IMPACT OF LINEAR PROGRAMMED INSTRUCTIONAL STRATEGY ON ANXIETY AND PERFORMANCE AMONG SECONDARY SCHOOL BIOLOGY STUDENTS IN TARAUNI, KANO STATE, NIGERIA

By

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DECLARATION

I hereby declare that this dissertation entitle “Impact of Linear Programmed Instructional Strategy on Anxiety and Performance among Secondary School Biology Students in Tarauni, Kano State, Nigeria” has been written by me and it is record of my own research work and it has not been presented in any previous publication for a higher degree. All the quotations and sources of information were fully acknowledged by means of references.

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Gali MUSA Date

CERTIFICATION

This dissertation entitled “Impact of Linear Programmed Instructional Strategy on Anxiety and Performance among Secondary School Biology Students in Tarauni, Kano State, Nigeria” by Gali MUSA meets the regulation governing the award of Masters Degree in Science Education Ahmadu Bello University, Zaria and approved, for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to my family members for their moral, spiritual and financial support to me throughout the period of this research work.

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Table of contents

		Page
Declaration		ii
Certification		iii
Dedication		iv
Acknowledgement		v
Table of contents		vi
List of figure		viii
List of tables		x
List of abbreviations		ix
Definition of the terms		xii
List of appendices		xiv
Abstract		xv
CHAPTER ONE: THE PROBLEM		
1.1	Introduction	1
1.1.1	Theoretical Framework	6
1.2.	Statement of Problem	7
1.3.	Objectives of the Study	8
1.4.	Research Questions	9
1.5.	Null Hypotheses	9
1.6.	Significance of the Study	10
1.7.	Scope of the Study	11
1.8.	Basic Assumptions	11

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.1	Introduction	12
2.2	Biology as a School Science	12
2.3	Science Teaching Methods	13
2.4	Models of Programmed Instruction in Education	15
2.5	Academic Performance in Biology	23
2.6	The Concept of Anxiety	24
2.7	Gender and Academic Performance in Biology	29
2.8	Overview of Similar Studies	30
2.9	Implication of Reviewed Literature for the Present Study	37

CHAPTER THREE: METHODOLOGY

3.1	Introduction	39
3.2	Research Design	39
3.3	Population of the Study	40
3.4	Sample and Sampling Technique	41
3.5	Instrumentations	42
3.6	Validity of the Instruments	43
3.7	Pilot Study	44
3.8	Administration of Treatment	46
3.9	Procedure for Data Collection	48
3.10	Procedure for Data Analysis	48

CHAPTER FOUR: DATA ANALYSIS, RESULT AND DISCUSSION

4.1 Introduction 50

4.2 Answering Research Question 50

4.3 Testing Null Hypotheses 54

4.4 Summary of Major Finding 57

4.5 Discussion of Results 58

CHAPTER FIVE: SUMMARY, CONCLUSIONAND RECOMMENDATION

5.1 Introduction 62

5.2 Summary 62

5.3 Major Findings 64

5.4 Conclusion 65

5.5 Recommendations 65

5.6 Limitations 66

5.7 Contributions to knowledge 67

5.8 Suggestion for Further Study 67

References 68

Appendices 72

LIST OF FIGURE

Figure		Page
3.1	Research Illustration Design	40

LIST OF APPENDICES

Appendix		Page
A:	Model of Linear Programmed Instructional Strategy	76
B:	Mode of Nutrition and Photosynthesis Performance Test on Frame	77
C:	Distributions of the topics covered within Mode of Nutrition and Photosynthesis according to the weeks and duration in the control and experimental groups	96
D:	Mode of Nutrition and Photosynthesis Performance Test	97
E.	Marking Scheme of MNPP	106
F:	Students Test Anxiety Inventory (STAI)	107
G:	Facility and Discrimination index	109
H:	Lesson Plan for Experimental Group (using LPIS)	111
I:	Lesson Plan for Control Group (using Lecture Method)	124

LIST OF TABLES

Table		Page
1.1	NECO Examinations Result for Biology Students from 2010-2014	2
3.1	Population of the Study	41
3.2	Sample for the Study	42
3.3	Table of Specification	43
3.4	Item Analysis	43
4.1	Descriptive Statistics on Difference between the Mean Scores of Students taught MNP using the Linear Programmed Instructional Strategy and those taught using the Lecture Method	50
4.2	Descriptive statistics (mean and standard deviation) result of the difference in academic performance of male and female students in experimental group	51
4.3	Mean Ranking Statistics between the anxiety levels among students taught MNP using the Linear Programmed Instructional Strategy in the experimental group	52
4.4	Mean Ranking Statistics of Anxiety level between male and female students taught MNP using the Linear Programmed Instructional Strategy	53
4.5	Comparison of posttest mean scores of experimental and control group	54

4.6 t-test Comparison of the Posttest Mean Scores of Male and Female taught using Linear Programmed Instructional Strategy 55

4.7 Mann Whitney tests analysis on difference between the Anxiety levels of Students taught MNP using the Linear Programmed Instructional Strategy and those taught using the Lecture method 56

4.8 Man-Whitney test Analysis of Mean Scores of anxiety level of between male and female in the experimental group 57

LIST OF ABBREVIATIONS

LPIS	Linear Programmed Instructional Strategy
MNPPT	Mode of Nutrition and Photosynthesis Performance Test
STAI	Students Test Anxiety Inventory
NECO	National Examinations Council
WAEC	West Africa Examinations Council
SSCE	Senior Secondary Certificate Examinations
CAI	Computer-Assisted-Instruction
STAN	Science Teachers Association of Nigeria
MDGs	Millennium Development Goals
NERDC	Nigeria Education Resource and Development Council
SERD	State Education Resource Department
GSS	Government Secondary School
GGSS	Government Girl Secondary School

OPERATIONAL DEFINITION OF TERMS

Linear Programmed Instructional Strategy: is an instructional strategy in which the learner is present with many small learning frame or pieces of information in logical sequence that provides immediate knowledge and feedback, thus, enhancing individualized learning.

Anxiety: Anxiety is an emotion characterized by feelings of tension, worried thoughts and physical changes like sweating, trembling, dizziness or a rapid heartbeat.

