General Science of yester years, and they see it as "an old wine in a new wine skin". To many, integrated science is without frame, form, worth or future in the process of education. These views are all terribly wrong, inaccurate and unfavourably biased (Asun, 1985).

The Federal Ministry of Education said that "Integration" of science for the junior secondary school is applied accurately when it describes a science course, or even unit which is devised and presented in such a way that students:

(a) gain the concept of the fundamental unity of science,

(b) gain the commonality of approach to problems of a scientific nature,

(c) are helped to gain an understanding of the role and functions of science

in everyday life, and the world in which they live.

Integrated science is not to be mistaken for General Science which is "nothing more than a collection of short units in several of the individual sciences...." (Rutherford and Gardner, 1971). General science lacks the unity of purpose and operation which characterizes true integrated science. The logic or the structure of the integrated science or any discipline for that matter determines the instructional process to be used.

The implementers of the integrated science curriculum are the teachers. For them to teach the course effectively, they must understand its nature and objectives.

The Review of Literature follows this order:

2.2 The Origin of Integrated Science

2.3 Integrated Science teaching

2.3a The definition of Integrated Science

2.3b Rationale for Integrated Science

2.3c Some factors affecting Integrated Science

2.2 The Origin of Integrated Science

The change in emphasis in science teaching in the late - fifties and early sixties from the acquisition of factual knowledge to the total personal development and active involvement of the individual student formed the foundation of what is now known as integrated science. Prior to the introduction of integrated science, memorization of definitions and of formulae dominated physics, chemistry and biology teaching were in existence especially in the United States of America (Lewis, 1979).

According to Raw (1979), reforms were initiated by the Physical Science Study Committee in the U.S.A. and subsequently by other projects like Chemstudy and the United Kingdom's Nuffield Project. Some major unified concepts and theories which were basic to these new integrated science were the familiar "big ideas" in science. Such included atomic physics, thermodynamics, chemical bonding, genetics, evolution etc.

UNESCO brought these various efforts together by convening a planning meeting in Paris in March 1969, to advise on its Programme of Integrated Science Teaching. It was adopted by the General Conference at its fifteenth session. The meeting used as its basis, the concern

for integrated science teaching at the primary and junior secondary levels set forth in the Report of the Varna Congress on the Integrated Science Teaching, and in the Final Report of the Regional Workshop on UNESCO/UNICEF Assisted Projects in Science Education in Asia, Bangkok, in November 1968.

The Planning meeting recommended that the UNESCO programme of integrated science should operate on materials in which the concepts of science are presented through a unified approach. The meeting also recommended that these projects should provide the expertise and knowledge which would be the starting point for the integrated science programme.

In Nigeria, the preliminary effort towards integrated science began with the Science Teacners' Association of Nigeria (STAN) committee working on the separate disciplines of Physics, Chemistry and Biology. This was followed by joint working sessions of representations from the three committees to make an attempt at integration of these disciplines. The result was embodied in the Association's Newsletter Number 1 on an Integrated Science Course which contained guidelines for effecting such a course for the junior forms of the secondary school, as

the Association saw it.

The major writing effort of the Nigerian Integrated Science Course took place at the Faculty of Education, University of Ibadan, in September, 1970. The Association produced a set of materials for a two year course, comprising pupils' Textbooks and Pupils' Workbooks (for practical work and recordings). A valid answer to the major problem of establishing experimental method as the basis for science education in Nigeria was therefore sought.

2.3 Integrated Science Teaching

2.3a The definition of Integrated Science

In reviewing the meaning of and arguments for, integrated science, Brown (1977) did mention that the meaning of integration and indeed the value of the integrated approach have not always been made explicit in spite of the fact that many integrated science curricula have been developed in recent years throughout the world.

According to Jegede (1981), the earliest call for what is now termed as integrated science arose partly from the reports of Hadow (1927), Spens (1938)

and Norwood (1943) who were dissatisfied with the abstract and too 'cognitive' traditional curriculum. They recommended a change to a correlated approach to the humanities, natural sciences and the arts.

Rutherford and Gardner (1971), Binder (1971), Yoloye (1971) and Jacobson (1971) have all looked at integrated science broadly as a subject arising from the learner's environment and way of learning about the natural world, science as a unified subject and education. In terms of real curriculum development, Schowalter (1975), asserted that: "Today, the label 'unified science' may be applied generally to any curriculum development effort in which two or more previously separate science subjects are combined."

Brown (1974) considered integrated science as a curriculum 'presented as a unified discipline rahter than the three separate disciplines that have characterized secondary school science'.

Brown (1977), identified four bread groups of the meaning of integrated science; namely:

(a) the unity of all knowledge,

(b) the conceptual unity of the sciences,

(c) a unified process of scientific enquiry,

(d) an interdisciplinary study.

In (a), the holistic view of knowledge as being essentially one and indivisible is reflected in science as different from (b) where the various conceptual units that make up the framework are identified.

Presenting science in (c) as a unified process of scientific enquiry emphasizes the methodological distinctions and similarities among the sciences. The fourth classification, (d), of defining integrated science as an interdisciplinary study looked at science as being a collaborative venture between subjects and a viewing of topic or theme from logically different viewpoints. Although Brown's classification is quite comprehensive, it is rather ineffective in real practical classroom application. Most of the integrated science projects are actually

mixtures of two or more of the four definition groupings, thus making the definition of integrated science less watertight. Examples of these are, the Scottish Integrated Science Project, Nuffield Combined Science and Nigerian Integrated Science Project.

According to Blum (1973), there has been concerted efforts made to identify effective guidelines to assist teachers, scientists, educational administrators and curriculum specialists in the planning of effective science teaching programmes, geared to the needs of school pupils. The formulation of a definition for integrated science teaching is the early outcome of these efforts. Literature reveals that simple definitions of integrated science teaching are very scantily documented.

Some of the definitions found in science literature include:-

(i) "Integration" when applied to science courses, means that the course is devised and presented in such a way that students gain the concept of the fundamental

unity of science; the commonality of approach of problems of a scientific nature; and are helped to gain an understanding of the role and function of science in their everyday life, and the world in which they live. An integrated science eliminates the repetition of subject matter from the various sciences and does not recognise the traditional subject boundaries when presenting topics or themes (d'Arbon, 1972).

(ii) Integrated science "is a natural response to the shifting views of science that the environment and all its natural phenomena can best be understood in the context of a unified scientific approach" (Akpan, 1983).

(iii) Integrated science could be seen as an anti-disciplinary programme that cuts accross the boundary of any of the physical, earth or life sciences. It unites or integrates

> these sciences, thus producing students who are scientifically literate in terms of unity of science (Olarinoye, 1983).

(iv) Teaching science as a unity is assumed to mean that all science, as a human endeavour, is taken as the source of educational objectives and learning activities, and that the traditional boundaries among separative sciences are minimised considerably for these purposes (Schowalter, 1978).

Whether it is called "basic", "unified", or "interdisciplinary" science, integrated science must be a science course:

> Which in treating each of the pervasive ideas of science, such as energy, conservation of matter, equilibrum, etc, frees itself of the restrictions imposed by the arbitrary subject boundaries of the separate sciences (Asun, 1985).

Integrated science can also be seen as training the student to:

> develop the motivation and ability to work and think independently; devise schemes for solving problems; apply previous knowledge to new situations: relate his experience ..... (to live) in his society (STAN, 1971).

These definitions can be interpreted thus in the context of school science teaching.

The integrated course is one that is devised and presented in such a way that students gain the concept of the fundamental unity of science. The course emphasizes both the social context of science and the processes of science.

Teaching science in the integrated manner is a means for developing scientific literacy, the understanding of the processes of science, meet learner's needs and showing the relationship of science and society. The traditional subject matter boundaries are phased out in integrated science while the individual identity of physics, chemistry and biology are maintained in non-integrated science.

At the secondary school level, the integrated science course is for the younger pupils and it is for a period of three years, while the traditional separate science courses are for the older pupils, extending over a period of three years. Though, both the integrated and non-integrated science courses are sequentially arranged, the sequence in the former tries to avoid duplication of content while duplication of topics is unavoidable or even built into the latter. Integrated science courses usually serve a general education function while the non-integrated courses serve a specialist's education function.

Integrated science can therefore be seen as an approach to the teaching of science, in which concepts and principles of science are presented so as to express the fundamental unity of scientific thought and to avoid premature or undue stress on the distinctions between the various scientific fields. Integrated science makes the word 'science' more meaningful to the learner than the individual science subjects. Even though the students' overall knowledge in the area of specific science concerned may be shallow, it may not necessarily be of a low quality.

2.3b Rationale for Integrated Science

The need for the inclusion of integrated science in the secondary school curriculum has been justified by several reasons advanced by proponents of the subject.

The arguments in favour of the subject, are as varied as there are the proliferations of the subject worldwide (Jegede, 1983).

Brown, (1977) made a classification system of arguments for integrated science based on the modification of an earlier set of determinants identified by Schwab, Dunket and Tyler (Schwab, 1962). The classifications include:-

(1) Outcomes demanded by society e.g. provision of scientists, informed lay population and informed political leadership.

(2) Resource constraints, e.g. accommodation, equipment, time-tabling, teacher availability, etc.

(3) Political constraints e.g. common-core courses for all pupils, national assessment system, etc.

(4) Conditions for effective teaching, e.g. teacher's interests and competence.

(5) Condition for effective learning, e.g. pupils' security, motivation and interest.

(6) Constraints imposed by the nature of the subject, e.g. unified nature of scientific enquiry.

The reasons for the proliferation of Integrated science have been documented by Brown (1978). Three major areas of concern which led to the development of integrated science are concerns for the nature of science, educational concerns and social concerns. It was concern for the nature of science and educational concerns that were most prominent when the first integrated science courses appeared.

According to Brown (1978), the Varna Conference drew attention to the significance of science education as a component of general education and the concept of "education through science" found widespread acceptance.

Another reason is that there was a worldwide movement to introduce science into primary school education. Integrated science courses tend to emphasise observation, enquiry, building up of simple science concepts and an awareness and exploration of the local environment.

The swing away from science which is prevalent in many countries is also another reason, as students tend to view science and technology as being responsible for many of the ills of our society, and they have not found science courses at school or university relevant to the problems that concern them. The development of relevant interesting and challenging integrated science courses has been perceived as one way of combating this trend.

Another reason is that there is a growing awareness on the importance of technology education in general education.