Academic Performance: Refer to the results obtained from the test administered immediately after treatment.

Lecture Method: Refers to chalk and talk method of teaching concepts in which teacher is active while learner remains passive. The teacher does most of the talking and student's participation is minimal.

ABSTRACT

The study examined the Impact of Linear Programmed Instructional Strategy on Anxiety and Performance among Secondary School Biology Students in Tarauni, Kano State, Nigeria. The study was a quasi-experimental control group design employing the use of pretest and posttest. The size of the population was 2493. A sample of 202 students was randomly selected from four schools out of 21 that formed the population. Data were collected using the instruments tagged Mode of Nutrition and Photosynthesis Performance Test (MNPPT) and Students Test Anxiety Inventory (STAI). The subjects in the experimental group were taught using Linear Programmed Instructional Strategy, while the subjects in the control group were taught using Lecture Method. Four research questions were raise and four null hypotheses was formulate. Research questions were analyzed descriptively while null hypotheses were tested using t-test and Mann Whitney statistics at $P \leq 0.05$ level of significance. The major finding of the results showed that (i) there was a significant difference between the performance mean scores of students taught using Linear Programmed Instructional Strategy and those taught using Lecture Method in favor of experimental group. (ii) There was no significant difference between the mean scores of male and female students taught using Linear Programmed Instructional Strategy (iii) Significant difference existed between the Anxiety levels of students taught using Linear Programmed Instructional Strategy and those taught using Lecture Method (iv) There was no significant difference in the anxiety level between male and female students taught using Linear Programmed Instructional Strategy. Based on the findings, it was recommended among other that the use of Linear Programmed Instructional Strategy should be emphasized and rigorously implemented in secondary schools across the state because students taught using Linear Programmed Instructional Strategy exhibited remarkable reduced anxiety level when compared with their counterparts taught using the lecture method.

CHAPTER ONE

THE PROBLEM

1.1 Introduction

The global aim of science education is to enable learners acquire knowledge, skills and attitude that would be relevant to their future livelihoods (Taber, 2009). Science, as a concept, is a process geared towards problem solving in order to enhance the living standard of man. Shaibu (2008) defines science as a complex human activities that lead to the production of a body of universal statement called laws, theories or hypotheses, which serve to explain the observable behaviour of the universe or part of it, which, in themselves, have predictive characteristics. Odunusi (2001) has observed that the economic and political strength of a nation is always assessing in terms of her achievements in science and technology. This is why the National Policy on Education (FME, 2013) has emphasized on the provision of science education at all levels of education in Nigeria. The emphasis placed, alongside the important role it plays towards national development, makes it pertinent and practically necessary for science to be taught in an organized and well-structured pattern involving activities for both teachers and students (Ibrahim, 2012).

Umeh (2010) defines Biology as a branch of science that is concerned with the characteristics and behavior of organism how species and individual come into existence, and the interaction they have with their environment. Neteiyin, (2012) and Abubakar (2012) have observed that Biology, as a discipline, has contributed tremendously to financial, physical and aesthetic benefits of humanity and to the nation building. The areas of contributions of Biology include but not limited to, the followings: medicine, aquaculture, crime detection, forestry, genetic engineering, parasitology.

Despite the importance of Biology as a science subject, Nurudeen (2011) has noted that the statistics of grades obtained by candidates in the West African Examinations Council (WAEC), especially in Biology examinations in recent years have not been encouraging. The West African Examinations Council (WAEC) Zonal Coordinator has reported that 57% of candidates who sat for West African Senior Secondary School Examinations (WASSCE) in the year 2013/2014 failed Biology. This also agrees with the report of the Registrar and Chief Executive of the National Examinations Council (NECO) who reported that 71% of candidates who registered for science subjects failed Biology. The importance of Biology as a valuable science subject was further emphasized in the Joint Admissions and Matriculation Board syllabuses (JAMB, 2013/2014). It is stipulated that a minimum of credit pass in Biology is required as one of the criteria for admitting candidates aspiring to study science and science-related courses in tertiary institutions in Nigeria. Unfortunately, the number of candidates with a minimum of credit pass in Biology has not been encouraging as indicated in Table 1.1below:

Table 1.1 NECO Examination Result for Biology Students from 2010-2014.

Years	**Total Number of students sat for Examination**	**A1-C6 percent (%)**	**D7-F9 percent (%)**
2010	1,249,028	57.27	42.73
2011	1,268,213	47.04	52.96
2012	1,348,528	41.95	58.05
2013	1,306,535	42.98	57.02
2014	1,508,965	52.17	47.83

Source: National Examinations Council Kaduna Office (NECO, 2014)

Poor performance in Biology among Nigerian secondary school students has been the major concern of parents, teachers and the public. Jibrin and Nuru (2007) have identified poor methods of teaching and improper use of instructional materials as some of the deficiencies of biology teachers, which lead to low academic performance on the part of the candidates. Researchers such as Lawal (2007), Atadoga and Lakpini (2013) have found that the persistent low academic performance in science education were attributed to teachers' instructional strategies such as lecture method in which the learner remained passive while the teacher is always active. It does not promote meaningful learning of science because differences in students' ability are not considered and it cannot satisfy the individual learning mode. Thus, instructional strategies used by teachers in the teaching and learning process have significant influence on learners' academic performance. It has been reported that the Linear Programmed Instructional Strategy is capable of enhancing academic performance of students.

The Linear Programmed Instructional Strategy is a student-centred strategy of learning in which the learner is present with many small learning frames or pieces of information in a logical sequence that provides immediate knowledge and feedback after a test of comprehension. Thus, it enhances individualized learning. Carbo and Davids (2005) have revealed that the Linear Programmed Instructional materials represent a viable alternative for the average and below average students who do not respond adequately to the conventional approach to instruction. Thus, it helps learners to overcome difficulties encountered during teaching and learning process. Pigcon (2004) is of the view the Linear Programmed Instructional Strategy is desirable in many instructional setting as it provides immediate knowledge and feedback. As such, it enhances effective learning. A learner under the LPIS system is therefore, expected to respond to the items presented to him/her in a

logical sequence. Thus, it enhances individualized learning of science. LPIS employs the use of improvised printed self-instruction to school subject areas including Biology as an alternative to the Teaching Machine or Computer-Assisted-Instruction for the average and below average students who do not respond adequately to the conventional approach to instruction (Carbo & Davids, 2005). Terry, (2011) has said that the Linear Programmed Instructional Strategy was effective in the teaching of complex Chemistry and Biology concepts. Therefore, this study, aimed to examine the Impact of Linear Programmed Instructional Strategy on anxiety and academic performance among Biology students at some secondary schools in Tarauni [local Government Area], Kano state.

Anxiety is an emotion characterized by feelings of tension, worried thoughts and physical changes like sweating, trembling, dizziness or a rapid heartbeat (Putman, 2010). Tobias (1999) and Elliot (2000) have shown that test anxiety affects the performance of science students. This is because within the classroom setting, there are numerous source of anxiety for students like teachers, examination, peers, social relation, and achievement/performance setting, likes and dislikes to mention but a few factors. Goldfarb (2008) has noted that anxiety, which affects students' academic performance, is called test anxiety. Andrew and Wilding (2004) are of their view that high level of emotional distress has a direct correlation to academic performance and higher overall student dropout rates. For instance, if student's anxiety is moderate, it will have a positive effect by enhancing performance. In the same manner, student's high anxiety will lead to negative or lowering of academic performance. Hollandworth (2010) has conducted a study in which he tested high-anxiety and low-anxiety children for achievement in sciences and mathematics. The low-anxious group was found to have done better in the sciences. For Mathematics, there was a

slight, though insignificant, difference in favour of the high-anxiety group. Kirkland (2009) has observed that the common factor for test anxiety recognized is the classroom factor, which majorities of learners have the general desire to manipulate and control their surroundings in order to produce a comfortable environment. But in the classroom setting, there may not be the opportunity to control the surroundings. Based on this background, this study aimed at examining the impact of Linear Programmed Instructional Strategy on anxiety level among SSII Biology Students in Tarauni.

The effects of gender on learning outcomes in sciences is still an issue of debate among educators because of conflicting results from studies that focus on gender and performance. Researchers such as James (2000) and Nwosu (2001) have come up with different findings on the effect of gender on learning outcomes in science. Their findings showed that the male perform well than their female counterparts. The findings of Bichi (2002) and Aweriale (2006) have shown that there was no significant difference between male and female performance in science. Ogunleye (2006), Raimi (2007), Morribend (2008), and Chukwuka (2009), have individually reported that males perform better than their female counterparts in science subjects. Okeke (2009) also reported significant effect of gender on learning outcomes in favour of male students. Ivowi (2008) and Solomon (2009) have reported significant difference in performance in favour of males in their researches. Oluwatoyin (2010) has observed that women perform better when they were exposed to science. Therefore, this study intends to examine the male and female performance outcome taught using Linear Programmed Instructional Strategy and anxiety level among SSII Biology Students.

1.1.1 Theoretical Framework

The theoretical framework for this study is rooted in Skinner's (1963) Linear Programmed Instruction based on "operant conditioning", a behaviourist theory that states that learning is change in behaviour, that is, the individual's response to events (stimuli). Behaviour could be conditioned by rewarding the right stimulus-response. According to behaviourists, a behaviour that is positively reinforced will reoccur and intermittent reinforcement is particularly effective. As such, information should be present in small amounts so that responses can be reinforcing ("shaping"). Reinforcements will generalize across similar stimuli ("stimulus generalization") producing secondary conditioning.

As an educational technique, the Linear Programmed Instructional Strategy was characterizing by self-paced, self-administered instruction, which should be presented in a logical sequence and with multiple content repetitions for easy comprehend by the learner. As such, Skinner (1954) has argued that learning could be accomplished if the content is divided into small, incremental steps, and if learners get immediate feedback, reinforcement and reward. As a method of instruction, LPIS can be applying through "Teaching Machines", Computer-Assisted-Instruction (CAI) and printed Self-instruction or Programmed textbooks.

The Linear Programmed Instructional Strategy allows students to advance through the instructional process in a particular order, as they provide the correct answers. Students are provided with pieces of information in a series of frames where they are asked to recall or apply the information during frequent tests of comprehension. Frames here imply small unit of instruction presented to students at a time. Each frame contains small information

and a statement with a blank space that students fill in. The students then uncover the correct answer before going to the next frame (Anderson & Fretzin, 2004).

Features of the Linear Programmed Instructional Strategy involves the following

i. Learners are exposed to small amounts of information and proceed from one frame or one item of information to the next in an orderly fashion

ii. Learners respond overtly so that their correct responses can be rewarded and their incorrect responses can be corrected

iii. Learners are informed immediately about whether or not their response is correct (feedback) or not.

iv. Learners proceed at their own pace (self-pacing)

Therefore, this study hinged on Skinner's linear programmed instruction.

1.2 Statement of Problem

The consistent poor performance of Biology students at the Senior Secondary School Certificate Examinations (SSCE) leaves one in doubt about the effectiveness of the teaching methods popularly used by Biology teachers for teaching the subject. Empirical studies have shown that students' performance in biology has been poor. The National Examinations Council (NECO) Chief Examiner's Reports of (2010, 2011, 2013, and 2014), showed that there is persistent failure in SSCE Biology examination which may be due to poor methods of teaching and lack of instructional materials. Jibrin and Nuru (2007) have identified poor methods of teaching and improper use of instructional materials as some of the deficiencies of Biology teachers all of which lead to students' anxiety in learning Biology.

Vogel and Collins (2010) have reported that several factors such as anxiety, poor methods of teaching, family background, school/classroom environment, peer group, over-loaded biology syllabus, difficulty of the topics and some concepts as well as absence of dedication and resourcefulness on the part of the teachers, among others, were found to be some of the reasons why academic performance of Biology students falls below expectation. Atadoga and Onaolapo (2008) have observed that teacher-centered (lecture) instruction is one of the many factors responsible for poor academic achievement and higher test-anxiety among science education students. Lawal, (2007) Atadoga, and Lakpini, (2013) found that the persistent low academic performance in science education is attributed to teacher instructional strategies, among others. Thus, instructional strategies used by teachers in teaching and learning process have significant influence on learners' academic performance. However, Anderson and Fretzin (2004) are of the view that linear programmed instructional strategy is very effective in teaching and learning science subjects because students are actively involved, it provides immediate knowledge and feedback, thus enhancing individualize learning. Therefore, the study aimed at finding out the Impact of Linear Programmed Instructional Strategy on anxiety and performance among Secondary School Biology Students in Tarauni, Kano State, Nigeria.