Certain considerations provide the reason for a change from the traditional General Science approach to integrated science. It was believed that in most cases, general science curriculum dealt with abstract concepts and ideas which the learner could not relate to his experience and background. (Arogundade, 1983).

One can see the futility in operating this kind of curriculum which had little or nothing to offer a learner apart from the basic acquisition of facts, in a country that aspires to technological development. In fact, the change was quite inevitable realising that the trend within education itself was towards integration and a coordination of various disciplines.

There is no agreement among the learning psychologists about the extent of training from one field to another. Jungwirth (1960); Levy and Blum (1970) pointed out that an integrated approach to science teaching can help to enhance whatever possible transfer of training, by giving the student more occasions to use the concepts and principles learned in one discipline in a not too distant field, as for example the use of biological principle in agriculture, or in nutrition.

According to Inhelder and Piaget (1958); Flavell (1963), children at the primary and junior secondary levels are more in the concrete stage of development, children in the concrete stage of development are mainly concerened with sensing and manipulating concrete phenomena, and the theoretical structures of various disciplines are still outside their full grasp. At this level, "undifferentiated" science is more appropriate in schools.

Jackson (1971) made a valid point on the nature of the learner being considered a very important psychological reason for advocating the integrated science approach (Mani, 1981). Jackson was quoted thus:

> "We are slowly gaining a better understanding of how children and young people learn and what kinds of learning experience may be most effective at different levels of intellectual development. For example, studies of intellectual development in children tend to support the experiences of many teachers that young children learn best when they have many opportunities to handle science materials and equipment. After rich

experiences with these concrete materials they are better able to deal with abstract concepts."

Andrew (1970) and Carter (1972) pointed out a practical advantage of the integrated approach of science teaching. The transmission of knowledge is not the only aim of science education. Science education should also concern itself with other goals such as, the training of a critical mind and the fostering of scientific attitudes such as the readiness to use one's own judgement in critical review of data. These attitudes are as important for work as for leisure. Therefore, a wide range of topics should be chosen to form the content of integrated science teaching programmes to demonstrate how science and scientific thought influence our lives. A narrow disciplinary approach may create the impression in students, that scientific attitudes were valid only when dealing with a relatively small range of problems, mainly those concerned with research in science. An integrated approach, on the other hand might include problems from different areas in life, and could stress the growing interdependence between society and science.

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According to Arogundade (1983), the inevitability of the change to integrated science becomes a simple task in view of:

(1) The relationship between the science subjects - Chemistry, Agriculture, Physics, Biology and even Mathematics. All science subjects are concerned with the study of the universal natural phenomenon which are interdependent.

(2) The fact that scientific methods remain basically the same throughout all the science subjects. In solving any problem, they all go by the method of first of all stating their problems, hypothesising, establishing which procedure to follow, collecting data, analyzing data and later making inferences and conclusions.

(3) The recurrence of some key concepts e.g. Energy and Equilibrum in almost all the science subjects. This offers the advantage of enabling the child to see the same concept and principle applied to many situations (Biological,

Chemical and Physical). This no doubt helps the child to achieve a better internal integration and meaningful concept formation.

(4) A more psychological consideration is the consistency of integrated science with the child's level of intellectual and emotional development. Most Nigerian Pupils are at the age of 12-13 years when they start secondary education. At this age, it is unlikely that the children will cope easily with the rigours of separate sciences. Integrated science therefore becomes more motivating than Chemistry, Biology and Physics taken separately and in isolation.

Olarinoye (1983) gave the following reasons for teaching integrated science in the junior secondary schools:-

(1) It can be used to expose all students to all science at a point in their educational progress where the scientific process will be both understandable and meaningful.

(2) It is more readily adaptable to build on the student's previous knowledge and experiences.

(3) It permits a higher level of students' appreciation of interdisciplinary relationships in science.

(4) It reduces compartmentalization and induces holistic thinking.

(5) It would tend to produce heuristic thinking in the student; i.e. helping students to have a better chance to learn to think for themselves.

Asun (1985) in his reasons for integrated science in the junior secondary schools was of the opinion that:

(1) Integrated science at the Junior Secondary School is trusted to be a sufficiently good foundation for further science, of the Senior Secondary School - Biology, Chemistry, Physics, Agricultural Science, etc.

(2) It is hoped that the course will provide the desired scientific literacy for those students who would

not pursue science beyond the Junior Secondary School.

(3) Integrated science will fulfil, in part, the goal of the Junior Secondary School namely, that it would get students ready for living effectively in our modern age of science and technology; and the programme will raise a generation of people who can think for themselves.

(4) Integrated science as recommended to the country will generate in the child the spirit of curiosity to comprehend and to describe the behaviour of nature.

Integrated science is just ideal when we appreciate that no life problem comes in tidy packages of biology, chemistry, earth science etc. Nothing remains fixed, and what we call our civilization today is characterized by its continual changes. Adjustment to the challenges of such civilization is worth our training the youth for integrated science. The Junior Secondary School intends to train the youth to understand his environment, to be able to control it and adjust to it.

The argument for Integrated science is often justified using as a basis the nature of science in relation to the processes, concept and values that are unique, but general to other aspects of science (Jegede, 1983).

Concerning the processes of science, Jacobson believed that some of the approaches used in science are among the most powerful intellectual tools available to us, and the ability to use some of these approaches in our daily life should be part of our cultural legacy. It was also his idea that the building of a scientific worldview, the organization of a conceptual structure of science, and the development of the ability to use some of the processes of science are important dimensions of science as a culture. He went further to suggest that in teaching the processes of science, students should be:-

> "encouraged to seek empirical tests for ideas, use hypotheses as tools for investigation, seek and listen to ideas from a variety of sources and relate their studies to the conceptual structure of science. Since there are different modes of enquiry in different sciences, students

should have experiences with many of these different modes of enquiry as much as possible (Jacobson, 1971)."

Many writers have also expressed their views supporting the fact that although there is no single scientific method of investigation, there is a commonality in methods that exists in the sciences which invariably gives science its distinctive niche. For example, in a lecture delivered on "Teaching" at the University of Cambridge as far back as 1880, Sir Joshua Fitch said that after all, the main reasons for teaching some branch of science is to be found in considering the sort of processes by which the truths of such science are investigated and the faculties of mind which are exercised in the course of physical investigations (Jegede, 1983).

He was of the opinion that a student studying any branch of natural history or science must learn to observe carefully by using his eyes, and to know the differences between facts which are abnormal and facts which are typical. Then the student should come in contact with realities, must handle objects, must experiment, question matter closely, wait and watch, invent new forms of tests until he is quite sure that

should have experiences with many of these different modes of enquiry as much as possible (Jacobson, 1971)."

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he had hold of the true answer.

It would appear that in the classroom situation at the junior secondary school level, these views are quite valid, and they underlined the Scottish Integrated Science course which is aimed at 'exposing pupils to the work of the scientist, the apparatus at his disposal, the experimental methods he uses, the different processes of thought by which he arrives at his conclusions' (Jegede, 1983). He further said that the American Association for the Advancement of Science (AAAS) also has its project centred upon the idea that, what is taught to children 'should resemble what scientists do - the processes that they carry out in their scientific activities'. Indeed the Nigerian Integrated Science Project also has as one of its cardinal aims the teaching of 'what science is' and 'how the scientist works' to the pupils.

The Science Teachers' Association of Nigeria, STAN, (1978) saw the effort to unify scientific principles as leading to a course which:

(a) is relevant to students' needs and experiences,

(b) stresses the fundamental unity of science.

(c) lays adequate foundations for subsequent specialist study; and

(d) adds a cultural dimension to science education.

These objectives are achievable by integrated science because it breaks down, and crosses over, the traditional boundaries created between the separate sciences. Two other characteristics of integrated science, as a school discipline are that it:

> emphasizes the underlying methodology and process which characterize the scientific outlook; and embodies a scientific study of the environment and the technological requirements of every day life (UNESCO - UNICEF, 1971).

Integrated science has been recommended for adoption at the junior secondary school level because at "the earlier stages of secondary education, a totally integrated course in experimental science appears generally desirable" (ICSU, 1968).

According to Asun (1983), it is through the integration of science that the youth may find science education which meets his early adolescent interest and

problems. Integrated science rejects the effort to load the student with encyclopaedic facts, which he cannot retain nor retrieve.

In contrast to what obtained in Nigeria as general science in the past, integrated science is not just a collection of short units of several individual sciences.

2.3c Some Factors Affecting Integrated Science Teaching

The human element particularly the teaching and the supervisory agents may be the over-riding factors that would determine the level of success of the integrated science programme.

The following are some of the factors that may hamper effective integrated science teaching in the junior secondary schools.

(1) Teachers: training background and experience

Many trained science teachers who now teach integrated science in our junior secondary schools do not have the appropriate training and therefore lack the knowledge criterion which is a valuable adjunct to effective

teaching (Maduabum, 1983).

Maduabum's view is in agreement with those of Mani, (1981); Odunbunmi, (1980); Jegede, (1982); Olarewaju and Balogun, (1984), Aminu, (1979); Bankefa (1976) and Olarewaju, (1987).

The researcher tends to agree with these findings also due to her experience in the classroom.

Jegede (1981), also found out that NISP faces a considerable amount of problem about teacher preparation and involvement in integrated science. He also said that most of the teachers of NISP were of single subject specialization who felt more comfortable teaching topics that pertained to their own areas of subject specialization and as a consequence taught only selected topics to the students as opposed to following the books from unit to unit sequentially as presented in the textbooks. Jegede's finding is supported by Stake et al (1978) when they said:

> "What science education will be for any one child for any one year, is most dependent on what that

> child's teacher believes, knows and does - and does not know and does not do. For essentially all of the science learned in school, the teacher is the enabler, the inspiration and the constraint."

From the teacher's viewpoint, the justification for teaching what he chooses to in integrated science must be that he can only teach what he knows. This is further supported by Foecke (1974) in an article on the education of teachers of integrated science, in which he said that:

> "I think it is true that with rare exception, teachers of integrated science are being asked to teach what they have not learned. He then asked:
> How can we expect teachers who have science only in specialized packages and by methods which may have stressed lecture and memorization and avoided direct involvement in experimental work, to completely depart from this background and

teach science in an integrated and inquiry-oriented manner?"

On the Nigerian scene, it seems as if STAN, in designing the curriculum for the teaching of integrated science did not put into consideration the teachers who were to use the materials in the classrooms, as Schowalter (1974) said that no instructional materials are teacher proof:- "The designers and writers can conceive and produce science instructional materials which should enable learners to achieve almost any goals but which in the hands of teachers get used in ways and towards achieving objectives, other than those which the designers intended."