1.3 Objectives of the Study

The objectives of this work are to:

i. investigate the impacts of the Linear Programmed Instructional Strategy on students' performance in Biology,
ii. determine the performance of male and female students taught using the Linear Programmed Instructional Strategy

iii. assess the impact of anxiety level among students taught using the Linear Programmed Instructional Strategy,

iv. find out the level of anxiety between male and female students taught using the Linear Programmed Instructional Strategy of teaching

1.4 Research Questions

This study provided the following research questions:

i. What is the difference between the performance mean scores of students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using Lecture Method?

ii. What is the difference between the mean scores of male and female students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy?

iii. What is the difference between the anxiety level among students taught using Linear Programmed Instructional Strategy and those taught using Lecture Method?

iv. What is the difference between the anxiety level of male and female students taught using the Linear Programmed Instructional Strategy?

1.5 Null Hypotheses

The following research hypotheses were formulated and tested at $P \leq 0.05$ level of significance.

HO1: There is no significant difference between the mean scores of students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using Lecture Method.

HO2: There is no significant difference between the mean scores of male and female students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy.

HO3: There is no significant difference between the anxiety level among students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using Lecture Method.

HO4: There is no significant difference in the anxiety level between the male and female students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy.

1.6 Significance of the Study

The main aim of this study is to examine the impact of Linear Programmed instructional Strategy on Anxiety and Performance among Secondary School Biology Students in Tarauni, Kano State, Nigeria. It is hoped the findings of this study would:

Help teachers to make effective use of LPIS in teaching biology for better academic performance.

Be useful to educational planner, science curriculum planner, administrators and principles of the school about the reality of educational practice and guiding them to encourage their teachers to use Linear Programmed Instructional Strategy in their teaching and learning process.

Be useful to professional and associations bodies such as the Science Teachers Association of Nigeria (STAN), Millennium Development Goal (MDGs), State Education Resource Department (SERD), the Nigerian Educational Resource and Development Council

(NERDC) and other related bodies in training their respective members on the effective use of the Linear Programmed Instructional Strategies.

Encourage textbook publishers in publishing Programmed Textbook at all educational levels. Also, encourage stakeholders in providing Teaching Machine/Computer-Assisted-Instruction and Programmed textbooks that will boost the teaching and learning process at all the educational levels.

1.7 Scope of the Study

The study is out to examine the Impact of Linear Programmed Instructional Strategy on Anxiety and Performance among Secondary School Biology Students in Tarauni, Kano State, Nigeria. Four schools out of the population were used for the study. SSII students were used for the study because they were available for the whole term and the concepts taught are in SSII syllabus. Mode of Nutrition and Photosynthesis concepts was used for the study because the former involve so many associations and are often confusing to students while Photosynthesis, on the other hand is seen as being abstract in nature. This makes the students to have little or no interest in learning and there is no way they will escape answering some questions on mode of nutrition and photosynthesis in their final examinations.

1.8 Basic Assumptions

The following are the basic assumption of the study:

i. All the schools under studied have qualified and experienced Biology teachers.
ii. The schools also run the same academic calendar and use the same curriculum.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This research study examines the Impact of Linear Programmed Instructional Strategy on Anxiety and Performance among Secondary School Biology Students in Tarauni, Kano State, Nigeria. The literatures were reviewed under the following sub-headings:

2.2 Biology as a Science Subject

2.3 Science Teaching Methods

2.4 Models of Programmed Instructional Strategy in Education

2.5 Academic Performance of students in Biology

2.6 The Concept of Anxiety

2.7 Gender Difference and Academic Performance in Biology

2.8 Overview of Similar Studies

2.9 Implications of Literature Reviewed for the Present Study

2.2 Biology as a Science Subject

Biology is a core subject for many science disciplines in post primary institutions in Nigeria. The science curriculum is designed in such a way that it will produce educated individuals some of whom will take to biological science as a professional pursuit. The study of biology education benefits students in a number of ways (James and Pemida, 2000)

i. It promotes understanding of the relationship between man and his environment.

ii. It promotes the knowledge of the interrelationship existing between living and nonliving components of the environment.

iii. It imparts factual knowledge and stimulates scientific, reflective thinking in the learner in order to produce better informed individuals.

iv. It inculcates scientific skills and attitudes in individuals.

v. Biology also bring into focus the need to maintain good health such as clean water, clean air, good sanitation, balance diet, vaccination against infectious disease, exercise and having adequate rest.

vi. Biology stimulates interest in biological-based hobbies such as growing flowers, collecting insects thereby encouraging leisure activities for individual enjoyment and conservation of plants and animals for the purpose of tourism and leisure attraction.

A good knowledge of the importance of biology benefits students and creates interest in learning. Hence, the need for effective study of biology in secondary schools is emphasize. In this study, biology as a science-teaching subject was used to investigate students' academic performance and anxiety level using Linear Programmed Instructional Strategy.

2.3 Science Teaching Methods

There are several methods of presenting scientific facts, information, principles, and skills on concepts to the students. Some of the methods include Demonstration, Inquiry, Discovery, Discussion, Project, Laboratory, Individualized, Fieldtrip, Excursion, Lecture, Linear Programmed Instruction, Direct Expository methods, to mention just a few. For this study, the researcher used lecture method to teach the control group.

The Lecture Method

The Lecture method of teaching emphasizes “talk - chalk” in the teaching of science subjects. More than 80% of scientific information, ideas, concepts, generalizations and facts are verbally presented to students by the teacher (Abdullahi, 1982).The teacher does much of the activity in the form of talking while the students are either passive or slightly involved.

However, Abdullahi (1982) has stated that two teaching skills that make the lecture method effective are:

i. Clear and good command of language and
ii. The ability to write clearly and boldly on the chalkboard

In its true nature, the lecture approach is not effective for science teaching because it does not promote meaningful learning (Abdullahi 1982, James 2009 and Usman 2000).

James (2009) has viewed the lecture method as one of the most popular methods of instruction commonly used in teaching Biology. He described the method as that traditional approach which is referred to as a didactic approach. It thus can be defined as a teaching technique in which one person usually the teacher, presents a spoken discourse on a particular subject. The Lecture method is characterized by a one-way flow of information from the teacher, who is always active, to the students who are always passive. The method saves time and energy. It allows easy handling of large classes without much stress and it is not expensive as only the chalkboard is required. The Lecture method is not effective for science teaching. Usman (2000), James (2000) and Bichi (2000) have argued that the lecture method does not promote meaningful learning of science, because difference in students’ ability is not considered and it cannot satisfy the individual learning needs. Students easily

become restless and disruptive since their attention span is very limited. The researcher used the lecture method to teach the control group

2.4 Models of Programmed Instructional Strategy in Education

Pigcon (2004) has defined Programmed Instruction as a teaching strategy in which the learner is presented with many small learning frames or pieces of information in a logical sequence that allow the learner to learn from the frame one after the other until the end of the program. The learner, under this system of instruction, is expecting to respond to the items presented in a logical sequence after which a test of comprehension follows. Linear Programmed Instructional Strategy is one of the student-centred of teaching which employs the use of printed self-instruction in all school subject areas. The Linear Programmed Instructional Strategy has been found to be very effective because of active students' participation, the step-by-step approach, immediate feedback and the use of reinforcement. It was Skinner who introduced this mode of instruction in 1954. There are two types of Programmed Instructional Strategies, which are discussed over after the other, below.

Linear Programmed instructional Strategy

The credit of introducing the linear programmed instructional strategy goes to B. F. Skinner (1954). The strategy is a derivative of "operant conditioning". Operant conditioning states that human behaviour is shaped through creating the suitable reinforcement to obtain the correct responses. It asserts that direction can be given to human behaviour. For this purpose, activities that are needed to be learnt are divided into small parts for easy comprehension. It is a gradual process and the responses are conditioned in a step-by-step manner.

Model of Linear Programmed Instructional Strategy

In a model of Linear Programmed instructional strategy, students are allowed to advance through the instructional process in a particular order as they provide the correct answers. The students are provided with specific pieces of information in a series of frames and are asked to recall or apply this information during frequent tests of comprehension. Frames here imply small units of instruction presented to students at a time. Each frame contains small information and a statement with a blank space that the students fill in. The students then uncover the correct answer before going to the next frame (Anderson & Fretzin, 2004). See the figure below:



Adapted from B.F Skinner (1954)

Linear Programmed Instructional Strategy involves the following features:

i. Learners are exposed to small amounts of information as they are made to proceed from one frame or one item of information to the next in an orderly fashion. This is what is meant by linear.

ii. Learners respond overtly so that their correct responses can be rewarded and their incorrect responses can be corrected.

iii. Learners are informed immediately about whether or not their response is correct (feedback).

iv. Learners proceed at their own pace (self-pacing).

Fundamental Principles of Linear Programmed Instructional Strategy

Linear programming is based on five fundamental principles:

i. Principles of small steps;

ii. Principle of active response;

iii. Principle of immediate confirmation;

iv. Principle of self-pacing; and

v. Principle of student testing;

In a Linear Programmed Instructional Strategy, all students read and respond to the same frames. The information in linear programmed instruction is broken down into pieces and it is broken sequentially into meaningful steps. The learner has to respond to each step actively and the reinforcement is given immediately. The reinforcement depends on the correctness of the responses given by the learner. If the response is correct, a positive reinforcement is given this motivates learners to attempt more responses (Skinner, 1968).

Advantages of Linear Programming

The assumption behind the Linear Programmed Instructional Strategy is that students learn better if the contents are presented in small units. Students responses are confirmed immediately and this result in better learning. Students' errors create hindrance to learning. Students learn better in a Laissez-fair environment.

Limitations of Linear Programmed Instructional Strategy

The following are some of the limitation of LPIS

i. Every learner has to follow the same path therefore. Student may cheat from one another.

ii. Wrong responses are avoided in the programme,

iii. No remedy is provided for the linear programmed instruction.

Components of the Linear Programmed Instructional Strategy

The LPIS has the following components:

i. Behavioral objectives are clearly stated

ii. Small frames of instruction are carefully sequenced

iii. Self-pacing instructional sections, units, modules are provided

iv. Active learners respond to questions asked.

v. Immediate feedback and positive reinforcements are part of the strategy.

Steps in Linear Programmed Instructional Design

The following are the steps in LPIS:

i. Specify the goals of instruction: what is to be learnt;

ii. Identify the 'entry skills of the learners', i.e. what is the current level of skills of the learners;

iii. Develop a series of steps that will get the students form where they are to where they should be;

iv. Instruction is programmed in small steps, i.e. successive approximations to the desired behavior; and

v. Provide appropriate reinforcements.

Branching Sequences

The founder of Branching Programmed Instruction is Norman (1960). It is base on configuration theory of learning. It is a problem-solving approach. It is a stimulus-centered approach to learning. “Branching,” means the subdivision of the stem or trunk. The main

concept (the trunk of the tree) is sub-divided into smaller concepts (the stems of the tree) and into other minute details of the topic.

Fundamental Principles of Branching Programmed Instructional Strategy

The fundamental principles of branching programmed instructional strategy are:

i. Principle of exposition;

ii. Principle of diagnosis; and

iii. Principle of remediation

Branching programmed learning is similar to linear programmed instructional strategy except that it is more complicated because it attempts to diagnose the learner's response. It usually involves a multi-choice form. After the learners have been present with a certain amount of information, they are given a multiple-choice question to answer. If they answer correctly, they branch to the next body of information. If they are incorrect, they are direct to additional information, depending on the mistakes they made. The best-known branching technique is called Intrinsic Programming. The Frame size is large. There may be a Para or page in the frame. It consists of rather long frames, which often appear as pages in an ordinary textbook. The student reads the page (or frame) and then responds by selecting the correct alternative in a three-alternative multiple-choice item. Each alternative is associated with a page number, which directs the students to another frame. Frame structure is Exposition- Diagnosis- Remediation types. There are two types of frames- Home page (for teaching and diagnosis) and wrong page (for remediation). The responses are not rigidly structured just as the responses are selected by the learner and not by the programmer. Confirmation of the correct responses provides reinforcement. Wrong responses also help in the diagnosis of the weaknesses of the learner. Remedies are provided based on diagnosed

weaknesses of the learner. Error helps in the diagnosis of the weaknesses of learner. More than 20% error rate can be accepted. The purpose of Branching Programming is to draw out weak points of the learner and provide remedy for recovering those weaknesses. Branching programming is used for secondary as well as higher classes. Higher objectives can be achieved, such as multiple discrimination, etc. It is useful for students of above average and high intelligence. It can also be use in Distance education programs.