However, there is a tendency for the teacher to misuse the curriculum materials due to their inadequate training as previously mentioned. Showalter listed three frequently occuring ways in which teacher misuse instructional materials as:-

(a) the inquiry aspect is overlooked completely,

(b) using a method of teaching that is contrary to the objectives and purposes of the materials, and

(c) the teacher acting as if he or she either did not learn or does not believe the main ideas in the materials.

In the case of the teachers of NISP, the points (b) and (c) seem to be very applicable. There are indications that the teachers use the NISP books (selectively teaching topics in their own areas of specialization) to defeat the objectives and purposes of how integrated science is meant to be taught.

Jegede (1982) further asserted that, the educational system for integrated science is being defeated because of the inadequate training of science teachers who tend to misuse the NISP books in the manner reflecting the fact that they never learned most of the concepts. Jegede's finding is further supported by that of Olarewaju (1982) who also found out that unqualified teachers

taught the subject, and the method adopted was contrary to the one recommended by NISP sponsors.

Olarewaju (1987) in his study identifying some problems encountered in the teaching of integrated science found out that most of the teachers encountered problems with the teaching of topics that were not related to their areas of specialization. This finding supports that of Jegede (1981) who also asserted that most teachers of integrated science in Nigeria seem to concentrate their NISP teaching on units that fall within their own areas of subject specialization.

(2) Inadequacy of laboratory facilities and teaching aids

As mentioned already, inadequate training background of the teacher is one of the factors that could affect integrated science teaching. In a similar way, inadequacy of laboratory facilities and teaching aids could also affect integrated science teaching.

According to Maduabum (1983), even a devoted integrated science teacher, in the midst of inadequate working materials will feel frustrated in his struggle to raise his science

teaching above the level of drudgery.

Maduabum (1983) further argued that the problem is compounded by the phenomenal increase in school enrolment in most states of the Federation, making whatever laboratory facility available inadequate for integrated science teaching.

Oladimeji (1978) in his findings stated that science teaching in Nigerian schools revealed that majority of post primary schools did not have sufficient laboratory space and equipment to teach science meaningfully to the pupils. It is more common to find that while chemistry is taught in chemistry laboratory, physics and biology are taught in one laboratory. Integrated science usually has no adequate laboratory space; more often than not, it is taught in an ordinary classroom, with occasional practical work held in physics cum biology laboratory.

Apea (1980) supports Oladimeji's results when he found that a high proportion of schools, especially those in the rural areas had a science room rather than a laboratory, and such rooms often lacked adequate storage facilities.

Bajah (1983) and Arogundade (1983) in their studies have identified the lack of facilities for teaching integrated science in the school as a problem facing the teacher. They further asserted that, because the teacher will require adequate supply equipment to enable him assist his students to acquire the required motor skills, he is left helpless when these materials are not available for use.

These findings are in agreement with those of Kooi (1977) and De Rose et al (1979) whose studies also revealed that science teachers considered lack of apparatus, aids and facilities as negative factors for the successful implemention of integrated science.

The results of Aminu (1979), Alaiyemola (1977) and Jegede (1982) further support those of Bajah and Arogundade.

(3) Superstition

Superstition is another factor that has been found to affect integrated science teaching.

According to Gilbert and Lovegrove (1968), the average African child is riddled with numerous

superstituous beliefs that inpinge directly on the ease with which he can appreciate science.

Awokoya (1961) recognised this conflict of science and superstition in Nigeria when he said:

> "There is a big difference between the position of science in Africa and in the Western world. In Africa, we have the products of science presented to us. We need the searchlight of science to illuminate the dark corridors in our knowledge, and it will seem that the first job of science is to explain natural phenomena in terms of the natural as distinct from the super-natural."

Jegede and Okebukola (1988) are also of the opinion that divergent situations arise when the common sense knowledge about certain phenomena are at variance with the western science view on them taught in the classroom. They also said that in the traditional society, the appearance of the rainbow is adduced to the death of a king or the crossing of a river by a snake. School science explains it as refraction of

the rays of light through droplets of water.

Therefore, the African child is thus faced with the problem of harmonising the conflicting explanations of environmental phenomena offered by their traditional beliefs on the one hand and the scientific explanations on the other hand. This predominant conflict between science and superstitions causes some inhibitory influences on the receptivity of the child and consequently on his behaviour (Jegede and Okebukola, 1988).

Arogundade (1983) expressed his view on the effect of superstition on integrated science when he said that "a lot of our students are so much imbibed in superstitions that it becomes quite uneasy for them to settle the conflict between their superstitions and scientific beliefs".

(4) Language of the textbooks

Language barrier is yet another factor that is affecting integrated science. As a teacher of integrated science, the researcher agrees with Soyinbo (1979) that "passages had to be translated into vernacular before many pupils could understand them".

Akanbi (1978) in his study observed that classroom teachers considered the set of integrated science textbooks used in Oyo State as inadequate because of the level of English used by the authors.

The finding of Aminu (1979) is also in agreement with that of Akanbi when he also discovered that teachers of integrated science said that the language level of the book was too high.

The finding of Jegede (1981) support those of Akanbi and Aminu when he found out in his study that the contents of the NISP books were hardly readable to the students they were intended for.

Yoloye (1975) thinks that improving on the low level of readability of our curricular materials will solve the problem, but then a problem still remains unsolved, because there are no vernacular equivalents for some of the specimens used in science. Ability to find equivalents for these specimens may solve the language problem to some extent.

(5) Allotment of time for the teaching of integrated science

Another factor which affects integrated science teaching is the inadequacy of time for teaching it.

According to Ogunniyi (1983) most schools have less than four hours a week for teaching the course.

Bankefa (1976) in his study found out that teachers adopted didactic teaching strategies because the teaching time allowed in the weekly school schedule was much shorter than the duration recommended by the developers of the course content.

Akanbi (1978) in supporting Bankefa also found out that majority of the teachers of integrated science considered the content to be too much for the allocated school years.

The findings of Olarewaju (1987) support those of Bankefa and Akanbi when he also found out that majority of the teachers of integrated science said that they could not cover all the contents of the curriculum for a particular year because of inadequate periods on the school time table.

Arogundade (1983) is of the opinion that the junior secondary school is patterned along the Comprehensive High School line, and this means offering as many as about 15 subjects in the first year. He further stated that the time table allocation of two double periods of 40 minutes each per week at the very least suggested in the integrated science curriculum may not be attainable. He therefore concluded that the problem that may arise from this is incompletion of the syllabus in the various forms.

(6) Lack of interest in the sciences

Lack of interest in the sciences is evidenced by the poor performances of the students in examinations where they take science subjects and also, the always very few number of applicants for admission into Polytechnics and the Universities.

According to Arogundade (1983), students' interests in Mathematics seem to be almost a thing of the past. The implication for these is that effective learning of science in the junior forms is impeded. He is of the opinion that this is a major problem and that there should be ways and means of solving it.

(7) Socio-cultural factors

There is a considerable amount of evidence to show that socio-cultural factors do significantly affect the acquisition of science concepts especially in non-western cultures where the traditional environment still exerts much influence on what goes on in a classroom (Bajah, 1981; Smith, 1984; Jegede, 1987; Ogunniyi, 1987; Okebukola and Jegede, 1987; Glasgow 1986).

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Jegede and Okebukola (1988) are of the opinion that conscious attempt must be made to relate positively the daily occurences and their explanations which meet with scientific concepts in order to strengthen the learning of science. They also said that in areas, where cultural beliefs and science are at variance, the curriculum must not only point these out but also explain the differences to convince the learner why he needs to abandon the explanations his culture offers. A good example in integrated science is the topic about eclipses. When there is an eclipse of the sun, the taditional belief is that the sun and the moon are fighting. Students should know that it is because of the movement of the earth and the moon that we have eclipses.

CHAPTER 3

THE DESIGN AND PROCEDURE

3.0 Introduction

The success of the Nigerian Integrated Science Project (NISP) and indeed any curriculum project, depends heavily on the classroom teachers who execute the project. For this reason, a teacher's questionnaire was designed to find out what their views were about some of the factors that control integrated science.

It was also necessary to gather information on the views of students who have been taught integrated science. A student's questionnaire was also designed for this purpose, namely to find out their views on some factors that control integrated science. So, two types of questionnaire were designed to collect data on these factors.

3.1 The Sample

The sample for the study consisted of ten post-primary schools in and around Zaria. The schools were selected by random sampling.

Four hundred students and forty teachers participated in the study.

The sample represented students who have been taught integrated science for at least two years and teachers who were teaching integrated science at the time of the research.

The schools that were used for the study are:

(1) Government Day Secondary School, Alhudahuda.

(2) Demonstration Secondary School, A.B.U. Samaru-Zaria.

(3) Government Day Secondary School, Samaru-Zaria.

(4) Basawa Teachers' College, Basawa.

(5) Barewa College, Zaria.

(6) Government Day Secondary School, Shika.

(7) Government Day Secondary School, Tukur Tukur.

(8) Government Day Girls' Secondary School, Kofan Gaya.

(9) Zaria Teachers' College.

(10) Government Day Secondary School, Giwa.

3.2 The Student's Questionnaire

A questionnaire is an inquiry form used as a substitute for personal interview. The inquiry form was used in order to gather information on what and

how the students felt about the integrated science course. It was also used to gather information about the specific activities the teachers and their pupils engaged in while operating the integrated science curriculum materials.

Twenty five (25) questions and statements representing various attributes of the NISP were contained in the questionnaire. A five-point Likert scale was developed and respondents were asked to indicate on the scale their respective degree of agreement with each of the attributes. The items of the questionnaire were introduced by a brief explanation of what it was designed for, and how it was to be completed.

There were two sections; Section I asked questions relating to sex, age, number of integrated science periods in a week, number of periods allocated to practical work and to theory.

Section II consisted of statements pertaining to the teachers' instructional methodology from the point of view of the students, application of what is learnt in integrated science by students, text book availability, change of attitude to science

which may be credited to the integrated science course, laboratory facilities, mathematical background of the students and the level of comprehension of integrated science by the students.

3.3 The Teacher's Questionnaire

The teacher's questionnaire was also to gather information about what and how the teachers felt about the integrated science curriculum. It was also used to gather information about some activities the teachers engaged in while using the curriculum materials.

Twenty nine questions and statements were contained in the questionnaire. A five-point Likert scale was also developed and teachers were asked to indicate on the scale their degree of agreement with each statement.