Advantages of Branched Programmed Instructions are as follows

The assumption behind this programmed is that a student learns better if he is exposed to a whole situation or content. Student errors help in diagnosis. Student learns better if remediation is provided side by side. In addition, a Student learns better in a democratic environment. In this format, the student proceeds to the next frame until he makes an error. The errors branch him to supplementary material designed to give him remedial instruction. The center of the teaching – learning process is the learner and not the facilitator or the instructor.

i. The learner learns at his or her own speed and pace. Much of the learning takes place when freedom is given to the learners. In branched programming style, freedom given to the learners so that they can learn at their own pace.

ii. Learning takes place when the new concepts are revised. The learner gets an opportunity to travel to and fro in the newly learnt content. If the responses given by the learner are not up to the mark, the learner can start learning the content from what he or she has not understood. The correct responses are appreciated there by internally motivating the learner to grasp the content to the end.

Limitations of Branching Programmed Instructional Strategy

The branching programmed instructional strategy has the following limitations:

i. It does not consider learning process whether learning is taking place or not. The main emphasis is on diagnosing the weakness of the learners and providing remedy to them.

ii. There is no sequencing of pages. Students find it difficult to follow the steps. They do not find it exciting or motivating, as a result of which they do not want to go through the pages.

iii. It places more emphasis on remediation rather than teaching, Hence, it is only a tutorial approach.

Some similarities are noted in both the linear and the branching programmed instructional strategy as matter or the concept is placed in a logical sequence in both the linear and branching programmed methods. The difference is the simplicity of the presentations of the matter. In linear programming, the subject matter is presented in a straightforward and uncomplicated form. It follows a certain direction. The branched programming follows a complicated format, which does not follow a definite direction. It is like a scrambled book where the pages do not follow the normal sequence. In the linear programmed instruction, the subject matter is presented in a straightforward and uncomplicated format. However, this is not the case with branched programming. The subject matter is generally in a complicated format and meant for students higher class.

Criticisms of Programmed Instruction

Various criticisms of the programmed instruction proposed so far are:

i. It assigns the responsibility for learning to the learning materials and not to the learners.

ii. It forces instructional problems to fit into observable behavior measuring and accepting only observable behaviors as the proper learning outcomes

iii. It presents technology as the key factor for learning without addressing learner's needs

iv. It is rigid and therefore it does not fit in to individual learner's needs; and

v. It ensures that learners are corrected as often as possible through shaping (Casas, 1997).

Scholars such as Kurbanoglu, Taskesenligil, and Sozbilir, (2006) have provided questionable results about the efficiency of the linear programmed instructional strategy and learning machines in learning sciences. A meta-study that summarized the results of 36 studies comparing the linear programmed instructional strategy with the traditional classroom teaching suggested that 18 of 36 showed no statistically significant difference, 17 showed a statistically significant difference in favour of linear programmed instructional strategy and one study showed a statistically significant difference in favour of classroom teaching. Others such as McDonald, Stephen, and Russell, (2005) found that linear programmed instructional strategy could result in frustration if a learner cannot follow the pace of his peers, paying less attention due to over-prompting and eventually disliking the concept to learn. There is still an ongoing, yet limited, research today that is examining the benefits of linear programmed instructional strategy as an additional teaching method. For

the purpose of this study, Linear Programmed Instructional Strategy was used to examine the level of anxiety and performance among secondary school biology students in Nigeria.

2.5 Academic Performance of Students in Biology

Adediwura and Taiwo (2007) have defined academic performance as a display of knowledge attained or skills developed in school subjects designated by test and examination scores or marks assigned by the subject teachers after a given treatment. Poopola (2010) sees academic performance as an expression used to present students' scholastic standing and which is a function of various factors such as method of teaching, teachers' qualifications, students' home background, school environment, attitude, and interest, among others. Chadau (2002) has referred to academic performance as what students are able to gain in the Senior Secondary Certificate Examination (SSCE) after completion of the senior secondary school instruction.

James and Pemida (2000) are of the viewed that Biology stands out easy to teach and learn among other science subjects because it has the potential in improving students' academic performance because of the availability of materials and teaching aid in open fields. The indiscriminate use of lecture method by science teachers affects students academic performance (Bichi, 2002).

Based on the report in Table 1.1 presented in chapter one, there is much failure in NECO results of biology 2010 – 2014. According to the NECO report, some of the factors responsible for the failure were lack of adequate facilities and unqualified number of teachers who were unable to apply positive teaching strategies in imparting knowledge to the learner. They depend most on lecture method in teaching and learning biology. Bichi

(2002) has investigated the effect of the lecture and the inquiry methods on the teaching and learning outcome activity concluded that the lecture method was inferior to the latter method in terms of enhancing student's achievement

2.6 The Concept of Anxiety

Anxiety is an emotion characterized by feelings of tension, worried thoughts and physical changes like sweating, trembling, dizziness or a rapid heartbeat (Putman, 2010). Huberty (2009) says that anxiety is an emotional state of a human, which is life – saving and causes many problems in the mental life of human beings. Anxiety interferes with school functioning only when an abnormal level is reached. Within the normal range, being anxious does not automatically imply worst school functioning and, indeed it may, to a certain extent, be motivating and enhancing academic performance .Erica (2010) has ranked anxiety into four levels: mild, moderate, severe and panic anxiety.