The questionnaire consisted of three sections; Section I asked questions relating to sex, age, academic qualification, length of time of teaching integrated science, the number of periods taught in each class in a week.

Section II consisted of statements pertaining to the methodology of the NISP texts, teacher's training for integrated science, size of the class

being taught, degree of effective feedback from the teachers to the curriculum planners, level of participation of classroom teachers directly in the curriculum design, adequacy of time available for teaching the course and availability of funds for teaching the course.

Section III consisted of statements related to the instructional methodology used by the teachers. It also asked the teachers to report the relative frequency of occurrence of some specific classroom activities during their science lessons.

Both questionnaires were modified and approved by Dr. P. Asun, the researcher's supervisor as suitable instruments for obtaining data on the problems of the study. Samples of the questionnaires are shown on Appendix A and B.

3.4 Treatment of Data

Each item on each questionnaire was coded by the researcher. The analysis of the data was ca carried out at the Iya Abubakar Computer Centre at the Ahmadu Bello University, Zaria. The Statistical Package for the Social Sciences (SPSS) was employed. The frequency distributions of the students' responses as well as those of the teachers were determined.

The percentage frequencies of these same responses were also found.

Contingency table (cross tabulation) analysis and chi-square (X^2) tests were also employed.

All tests were taken at 0.05 level of significance. For the testing of the hypotheses, items on the questionnaire were grouped together as shown.

Grouping of Students' Questionnaire

	Group	Questionnaire items
(1)	Textbooks	10, 11 and 16
(2)	Attitude	17 and 20
(3)	Methodologies of Teachers	2, 3, 4, 5, 6, 7, and 9
(4)	Application	15, 16 and 17
(5)	Activity	14
(6)	Laboratory/Equipment	12 and 13

Grouping of Teachers' Questionnaire

Group	Questionnaire items
Background in basic sciences	2, 3, 4, 5 and 6
Equipment	7
Methodology	1, 2, 3 and 8
Apply	21
Periods	6
Coverage	16

CHAPTER 4

4.0 RESULTS, ANALYSIS AND DISCUSSIONS

4.1 Introduction

This chapter contains the results obtained from the study. The main focus was on the factors that could affect the teaching and learning of integrated science. The study sought to gather information from students and teachers who are the principal dramatist personae in implementing the integrated science curriculum at the classroom level.

By collecting the views both of the teachers and the students about the teaching and learning of integrated science, it was hoped that such would mutually validate the other i.e. the views of one cross-checking the truth of the other.

4.2 Results and Analysis

Tables 1, 2, 3 and 4 are in respect of students, while tables 5, 6 and 7 are in respect of teachers.

Table 1

Factor of number of integrated science periods per week

No. of Periods per week	No. of students	Percentage frequency
2	91	22.7%
3	245	61.2%
4	63	15.8%
5	1	0.2%
Total	400	100%

Table 1 shows that:

(1) 91 students indicated that they had 2 periods of integrated science in a week.

(2) 245 students indicated that they had 3 periods of integrated science per week.

(3) 63 students indicated that they had 4 periods of integrated science in a week.

(4) Only one student indicated that they had 5 periods of integrated science in a week.

Table 2

Number of integrated science theory periods per week

Theory periods per week	Number of students	Percentage frequency
All periods for theory	330	82.5%
2 " " "	36	9.0%
3 " " "	24	7.0%
4 " " "	4	1.0%
No response	2	0.5%
Total	400	100%

Table 2 shows the following:

(1) 330 students agreed that all their periods were used for theoretical lessons.

(2) 36 students indicated that 2 of their integrated science lessons were used for theoretical lessons.

(3) 24 students indicated that 3 of their integrated science lessons were used for theoretical lessons.

Table 3

Number of integrated science periods used for practical lessons

No. of Periods	No. of students	Percentage frequency
None	378	94.5%
3 periods	5	1.2%
2 "	15	3.8%
All of them	2	0.5%
Total	400	100%

Table 3 shows that:

378 students indicated that none of their integrated science lessons were used for practical lessons.

Table 4

Students' responses on the instructional methodologies of the teachers

	Disagree	Agree
All questions	0	12
7 "	4	44
6 "	21	80
5 "	41	103
4 "	95	0
3 "	0	0
2 "	0	0
1 "	0	0
Total	161	239
% Total	40.25%	59.75%

Table 4 shows that:

239 students (59.75%) agreed that the instructional methodologies of their teachers were good.

Table 5

Number of integrated science periods taught by teachers per week

No. of periods	No. of teachers	Percentage frequency
2	0	0.0%
3	30	75.0%
4	8	20.0%
5	2	5.0%

Table 5 shows that:

(1) 30 teachers indicated that they had 3 periods of integrated science in a week.

(2) 8 teachers indicated that they had 4 periods of integrated science in a week.

(3) Only 2 teachers showed that they had 5 periods of integrated science in a week.

Table 6

Summary table of activities carried out by teachers

		Disagree	Agree
(1)	Tell the class the purpose of the lessons	6	34
(2)	Tell the class facts relating to the lessons	0	40
(3)	Ask pupils questions to recall information	11	29
(4)	Use teacher's guides to plan my lessons	33	17
(5)	Use the blackboard very much during my lessons	1	39
(6)	Use other aids, e.g. charts, models and apparatus for teaching	19	21
(7)	Present situations that encourage and improve scientific skills and techniques	16	24
(8)	Provide apparatus for the pupils to carryout investigations on their own	30	10

Table 7

Inability of teachers to cope with integrated science for want of knowledge in chemistry, physics, biology and maths

Subject	Disagree	Agree	Total
Chemistry	18	22	40
Biology	36	4	40
Physics	18	22	40
Maths	32	8	40

Table 7 shows that:

(1) 22 teachers agreed that they could not cope with integrated science for want knowledge in chemistry.

(2) 4 teachers agreed that they could not cope with integrated science teaching for want of knowledge in biology.

(3) 8 teachers indicated that they could not cope with integrated science teaching for want of knowledge in mathematics.

(4) 22 teachers also agreed that they could not cope with integrated science teaching for want of knowledge in physics.

Table 8

Frequency showing students' response to questionnaire items

	Items	Agree	Percentage %	Disagree	Percentage %
1.	My teacher always asks us to collect materials we see around us for our science lessons.	152	38.0	248	62.0
2.	Our teacher usually demonstrates experiments for us in the laboratory.	98	24.5	302	75.5
3.	Our teacher uses everyday life situation (common examples) around us to illustrate all the major topics of Integrated Science.	295	73.7	105	26.2
4.	Our teacher gives us assignments from the workbook.	212	53.0	188	47.0
5.	Our teacher always asks us questions during the integrated science lessons.	350	87.5	50	12.5
6.	Our teacher always explains to us why he/she is teaching us a particular topic.	273	68.2	127	31.7
7.	Our teacher always uses aids like models and apparatus to show what he/she is teaching us.	157	39.2	243	60.7
8.	Our teacher always uses the blackboard very much during our Integrated Science lessons.	349	87.2	51	12.7
9.	I have the Integrated Science textbook for my own use.	279	69.7	121	30.2
10.	I have the Integrated Science students' workbook for my own use.	262	65.5	138	34.5

	Items	Agree	Percentage %	Disagree	Percentage %
11.	I understand the Integrated science textbook.	325	81.3	75	18.8
12.	We always perform experiments in Integrated Science in the laboratory.	102	25.5	298	74.5
13.	We cannot perform experiments in Integrated Science because we do not have a laboratory in my school.	135	33.7	265	66.2
14.	Our teacher does not allow us to perform experiments in Integrated Science for ourselves.	216	54.0	184	46.0
15.	I apply much of the things I learn in Integrated Science to my everyday life situation.	329	82.2	70	17.5
16.	The Integrated Science workbook helps me to understand what my teacher teaches me.	341	85.3	58	14.5
17.	As a result of being taught Integrated Science my attitude has changed positively towards science.	278	69.5	122	30.5
18.	Integrated science has helped me to know more about my body.	363	90.8	37	9.2
19.	I cannot cope with learning Integrated science because I don't know mathematics.	116	29.0	284	71.0
20.	Integrated science is a very easy subject.	213	53.3	187	46.7

Table 9

Frequency showing teachers' responses to questionnaire items

	Items	Agree	Percentage %	Disagree	Percentage %
1.	Teachers do not have enough knowledge about the Integrated approach of science teaching	27	67.5	13	32.5
2.	I cannot cope with teaching Integrated Science course for want of knowledge in Biology, Chemistry and Physics	6	15.0	34	85.0
3.	I cannot cope with teaching Integrated Science course for want of knowledge in Chemistry	22	55.0	18	45.0
4.	I cannot cope with teaching Integrated Science for want of knowledge in Biology	4	10.0	36	90.0
5.	I cannot cope with teaching Integrated Science for want of knowledge in Physics	22	55.0	18	45.0
6.	I cannot cope with teaching Integrated Science for want of knowledge in Mathematics	8	20.0	32	80.0
7.	I do not allow my students to perform experiments by themselves because the laboratory in my school is not well equipped	31	77.5	9	22.5
8.	My students do not perform experiments because they are too many for the size of the laboratory	31	77.5	9	22.5
9.	Integrated Science curriculum planners do invite teachers to send the problems they encounter in teaching Integrated Science	6	15.0	34	85.0
10.	Practising Secondary School Science teachers are involved in the Integrated Science curriculum planning and development at the national level	4	10.0	36	90.0

	Items	Agree	Percentage %	Disagree	Percentage %
11.	As a teacher, I prefer the inquiry method to the traditional method of teaching Integrated Science	15	37.5	25	62.5
12.	My principal usually gives me money to buy materials needed for my Integrated Science lessons whenever I ask	2	5.0	38	95.0
13.	I have everyday life situation to illustrate all the major topics of Integrated Science	14	35.0	26	65.0
14.	Generally, teaching Integrated Science lesson demands more time to prepare the lessons	37	92.5	3	7.5
15.	I find the Integrated Science syllabus content too extensive for the hours available to teaching the subject	34	85.0	6	15.0
16.	My students possess the prescribed Integrated Science textbooks	2	5.0	38	95.0
17.	I always give Integrated Science assignments to my students from their workbook	23	57.5	17	42.5
18.	Students have and use the accompanying workbooks to the prescribed textbooks	2	5.0	38	95.0
19.	The students' workbook does not aid the learning of the principles/concepts of the Integrated Science	3	7.5	37	92.5
20.	My students demonstrate improved scientific attitudes as a result of the integrated science course	29	72.5	11	27.5

4.3 Hypothesis Testing

Hypothesis 1

Background in the basic sciences does not significantly affect the level of ease of teaching integrated science.

Table 10

Level	Background in basic sciences					
	0	1	2	3	5	Total
Low	9	1	0	2	1	13(32.5%)
High	3	7	10	6	1	27(67.5%)
Total	12	8	10	8	2	40(100%)
% Total	30%	20%	25%	20%	5%	

Chi-square (X^2) = 16.63818

degree of freedom (df) = 4

significance (p) = 0.0023

Table 10 shows that:

(1) 13 out of 40 teachers agreed that they had a low level of ease of teaching integrated science i.e. they find integrated science difficult to teach.

(2) 27 out of 40 teachers agreed that they had a high level of ease of teaching integrated science i.e. they find it easy to teach.

Since the significance Level (0.0023) is less than 0.05, then there is a high association between background in basic sciences and level of ease of teaching integrated science. Therefore, background in the basic sciences significantly affects the level of ease of teaching integrated science.

This hypothesis is therefore rejected.

Hypothesis 2

The number of periods allocated to teaching integrated science in a week does not significantly affect the coverage of the subject syllabus by the teachers.

Table 11

Number of periods by coverage of integrated science syllabus

No. of period	can cover syllabus i.e. not too extensive	cannot cover syllabus i.e. too extensive	Total
3	3	27	30(75.0%)
4	2	6	8(20%)
5	1	1	2(5%)
Total	6	34	40
% Total	15%	85%	100%

X^2 = 3.13725

dof = 2

Significance = 0.2083

Table 11 shows the following:

(1) 30 teachers out of 40 sampled had 3 periods a week in a class for integrated science.

(2) 8 indicated that they had 4 periods a week.

(3) 2 indicated that they had 5 periods a week.

(4) None of the teachers had 1 or 2 periods a week for integrated science.

(5) 6 out of 8 who had 4 periods agreed that the syllabus was too extensive.

(6) 27 out of 30 teachers who had 3 periods agreed that the syllabus was too extensive.

(7) I out of 2 who had 5 periods also indicated that the syllabus was too extensive.

A significance Level of 0.2083 shows that there is no association between number of periods allocated to the teaching of integrated science and the coverage of the syllabus. Therefore the periods allocated to the subject on the time table are not enough to cover the course.

This hypothesis is accepted.

Hypothesis 3

There is no relationship between possesion of integrated science texts by the students and their attitude towards the subject.

Table 12

Text by attitude

Text	Attitude				
	0	1	2	Total	% Total
0	3	2	0	5	1.2%
1	5	18	8	31	7.7%
2	16	38	27	81	20.2%
3	22	47	43	112	28.0%
4	19	73	78	170	42.5%
Total	65	179	156	400	100%
% Total	16.2%	44.8%	39.0%		

X^2 = 18.85467

dof = 7

Significance = 0.0408

Table 12 can be interpreted thus:

(1) 19 out of 170 students who claimed that their attitudes had not changed did not have the integrated science text books.

(2) 73 out of 170 students who claimed to have the text books indicated that their attitude towards integrated science was slightly changed.

(3) 78 students out of 170 who had the textbooks claimed that their attitudes had completely changed positively towards the subject.

The significance of 0.0408 shows that there is a relationship between the possession of integrated science textbooks and favourable attitude towards the subject.

It also means that possession of integrated science text books significantly affects attitudes of the students towards the subject.

This hypothesis is rejected.

Hypothesis 4

The instructional methodologies of the teachers do not promote the students' understanding of integrated science.

Table 13

	Understanding						
Method	0	1	2	3	4	Total	%Total
0	0	0	0	1	0	1	0.2%
1	1	2	1	0	0	4	1.0%
2	0	1	8	6	0	15	3.7%
3	2	8	15	27	0	52	13.0%
4	1	4	21	61	0	87	21.7%
5	0	5	18	96	0	119	29.8%
6	1	3	19	56	0	79	19.8%
7	0	2	6	25	0	33	8.2%
8	0	0	3	6	1	10	2.5%
Total	5	25	91	278	1	400	100%
%Total	1.2%	6.3%	22.7%	69.5%	0.2%	100%	

X^2 = 104.45371

dof = 32

Significance = 0.000

Table 13 shows a significance of 0.000, and this means that the methodologies of the teachers significantly affects the students' understanding of integrated science. Therefore, good teaching by the teachers promotes students' understanding of the subject. This hypothesis is therefore rejected.

Hypothesis 5

Availability of science laboratories and equipment to the integrated science class in a school does not significantly affect students' activities in the subject.

Table 14

Activity by Lab

Lab	Activity		
	0	1	Total
0	138	127	265 (66.2%)
1	78	57	113 (33.7%)
Total	216	184	400
%Total	54.0%	46.0%	100%

X^2 = 0.95245

df = 1

Significance = 0.3291

The significance of 0.3291 shows that the availability of a science laboratory in a school is not associated with activities carried out by integrated science students. This means that students can still carry out activities in integrated science without using a laboratory. This hypothesis is accepted.

4.4 Discussion

The rejection of hypothesis 1 shows that background in the basis sciences (physics, maths, chemistry and biology) significantly affects the level of ease of teaching integrated science. According to Table 9 (page 72) out of 40 teachers involved in the study, 27 of them (67.5%) agreed that teachers did not have enough knowledge about the integrated approach of science teaching.

Table 7 (page 69) shows that 22 teachers out of 40 sampled agreed that they could not cope with the teaching of integrated science for want of knowledge in chemistry; the same number (22) also indicated that they could not cope with integrated science teaching for want of knowledge in physics; 4 teachers indicated that they could not cope for want of knowledge in biology while 8 of them claimed that they could not cope for want of knowledge in maths.

These results show that integrated science teachers are not qualified to teach the course because of their inadequate training in the basic sciences. These findings are in general agreement with those of Odunbunmi (1980, Jegede (1982), Olarewaju and Balogun (1984) as earlier mentioned.

The results show that most of the teachers indicated that the laboratory equipment for integrated science were not adequate. 77.5% of the teachers claimed that their students could not perform experiments by themselves because the laboratories in their schools were not well equipped (Table 9 (page 72).

From Table 8 (page 70) there were 298 students which is 74.5% of sample who indicated that they did not perform experiments in integrated science in the laboratory. 302 students (75.5%) also agreed that their teachers did not demonstrate experiments for them. Since the students did not perform experiments, then all or most of the periods of integrated science were devoted to theory lessons as is shown on Table 2 (page 64) where 330 students (82.5%) indicated that all their periods were used for theoretical lessons. Table 3 (page 65) shows that 378 students claimed that none of their integrated science periods was used for practical work.

These results show that laboratory equipment for integrated science teaching are inadequate. This finding is in agreement with those of Aminu (1979), Alaiyemola (1977) and Jegede 1982 as mentioned already.

Results show that the number of periods allocated to integrated science in a week does not significantly affect the coverage of the subject by the teachers. This could be interpreted to mean that there is no association between number of periods allocated to integrated science in a week and coverage of the subject by the teachers. Therefore, the periods are not enough to cover the course syllabus. The timetable allocation of two double periods of 40 mins each per week (a total of 160 minutes weekly) at the very least was suggested in the integrated science curriculum (Arogundade, 1983).

Table 1 (page63) shows that majority of the students (61.2%) indicated that they had 3 periods of integrated science in a week. Table 5 (page 67) also shows that majority of the teachers (75.0%) had 3 periods of integrated science a week in a class.

27 out of 30 teachers who had 3 periods of integrated science a week claimed that the integrated science syllabus was too extensive (Table 11 page 76). 6 out of 8 teachers who had 4 periods agreed that the syllabus was too extensive. Even 1 teacher out 2 who had 5 periods still claimed that the syllabus was too extensive.

These findings show that enough periods are not being allocated to integrated science on the school time table. In schools where the J.S.S. students attend school in the afternoon, this means that only 90 minutes are used for integrated science in a week in a class because 30 minutes are spent on a period. On Fridays, 25 minutes are spent on a period! In most cases there are no double periods. It is not surprising therefore that 85.0% of the teachers indicated that they found the integrated science syllabus content too extensive for the hours available to teaching it (Table 9 (page 72). The finding that teachers cannot cover the integrated science syllabus because of inadequate periods is in agreement with that of Olarewaju (1987) as mentioned earlier.

This research has revealed that there is a relationship between the possession of integrated science textbooks and attitudes of students towards the subject. Even though the hypothesis is rejected, it shows that possesion of the integrated science textbooks (pupils' text book and workbook) significantly affects the attitudes of integrated science students favourably.

Table 8 (page70) shows that 279 students (69.7%) agreed that they had the integrated science pupils' textbooks for their own use. 262 students also indicated that they had the integrated science workbook for their own use. 341 students also claimed that the workbook helped them to understand what their teachers taught them (i.e. the workbook was helpful).

Results of this study have shown that the instructional methodologies of the teachers significantly promotes the students' understanding of integrated science. Therefore, good teaching by the teachers promotes students' understanding of integrated science. Table 4 (page 66) shows that out of 400 students used for the study, 239 of them claimed that their teachers' methodology was effective 161 students did not agree that their teachers' methodology was effective.

Even though the students claimed that, their teachers' methodology was good, 243 (60.7%) disagreed that their teachers used aids like models and apparatus (Table 8 page 70). 53.0% of the students agreed that their teachers gave them assignments from the workbook while 57.5% of the teachers claimed that they always gave integrated science assignments to their students from the workbook. Table 6 (page 68) shows that 52.5% of the teachers used teaching aids. These results show that

teachers of integrated science do not use teaching aids and the workbook as much as is expected even though 92.5% of them agreed that the students' workbook can aid the learning of the principles/concepts of the integrated science curriculum (Table 9 page 72). 33 out of the 40 teachers sampled indicated that they did not use the teacher's guides to plan their lessons as shown on Table 6 (page 68). Oyewole (1971) said that the pupils' textbooks, pupils' workbooks (for practical work) and teachers' guides are means of seeking a valid answer to the major problem of establishing experimental method as the basis for science education in Nigeria. This objective of STAN is yet to be properly achieved.

The majority of the teachers (77.5%) indicated that they did not allow their students to perform experiments because their school laboratories were not well equipped or that their students were too many for the size of the laboratories (Table 9 page 72). Results from this study show that students can still carry out activities in integrated science without using a laboratory as pointed out on Table 14 (page 81).

Akpan (1983) in previewing the STAN integrated science texts, discovered that much of the content (75.7%) is improvisable while 24.3% is non-improvisable.