i. The mild level of anxiety is healthy. At this level, the perceptual field is heightened as the pupils dilate to accommodate much light, hearing, smelling intensified, and the sense of touch is highly sensitive. The individual is highly alert, attentive, and learning and cognition is in its best state. This stage improves academic performance.

ii. The moderate level of anxiety on the other hand is unhealthy, the perceptional field of a person at this level is narrowed; individuals experiencing this level of anxiety have selective inattention. They have decreased focus and automatism can be observing as repetitive purposeless movements such as shaking of the hands and feet, twirling of hair and, tapping of fingers. Academic performance at this level

depends on the individual's ability to control the anxiety and carry out the assigned task.

iii. The severe level of anxiety is characterized by reduce perceptual field and a difficulty in communication. Gross motor movements, such as pacing are characteristic of people at this stage. Academic performance at this stage depends on the educator's ability to recognize such individuals and provide a safe environment for them. Communication should be kept short and simple since communication is altered. Performance at this stage is reducing since most educators may not be able to provide such environment for the student.

iv. The panic level of anxiety is the worst and most severe form of anxiety. Total disruption of perceptual field is present. It is also characterize by loss of ability to communicate, loss of rational thought and total loss of conscious thinking. Academic performance at this level is very poor since the student will be unable to remember exactly what he/she is supposed to d

Causes of Anxiety

Anxiety is the common mental issue that comes in the form of panic or disorder, agoraphobia, social anxiety and even observed compulsive disorder (Bensoussan, 2012). The causes of anxiety may include parental socio-economic status, educational background, emotional climate in the school and at home, teacher-pupil relationship, heredity and low intelligence (Huberty, 2009). All these conditions reduce student’s attention towards learning in the classroom. As such, it leads to low academic performance. Students under this stressful conditions, coupled with the traditional lecture method used by most science teachers learn very little in the classroom, since the teacher does not involve them in the

learning process. Matter (2010) has observed that certain number of adolescents experience psychological conflict leading to many behavioural problems, which may include anxiety. Anxiety is often regarded as a form of developmental disturbance, which affects students' learning and performance in tests or examinations.

Test and examination related stress is thought to prevent some individuals from reaching their academic potential because test and examination results form the basis for many academic decisions about the schoolchild. Huberty (2009) has found that students consistently perceive examination as a source of increase in anxiety and a situation engulfed with uncertainty/unfairness in letting them demonstrate their true achievements. Sajeev (2006) has maintained that tests or examinations are important measuring instruments for academic performance. Needham (2006) says that it is, therefore, not surprising when students become more anxious about taking test or examinations even though the specific purpose of test or examination and the intended use of the results may differ from one school to another. It is essential, therefore, to recognize the value that test/examination results can play a significant role in the life of the student as well as parents, teachers, counselor and other educators. Such feelings among students limit their potential performance during the test situation. This results in higher text anxiety directly causing a drop in the student's performance.

Rohen (2012) is of the opinion that the effect of anxiety on academic achievement is not always obvious but new research by the Economic and Social Research Council suggests that there may be hidden costs. The research found that anxious individuals find it harder to avoid distractions and take more time to turn their attention from one task to the next than their less anxious fellow students. Eysenck (2009) says, "A lot of the negative

effects of anxiety appear to be caused by difficulties with controlling attention. This suggests that training techniques designed to enhance attention control - the ability to ignore distractions and to switch attention from one task to another - could help anxious students to achieve their academic potential," he explains. In addition, he showed that anxious individuals often perform at a comparably level to their non-anxious ones but only do so at a greater cost in terms of effort or perhaps long-term stress. This shows that it is important that teachers focus not only on whether a student's academic performance seems to be satisfactory but also on how much effort the student had to put in to achieve that level. Ormord (2000) has a view about the relationship between anxiety and academic achievements, that anxiety and academic achievements has been a difficult relationship to clear elucidate. Academic achievements are related scholastic aptitude, it seems reasonable to suggest that students that are more able can spend their time in more non-academic activities. Another research conducted by Davis (2004) found that test- anxiety decreases attention span, memory and concentration, and leads to low academic performance. Eysenck (2009) found that test-anxiety creates irrelevant thoughts, preoccupation, and decreased attention and concentration and leads to academic difficulties. When attention and concentration are impaired, this will disrupt memory and consequently lead to low academic achievement (Chen, 2000 and Sanders, 2001, cited in Needham, 2006).

Anxiety Reduction Strategies

In the reduction of test anxiety, different techniques or treatment methods such as cognitive reorientation have been use. This is mean to reduce tension and anxieties, and improves academic performance (Chen, 2012). Experimental psychologists have developed principles derived from researchers, and are used to alleviate problems and enhance

development. This process is viewed as a scientific method that seeks to correct or change behavior on the basis of that the observed behavior is abnormal, nonfunctional or undesirable (Vogel, & Collins 2010). Cassady and Johnson (2002) have found motivation to be an important factor in reducing test anxiety and increasing motivation. Students feel positive and negative emotions before, during, and after a test. Students who practiced motivational strategies had higher levels of emotional functioning when faced with stress or anxiety during a test.

Coping is an emotional self-regulation to control a form anxiety (Ader & Erktin, 2010). "Non-productive" coping strategies, which focus on the emotional aspects of academic anxiety, were the most successful when dealing with anxiety. Students benefit from learning stress reducing techniques and relaxation techniques to improve coping skills. Metacognition is related to anxiety. People can have positive or negative metacognitive beliefs. Students with more positive metacognitive beliefs are better at coping with anxiety. Students with more negative metacognitive beliefs are report to have higher levels of anxiety (Tajrishi, Mohammad, khani, & Jadidi, 2011).

Mindfulness meditation is a form of meditation whereby a person focuses on the present and looks at emotions that they are feeling. Semple, Lee, Rosa, and Miller (2010) have maintained that mindfulness is another method of combating academic anxiety. The focus is on being aware of emotions, and understanding how to work with or tackle them. Students with high levels of anxiety may also have more difficulty when learning a new language than students with lower level of anxiety. Anxiety can also lead to problems with reading comprehension. Some students are so worried about failing an assignment or test that the students cannot retrieve information or store new information in their brains.