Integrated science teachers therefore cannot be excused for not improvising in their teaching. They should make use of the local materials of their immediate environments, and also make effort to carry out activities in classrooms other than the laboratories.

Except the activity methods as spelt out in the workbook are competently and honestly applied, efforts at developing inquiring minds may not be achieved. Science is best learnt not by describing, but by doing.

Other findings which do not have any statistical significance but which are related to the study are: Majority of the teachers (72.5%) agreed that their students showed positive attitudes towards science as a result of the course. (Table 9 page 72) 69.5% of the students agreed that their attitudes changed positively towards science as a result of being taught integrated science (Table 8 page 70).

Table 8 (page 70) shows that 62.0% of the students sampled claimed that their teachers did not ask them to collect materials they saw around them for their integrated science lessons. This shows that students were not encouraged to learn by the inquiry method.

The fact that 82.2% of the students said that they applied much of the things they learned in integrated science to their everyday life situation, and 90.8% of them also said that integrated science helped them to know more about their bodies (Table 8, page 70) shows that one of the objectives of the NISP, namely students should be able to apply previous knowledge to new situations is being achieved. Indeed, integrated science can go a long way to popularize science and equip students to live effectively in our modern age of science and technology.

Practising secondary school science teachers are not usually involved in the integrated science curriculum planning and development at the national level as is indicated by 90% of the teachers sampled. 85% of the teachers also indicated that integrated science curriculum planners did not invite teachers to send the problems they encountered when teaching the syllabus (Table 9 page 72).

The results of the study shows that 92.5% of the teachers claimed that teaching integrated science lessons demanded more time to prepare the lessons, and 95.0% of them also indicated that their principals were not giving them money to buy materials needed for their integrated science lessons (Table 9 page 72).

CHAPTER 5

SUMMARY, GENERALISATIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter contains the summary of the findings of the present study. The limitations and problems encountered during the conduct of this study are discussed, and some recommendations on how to improve the teaching and learning of integrated science are made.

5.1 Summary

This study was an attempt to find out some of the factors that are in control of the teaching and learning of integrated science.

Ten post primary schools in and around Zaria were used for the study. 400 students and 40 teachers participated in the study.

Participation in the study was limited to those students who had been taught integrated science for at least two years, and teachers who were teaching the subject at the time of the study.

The following hypotheses were stated for the study:

(1) Background in the basic sciences does not significantly affect the level of ease of teaching integrated science.

(2) The number of periods allocated to teaching integrated science in a week does not significantly affect the coverage of the subject by the teachers.

(3) There is no relationship between possesion of integrated science texts by the students and their attitude towards the subject.

(4) The instructional methodologies of the teachers do not promote the students' understanding of integrated science.

(5) Availability of science laboratories and equipment to the integrated science class in a school does not significantly affect students' activities in the subject.

In order to test these hypotheses, two questionnaires were used, one for the students and the other for the teachers. The students' questionnaire was designed to gather information on what and how they felt about the integrated science course, and the specific activities the teachers and their pupils engaged in while using

the curriculum materials. A five-point Likert scale was developed and respondents were asked to indicate on the scale their respective degree of agreement with each of the attributes.

The teachers' questionnaire was also designed to gather information about what and how they felt about the integrated science curriculum, and some of the activities they engaged in while using the curriculum. A five-point Likert scale was also developed and the teachers were asked to indicate on the scale their degree of agreement with each statement. The items on each questionnaire were grouped together as shown on page 61.

The frequency distributions of responses from both students and teachers were determined. Contingency table analysis and chi-square (X^2) tests were also employed.

The hypotheses were tested at the 0.05 level of significance.

For the first null hypothesis, the chi-square (X^2) analysis,of 16.63818 and significance (p) of 0.0023 showed that background in the basic sciences significantly affects the level of ease of teaching integrated science. This hypothesis was therefore rejected.

Chi-square (X^2) analysis of 3.13725 and p.= 0.2083 showed that there is no association between the number of periods allocated to integrated science teaching in a week and the coverage of the syllabus. This means that the periods allocated to integrated science on the time table are not enough to cover the course. This hypothesis was accepted.

For the fourth hypothesis, results show that there is a relationship between the possesion of integrated science texts by students and their attitude towards the subject. This means that possesion of integrated science texts significantly affects students' attitudes towards the subject (X^2 = 18.85467, P = 0.0408). This hypothesis was rejected.

Results of this study show that the instructional methodologies of the teachers significantly promote the students' understanding of integrated science (X^2 = 104.45371, P = 0.000). This hypothesis was therefore rejected.

On the availability for use of science laboratory in a school and the students' activities in integrated science, a Chi-square of 0.95245 and significance of 0.3291 showed that the availability of a science laboratory in a school is not associated with activities carried out by integrated science students. This hypothesis was accepted.

Other findings from the results are that:

Majority of the students agreed that integrated science changed their attitudes positively towards science, and many of the teachers also agreed that their students showed positive attitudes towards science.

Many of the students claimed that their teachers did not ask them to collect materials around them for their lessons.

5.2 Limitations of the Study

During the conduct of this study, a number of problems, particularly those associated with the data collection procedure were noted.

1. Due to limited time and distance between schools in the local government area, it was not possible to visit every school, so the research was limited to schools in and around Zaria.

2. 600 questionnaires were sent out, but only 400 were returned. Being mostly day schools, probably some of the students did not come to school

on the day the questionnaires were collected.

(3) Out of 60 questionnaires distributed to the teachers, only 40 responded. This non-challant attitude of some teachers poses a problem to researchers.

5.3 Generalizations

Within the limitations of this study, the following generalizations could be made.

(1) Even though integrated science is the prescribed science of the Junior Secondary School, relatively few teachers of this subject are really confident to teach it. They are not adequately equipped by their pre-service training to present science in its integrated form due to their shortcoming in one science discipline or the other. The stumbling block in this

teaching aids like models and charts as much as is expected. Integrated science teachers rarely use the teachers' guides to prepare their lessons.

(6) Absence of laboratories and equipment does not stop the students from carrying out integrated science lessons.

(7) Integrated science has changed students' attitudes positively towards science and students apply much of what they learn in it to their everyday life.

(8) Practising secondary school science teachers think that they are not usually involved in the integrated science curriculum planning at the national level, and curriculum planners do not ask for feedbacks from the teachers.

(9) Principals do not give integrated science teachers money to buy materials for their lessons.

(10) Students are not encouraged to learn by the inquiry approach.

5.4 Conclusion

The results of this study show that the following are some of the factors that are considered as being important in integrated science teaching and learning.

(1) Teachers' training background in the basic sciences.

(2) Inadequacy of periods allocated to integrated science on the school time table.

(3) Possession of integrated science text books by students.

(4) Lack of laboratory equipment and materials for integrated science.

(5) Inadequate use of workbooks, teachers' guides and teaching aids by teachers.

(6) Large number of students in an integrated science class.

(7) Lack of fund to buy materials for integrated science lessons.

5.5 Recommendations

From this study, it is obvious that one of the factors affecting integrated science teaching in Nigeria is the inadequate training of the teachers teaching it in the schools. It is therefore recommended that our teacher training should be continuous.

In-service training for teachers of integrated science and all other teachers of specialist subjects should be arranged by each state during the school holidays on a continuous basis. The subject specialist teachers should be reoriented to accepting integrated science as intellectually and professionally respectable (Haggis, 1974). In Nigeria, integrated science seems to be looked on as a subject which is meant for the lower classes. As a result, the senior teachers who do not find it respectable leave the subject to be taught by newly qualifed teachers or the N.C.E. teachers. Experienced teachers who have been attending workshops and inservice courses should teach integrated science.

The science teacher must consider himself a continuing student, and he should take advantage of seminars, workshops and courses to bring himself up to date. Teachers should also be encouraged to seek help from one another, particularly from other science subject specialists in order to integrate the concept, skills and activities they present to the students.

Another aspect of the integrated science teacher training is the pre-service training. There is a

need to structure the training of integrated science teachers along the line the single science subject teachers are being trained. For example, integrated science should be an option to be studied together with education up to the degree level in all faculties of education in Nigerian universities. A similar structure should be introduced in all colleges of Education. In planning such a teacher training programme, there is a need to take into consideration the science background of the would be teachers, whether they studied science in the primary or secondary schools, the strategy through which they learned science i.e. guided discovery, inquiry learning or the memorization of science facts, their attitude towards science and teaching science as integrated. The teacher training programme must include the improvisation of materials and exploration of the environment. The teacher must be well trained to see his environment as his initial laboratory.

School proprietors must be prepared to buy materials needed by the teachers for improvisation.

Classrooms can be converted into integrated science "laboratories" where there are no laboratories.

Students should be encouraged to work in groups so that they can share equipment and facilities.

Schools should allocate the recommended four hours a week for integrated science on the school time table.

Teachers of integrated science should be encouraged to use the workbooks and teachers' guides appropriately. Schools should provide these text books for the teachers.

Practising secondary school science teachers should be involved in integrated science curriculum planning and improvement at the national level. Integrated science curriculum planners should invite feedback from the classroom. Such would highlight problems the teachers have with the curriculum.

Both the federal and state governments should render all possible assistance to schools to provide adequate learning environment where students may be helped to learn science through discovery, inquiry and field experiences. To this end, fewer students should be put in classrooms and teachers with better science educational qualification should be employed. Less crowded schedules of teaching should be given to each teacher of integrated science. Teachers of integrated

science should use audiovisual aids to truly aid teaching and learning.

Since integrated science deals mostly with things that can be found in a learner's environment, teachers' complaints of lack of learning materials is certainly unacceptable. Most of the pieces of equipment can be purchased locally. With the present economic recession it is unwise for any science teacher to place all his hope on imported scientific equipment. Workshops on improvisation of equipment should be organised by each state on a regular basis. Science fairs should also be organized so that teachers can display improvised integrated science equipment. Schools with best improvised equipment should be awarded prizes.

The core curriculum for integrated science should be revised with particular reference to the content vis-a-vis the level of students and amount of time available to students and teachers.

Students should be encouraged to buy the integrated science textbooks.

5.6 Implications for further

The bulk of the solution to the problems of integrated science teaching lies in sound teacher training. So

research studies should be carried out to improve the content and the learning activities of integrated science in teacher education programmes at all levels. The research studies should include investigations into the realities of the environment in the classrooms in which the curriculum is implemented. Such studies for example should investigate: -

(i) the training of the science teachers,

(ii) over-crowding of the classroom,

(iii) the science teaching facilities in the schools,

(iv) the extent to which teachers improvise materials,

(v) methods of getting feedback from the teachers of integrated science to the curriculum designers and innovators.

Classroom observation instruments should be developed to monitor the classroom activities of the teachers and students during integrated science instruction. Such instruments should be used to monitor the strength and weaknesses of instruction, text and curriculum. These instruments could also be of use during orientation workshops for teachers of integrated science.

This study can be replicated in some other parts of the country. In addition there can be a survey that covers all the states of the federation.

Since the integrated science curriculum is mainly activity oriented, there is need for further studies to be carried out on how integrated science equipment can be improvised. Results of such studies can be written in the form of handbooks for teachers, so that those who were not trained to improvise can follow the procedure in the handbooks.

References

Akanbi, T. 1978. An investigation into the adequacy of the STAN Integrated Science Textbooks. JSTAN. Vol. 16, No. 2, 11-14.

Akpan, O. E. 1983. Teacher's Training: A problem in Integrated Science. Proceedings of the 24th Annual Conference of STAN. 114-121.

Alaiyemola, F. F. 1977. The Teaching of Integrated Science in the Post Primary Institutions of Kaduna. Unpublished P.G.D.E. Thesis. Ahmadu Bello University, Zaria.

Aminu, D. M. 1979. A survey of the teaching of integrated science in Kaduna State. JSTAN. Vol.18, No.I.

Andrew, M. D. 1970. Schools, Science and Society, Science Education. Vol. 54, No. 4, 319-324.

Apea, E. 1980. Science Education of the African child; Economic Constraints on Science Teaching; In: Varda Bhatta Char, S. V. Proceedings of the 24th Annual Conference of STAN, 179-182.

Arogundade, O. B. 1983. Integrated Science in Nigeria: Problems and Prospects. Proceedings of the 24th Annual Conference of STAN, 221-226.

Asonibare, B. 1984. The Nigerian Science Teachers and Stress Management". J.STAN, Vol. 22, No. 2, 14-19.

Asun, P. 1983. The Federal Core Curriculum for Integrated Science: What is it? Proceedings of the 24th Annual Conference of STAN. Jos. 129-134.

Asun, P. 1985. Coping with the Teaching of the Junior Secondary School Science. Paper presented at the National Workshop on Problems and Implications of the 6-3-3-4 Policy on Nigerian Education, at the Ahmadu Bello University, Zaria, 8-12 July.

Awokoya, S. O. 1961. "Science Education in Africa". Paper presented at the African Summer Study, Endicott House, Water town, Massachusetts: Educational Services Incorporated.

Bajah, S. T. 1981. Dichotomy of Science and Superstitious beliefs. Recognition in Science education for Africa. JSTAN. Vol.20, No.1, 22-32.

Bajah, S. T. 1983. "Crisis in our classroom: A contextual Appraisal of Integrated Science Education in Nigeria. Presidential Address. Proceedings of the 24th Annual Conference of STAN. Jos. 11-15 Sept.

Bankefa, R. A. 1976. Problems in the Teaching of Integrated Science in Secondary Schools. Mimeographed, Faculty of Education, University of Ibadan.

Binder, A. 1971. Proposition Pour Integer Les Enseignments Scientifiques Par une Formulation Operationalle des Objectifs D'education.

Blum, A. 1973. Towards a rationale in Integrated Science teaching. In: New Trends in Integrated Science teaching. Vol.II. Paris, UNESCO.

Bomide, G. S. 1983. Pupil-Perceived Difficulties in the Contextual Material of Nigerian Integrated Science: A case study of Jos Local Government Area, Plateau State. Proceedings og of the 24th Annual Conference of STAN. Jos 11-15 Sept.

Brown, S. A. 1974. Integrated Science - A useful Innovation. Education in Science. September.

Brown, S. A. 1977. A review of the meanings of and Arguments for Integrated Science. Studies in Science Education. Vol.4

Brown, S. M. 1978. Integrated Science Education World-wide, International Conference. Nijmegen Netherlands.

Carter, J. 1972. In my opinion: Inter-disciplinary science courses. American Biology Teacher. Vol. 33, No. 3, 30.

D'Arbon, J. A. 1972. A study of the concept of Integration of Science subjects in secondary schools. Unpublished M.Sc. Thesis. Macquarie University, N. S. W. Australia.

De Rose, J. V. et al 1979. "The teacher is the key a report on three NSF studies". The Science Teacher. 31-37.

Federal Republic of Nigeria, 1981. National Policy on Education. Federal Ministry of Information, Printing Division, Lagos.

Flavel, J. 1963. The Developmental Psychology of Jean Piaget. Princeton: Van Nostrand.

Foecke, H. A. 1974. The Education of Teachers of Integrated Science: Some Basic Questions and Proposed Answers. New Trends in Integrated Science Teaching. Vol.III. Paris. UNESCO.

Gilbert, P. G. S. & Lovegrove, M. N. 1968. Science Education in Africa. A report of the sixth Loverhulme Inter-University Conference in Africa. University of Malawi, Malawi, Heinemann Publishers, London.

Gyuse, E. Y. & Akinmade, C. T. O. 1986. A Study of some of the factors affecting science achievement at the Junior Secondary School Level. Paper presented at the 27th Annual Conference of STAN, Federal University of Technology, Owerri.

Haggis, S. 1974. Integrated Science - A Challenge to the Science Teacher: New Trends in integrated science teaching. Vol.III. Paris. UNESCO.

Inhelder, N. and Piaget, J. 1958. The Growth of Logical Thinking from Childhood to Adolescence. New York: Basis Books.

Inter-Union Commission on Science Teaching (ICSU). 1968. "Congress on the Integration of Science Teaching: Conclusion." Extracts from the report of the Congress Organised by the Inter-Union Commission on Science Teaching. (ICSU), Droujba.

Jacobson, W. J. 1971. Integrated Science Programmes for schools and colleges. In: New Trends in Integrated Science Teaching, Vol.I. Paris. UNESCO.

Jegede, O. J. 1981. An Evaluation of the Nigeria Integrated Science Project (NISP). Unpublished Ph.D. thesis. University of Wales.

Jegede, O. J. 1982. Evaluation of the present Nigerian Integrated Science Project. In Okebukola, P. A. O. and Inyang, N. E. U. (Eds.) S.T.A.N. National Workshop on "The New Nigerian Integrated Science Project and the 3-3 Secondary School System, Alvan Ikoku College of Education, Owerri, April 27 - May 1 pp. 22-36.

Jegede, O. J. 1982. An Evaluation of the Nigerian Integrated Science Project (NISP) After a decade of use in the classroom. International Review of Education. Vol. 28, No.3.

Jegede, O. J. 1983. Integrated Science in Nigeria: A review of the problems and Prospects. Proceedings of the 24th Annual Conference of STAN. 209-219.

Jegede, O. J. 1987. Socio-cultural Correlates of Anxiety in Science classrooms: A Preliminary Report Paper presented at NSTA National Convention. Washington D.C. 26-29 March.

Jegede, O. J. & Okebukola, P. A. O. (1988): A suggested curriculum and instruction model for sustaining students' interest in science and technology in a non-western culture. Paper presented at the 29th Annual Conference of STAN. University of Ibadan, 19-24 Sept.

Jungwirth, E. 1960. A study of the Influence of teaching Integrated Subjects in the first grade of Agricultural Secondary Schools. Unpublished Ph.D. Thesis. Hebrew University. Rehovot.

Kooi, S. W. 1977. "Evaluation of Integrated Science teaching in Malasia". In: New Trends in Integrated Science Teaching. Vol.IV. 173-185.

Levy, M. and Blum, A. 1970. Achievement Tests on Let's Grow Plants. Jerusalem: Ministry of Education and Culture, Curriculum Centre.

Lewis, J. 1979. Science in Society. In: New Trends in Integrated Science Teaching. Vol. V. Paris. UNESCO.

Maduabum, M. A. 1983. Effective integrated science teaching for the junior secondary school: Problems and prospects. Proceedings of the 24th Annual Conference of STAN. Jos. 249-252.

Mani, T. C. 1981. The Gap Between the Intended and Operational Forms of the Nigerian Integrated Science Project (NISP) Curriculum. Paper presented at STAN's 22nd Annual Conference, MUCAST, Makurdi.

Mani, T. C. 1981. A study of some aspects of the Intended and Operational forms of the Science Teacher's Association of Nigerian (STAN) Integrated Science Curriculum. Unpublished Ph.D. Thesis. Ahmadu Bello University, Zaria.

Odunbunmi, E. O. 1980. A survey of the Teaching of Integrated Science in some of the Oyo State Secondary Schools. Unpublished M.Ed. Project, University of Ibadan.

Odunbunmi, E. O. 1986. Pre-service science and technological teachers' attitude towards the teaching of Integrated Science and teaching methods employed by them. J.STAN. Vol. 24, Nos. 1 & 2. 209-217.

Odunbunmi, E. O. & Balogun, T. A. 1985. The Attitude of some Nigerian Students Towards Integrated Science. JORIC. Vol.3, No.1, 3-11.

Ogunniyi, M. B. 1983. The Logic and Practice of Integrated Science in Nigeria. STAN 24th Annual Conference Proceedings, 47-57.

Ogunniyi, M. B. 1987. Conceptions of traditional cosmological ideas among literate and non-literate Nigerians. Journal of Research in Science Teaching. Vol. 24, No.2, 107-118.

Okebukola, P. A. O. and Jegede, O. J. 1987. Ecocultural influences upon students concept attainment in Science. Paper presented at the 60th Annual Conference of the NARST. Washington D.C. 23-25 Apr.

Oladimeji, C. A. D. 1978. Improvisation in Integrated Science. J.STAN, Vol. 16, No. 2, 101.

Olarewaju, A. O. 1982. Attitudes and teaching methods of some integrated science teachers relative to the NISP and students' Achievement. In: Olarewaju, A. O. 1983. Proceedings of the 24th Annual Conference of STAN. Jos.

Olarewaju, A. O. 1986. Report on Integrated Science in the Teacher vacation course organized by the Federal Ministry of Education and Ondo State Ministry of Education, Sept. 29-Oct. 24.

Olarewaju, A. O. 1987. Awareness of the Importance and Usefulness of integrated science: A strategy for winning young students for science. Paper presented at the 28th Annual Conference of STAN, Abubakar Tafawa Balewa College, Bauchi, 17-22 August.

Olarewaju, A. O. 1987. Some Problems identified in Implementing the Core Curriculum for Integrated Science. J.STAN. Vol. 25, No. 2, 61-69.

Olarewaju, A. O. & Balogun, T. A. 1984. Attitudes and Teaching methods of some Integrated Science Teachers and Students' Achievement JORIC Vol.2, No.1, 15-27.

Olarinoye, R. D. 1983. The Training of Teachers of Integrated Science. Proceedings of the 24th Annual Conference of STAN. 95-104.

Osondu, C. C. 1976. The Identification of Topic Difficulties in Integrated Science as Perceived by students. Faculty of Education, University of Ibadan. (Mimeographed).

Oyewole, F. 1971. "Presicential address". JSTAN, Vol.10, No. 2, Sept.

Padambo, G. H. 1978. A study of the Attitudes of some Teachers and Students towards Integrated Science. Unpublished M.Ed. Project, University of Ibadan.

Raw, I. 1979. Development in Integrated Science Education in Relation to Nutrition and Health Education. In: New Trends in Integrated Science Teaching. Vol. V. Paris. UNESCO.

Rutherford, J. and Gardner, M. 1971. Integrated Science Teaching. In: New Trends in Integrated Science Teaching. Vol.I, 47-49.

Showalter, V. 1974. Desirable Characteristics of teachers of Integrated Science. New Trends in Integrated Science Teaching. Vol.III, Paris, UNESCO.

Showalter, V. 1975. "Rationale for Unbounded Science curriculum". School Science and Mathematics. 75.

Showalter, V. 1978. "The Case for teaching Science as a unity". In: The Integrated Daily. Nijmegen. Netherlands: ICASE/ICSU/UNESCO/NVON Conference Publication.

Schwab, J. J. 1962. The Teaching of Science as Enquiry. In Schwab, J. J. and Brandwin, F.G. (eds.) The te ching of science, Cambridge, Mass. Harvard University Press.

Science Teachers' Association of Nigeria, 1971. "Integrated Science: A Course for the Junior Forms of Nigerian Secondary Schools". In: New Trends in Integrated Science Teaching. Vol.I: 1969-70 (ed) P.E. Richmond. Paris: UNESCO.

Smith, M. 1984. A Model for Teaching native-oriented science. In: J. J. Gallager and G. Dawson (eds) Science Education and Cultural Environment in the America (Panamcity) 25-31.

Soyibo, K. 1979. The Role of the Nigerian Integrated Science Project in the Teaching and learning of Science with particular reference to Biology. Unpublished M.A. Thesis. Leeds University.

Stake, R. E. et al. 1978. Case Studies in Science Education. Vol.II. Centre for Instructional Research and Curriculum Evaluation. University of Illinois, Urbaba.

UNESCO-UNICEF 1971. Planning for Integrated Science in Africa: Report of the Workshop for Science Education Program Planners in English-Speaking African Countries, Ibadan, Nigeria, Sept. 20 - October 4. Paris. UNESCO-UNICEF.

Yoloye, E. A. 1971. "Towards change in Primary School Science". In: Extracts of the Report of a Conference of African Educators. Kenya, Mombassa: EDC/CREDO.

Yoloye, E. A. 1975. Readability Indices in the Evaluation of Curriculum materials. Journal of Curriculum Studies. Vol.7, No.1

Appendix A

The following statements and questions are designed to find out the factors that are in control of the teaching and learning of integrated science.

Section I

Respond to the following by placing a tick ( ) in the appropriate brackets as applicable to you.

1. Sex: Male ( ) Female ( )
2. Age:
   - Under 10 years ( )
   - 10 - 12 years ( )
   - 13 - 15 year ( )
3. How many periods of Integrated Science do you have in a week?
   - 5 periods ( )
   - 4 periods ( )
   - 3 periods ( )
   - 2 periods ( )
4. How many of these periods are for practical work?
   - None ( )
   - 3 periods ( )
   - 2 periods ( )
5. How many of these periods are theory?
   - All of them ( )
   - 4 periods ( )
   - 3 periods ( )
   - 2 periods ( )

Section II

Study these statements about Integrated Science made by students. Indicate the extent to which you agree with each by circling the appropriate number.

5 means I agree strongly
4 means I agree
3 means I am undecided
2 means I disagree, and
1 mean I strongly disagree

For example:

Integrated science is a very difficult subject circling 4 against the statement means that you agree with the statement.		5 4 3 2 1
1.	My teacher always asks us to collect materials we see around us for our science lessons.	5 4 3 2 1
2.	Our teacher usually demonstrates experiments for us in the laboratory.	5 4 3 2 1
3.	Our teacher uses everyday life situation (common examples) around us to illustrate all the major topics of Integrated Science.	5 4 3 2 1
4.	Our teacher gives us assignments from the workbook.	5 4 3 2 1
5.	Our teacher always asks us questions during the Integrated science lessons.	5 4 3 2 1
6.	Our teacher always explains to us why he/she is teaching us a particular topic.	5 4 3 2 1
7.	Our teacher always uses aids like models and apparatus to show what he/she is teaching us.	5 4 3 2 1
8.	Our teacher always uses the blackboard very much during our Integrated Science lessons.	5 4 3 2 1
9.	I have the Integrated science textbook for my own use.	5 4 3 2 1
10.	I have the Integrated Science students' workbook for my own use.	5 4 3 2 1
11.	I understand the Integrated science textbook.	5 4 3 2 1
12.	We always perform experiments in Integrated science in the laboratory.	5 4 3 2 1
13.	We cannot perform experiments in Integrated Science because we do not have a laboratory in my school.	5 4 3 2 1
14.	Our teacher does not allow us to perform experiments in Integrated science for ourselves.	5 4 3 2 1

Appendix B

The following statements and questions are designed to find out the factors that are in control of the teaching and learning of integrated science.

Section I

Respond to the following by placing a tick ( ) in the appropriate brackets as applicable to you.

1. Sex: Male ( ) Female ( )
2. Age:
   - Under 25 years ( )
   - 25 -30 years ( )
   - 31 - 35 years ( )
   - Over 35 years ( )
3. Academic qualification:
   - Higher School Certificate ( )
   - Nigeria Certificate of Education ( )
   - Bachelor of Science ( )
   - Higher degree ( ) State which _____
   - Others (State) _____ ( )
4. Do you teach Integrated Science/Have you ever taught Integrated Science? _____ ( )
5. If yes to (4): for how long?
   - Under 2-years ( )
   - 2 - 5 years ( )
   - Over 5 years ( )
6. If you are still teaching Integrated Science, how many periods of it do you teach a week in each class?
   - 5 periods ( )
   - 4 periods ( )
   - 3 periods ( )
   - 2 periods ( )

15.	I apply much of the things I learn in integrated science to my everyday life situation.	5 4 3 2 1
16.	The integrated science workbook helps me to understand what my teacher teaches me.	5 4 3 2 1
17.	As a result of being taught Integrated science my attitude has changed positively towards science.	5 4 3 2 1
18.	Integrated science has helped me to know more about my body.	5 4 3 2 1
19.	I cannot cope with learning Integrated science because I don't know Mathematics.	5 4 3 2 1
20.	Integrated science is a very easy subject.	5 4 3 2 1

Section II

Read the following reactions of teachers to Integrated Science. Then indicate the extent to which you agree with each of them by circling the appropriate number on the rating scale of 1 to 5.

Example: Integrated Science is enjoyable for pupils to learn 5 4 3 (2) 1

This means that your extent of agreement with this statement is 2.

5: I strongly agree
4: I agree
3: I am undecided
2: I disagree
1: I strongly disagree

So in the example given, the respondent "disagreed"

1. Teachers do not have enough knowledge about the Integrated approach of science teaching. 5 4 3 2 1

2. I cannot cope with teaching Integrated science course for want of knowledge in Biology, chemistry and physics. 5 4 3 2 1

3. I cannot cope with teaching Integrated science course for want of knowledge in Chemistry. 5 4 3 2 1

4. I cannot cope with teaching Integrated science for want of knowledge in Biology. 5 4 3 2 1

5. I cannot cope with teaching Integrated science for want of knowledge in Physics. 5 4 3 2 1

6. I cannot cope with teaching Integrated science for want of knowledge in Mathematics. 5 4 3 2 1

7. I do not allow my students to perform experiments by themselves because the laboratory in my school is not well equipped. 5 4 3 2 1

8. My students do not perform experiments because they are too many for the size of the laboratory. 5 4 3 2 1

9.	Integrated science curriculum planners do invite teachers to send the problems they encounter in teaching Integrated Science.	5	4	3	2	1
10.	Practising Secondary School Science teachers are involved in the integrated science curriculum planning and development at the national level.	5	4	3	2	1
11.	Teachers find it easy to change from the traditional method of teaching which integrated science demands.	5	4	3	2	1
12.	As a teacher, I prefer the inquiry method to traditional method of teaching integrated science.	5	4	3	2	1
13.	My principal usually gives me money to buy materials needed for my Integrated Science lessons whenever I ask.	5	4	3	2	1
14.	I have everyday life situation to illustrate all the major topics of integrated science.	5	4	3	2	1
15.	Generally, teaching Integrated Science lesson demands more time to prepare the lessons.	5	4	3	2	1
16.	I find the Integrated Science syllabus content too extensive for the hours available to teaching the subject.	5	4	3	2	1
17.	My students posses the prescribed Integrated Science textbook.	5	4	3	2	1
18.	I always give Integrated Science assignments to my students from their workbook.	5	4	3	2	1
19.	Students have and use the accompanying workbooks to the prescribed textbooks.	5	4	3	2	1
20.	The students' workbook does not aid the learning of the principles/ concepts of the Integrated Science curriculum.	5	4	3	2	1

21. My students demonstrate improved scientific attitude as a result of the Integrated Science course. 5 4 3 2 1

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Section III

Identify which of the teachers' and pupils' activities listed occur in your lessons and their respective frequency of occurence. Indicate by a tick in the appropriate places.

For example

Ask pupils questions to recall information .....

This mean that in your integrated science lessons, your asking pupils questions to recall information occurs many times

	Many times	Some times	Rarely	Never
1. Tell the class the purpose of the lessons.	✓			
2. Tell the class facts relating to the lessons.				
3. Ask pupils questions to recall information.				
4. Use teacher's guides to plan my lessons.				
5. Use the blackboard very much during my lessons.				
6. Use other aids, e.g. models and apparatus for teaching.				
7. Present situations that encourage and improve scientific skills and techniques.				
8. Provide apparatus for the pupils to carry out investigations on their own.				