Bensoussan (2012) found that teachers' willingness to work with their students to repair poor test scores has a positive effect on reducing test anxiety. It is against this background that the researcher utilized the teaching method, which is student-centred (Linear Programmed Instructional Strategy) in order to determine its impact on anxiety and academic performance among secondary school Biology students.

2.8 Gender Difference and Academic Performance in Biology

The concept '*gender*,' could be discussed in term of masculinity and feminity observed in an individual. The academic performance of boys and girls in science, technology and mathematics has been perceived differently, where boys are rated higher than girls. Bichi (2002), Bello (2002), Linver, Davis-kean and Eccles (2002), have expressed concern over poor performance among females and other gender related issues with the view to improving science teaching and learning. Jimoh (2001) has observed that the position of females in science, mathematics and vocational education is below average when compared to male counterpart.

Ibe (2006) is of the view that gender discrimination in science in Nigeria is the practice of the day, because people always think that science in only for the males while languages are for female. Habeeb (2001) also believed that quite a number of factors are responsible for the low achievement of females in the sciences. Oluwatoyin (2010) has observed that women perform better when they were exposed to science. The finding of Bichi (2002) and Aweriale (2006) showed no significant difference between male and female achievement in science. Parents discourage their girls from science and technology related careers saying that they are abnormal and may not be capable of managing marital

home (Ifamuyiwa, 2003). That is why it is affecting their academic performance in teaching and learning science.

Ogwuazor (1992) says that girls themselves feel discouraged by the attitudes of their teachers and parents and often suffer from low self-esteem with respect to taking carrier in the science. This probably ought to be the result of stereotyping of tasks that take place that require with more attention being given to the training and education of males in the sciences. Despite the fact that certain measures have taken to bridge the gap between boys and girls, gender inequality is still a limiting factor to the achievement of the desired learning outcomes and developments in science enrolment and performance. This to results in unequal access to education, health and employment on the part of females. Gender imbalance has actually attracted the attention different world bodies and NGOs such as the UNESCO in order to check the problem. Therefore, the study investigated the Impact of Linear Programmed Instructional Strategy on Anxiety and Performance among male and female Biology students.

2.9 Overview of Similar Studies

A number of studies that are relevant to the present study have been overviewed by researcher. This section gives an overview of such studies.

Boden, (2000) carried out a study on Linear Programmed Instruction in Secondary Education: A meta-analysis of the impact of Class Size on its Effectiveness at New Orleans Louisiana city USA. A quasi- experimental design was used for the study. A sample of 125 subjects was used for the study. Instrument used for the study was Science Achievement Test (SAT). Data was analyzed using ANOVA. The finding showed that the meta-analysis

demonstrated that linear programmed instructional strategy resulted in higher achievement when compared to conventional methods of instruction. It also indicated that linear programmed instructional strategy maintains its effectiveness over the conventional methods of instruction regardless of class size. Therefore, the study reviewed is similar to the present one because it used the linear programmed instructional strategy and lecture method on the one hand, and it is dissimilar, on the other hand where the present study incorporated anxiety, which might affect students' performance.

Kurbanoglu, Yavuz and Mustafa (2005) in their study, Linear Programmed Instructional Revisited: A study on Teaching Stereochemistry, Chemistry Education, compared the success of linear programmed instructional strategy with the conventional teaching approach in teaching of stereochemistry, and whether gender has any effect on students success. A quasi-experiment research design was used for the study. One hundred and fourty-two (142) Chemistry teacher trainees attending the same class in the Department of Chemistry Education in a large State University in eastern Turkey formed the population of the study. A sample forty chemistry teacher trainees was used for the study. Twenty (20) were randomly selected as the experimental group and the other twenty (20) were selected as the control group. The study was implemented in a total of sixteen-lecture hours (each 50 min) in four weeks. The Stereochemistry, aspect of inorganic chemistry was taught to the experimental group by the researchers using linear programmed instructional strategy while the control group was taught using traditional teaching. The instrument used for data collection was Stereochemistry Achievement Test (SAT). ANCOVA was used to analyze the data. The finding of their study showed that there was a significant difference between those taught using linear programmed instructional strategy and those taught using

conventional teaching approach on the students' success level in learning the subject. In addition, it was found that female students were more successful than their male counterpart in the experimental group. The findings suggest that linear programmed instructional strategy could be consider as a better alternative to the conventional lecture method in teaching stereochemistry. The study reviewed is similar to the present study because it compared the linear programmed instruction with the conventional method of teaching and dissimilar in the subject. This study taught biology students photosynthesis and mode of nutrition to secondary school students while the reviewed study taught stereochemistry to teacher trainees.

McDonald, et al (2005) in their study compared the effect of Learning from Linear Programmed Instructional Strategy on academic performance among secondary school science students in Houston, Texas, USA. A quasi-experiment was used. One hundred (100) students participated in the study. Science Achievement Test (SAT) was used as an instrument for the study. Analysis of variance (ANOVA) was used to analyze the data. The researcher concluded that Linear Programmed Instructional Strategy was more effective than the lecture method. The study reviewed here is similar to the present study because it used LPIS and the research design. However, the present study is dissimilar to the reviewed by adding anxiety as a variable to investigate.

Uhumuavi and Mamudu (2009) compared the effects of Linear Programmed Instructional Strategy and Demonstration methods on secondary school students' academic performance in science in Esan West Local Government Area of Edo State. A sampling technique (balloting) was used in selecting two schools in that area of study. Quasi-experimental, non-control design (without a control group) was used. Two intact classes of

fifty (50) students each from the two schools selected were used for the study. These (100) students consist of 50 males and 50 females. The Instrument used was Test of Performance Level in science (TOPLIS) to test students' performance in science. All the groups were pre- and post-tested using the 20 items of Test of Performance Level (TOPLIS). t test was used for data analysis. The hypotheses were tested at 0.05 level of significance. The findings indicated that: (1) Exposing students to Linear Programmed Instructional Strategy improved performance in science (2) Exposing female students to demonstration method yielded a better performance on their part than their male counterparts. The study reviewed, shared the same variable with the present study that is LPIS and gender but they differ in such a way that present study does not use the demonstration method of teaching.

Nowell and Quinn (2010) in their study on "Learning from Home while Abroad" using Linear Programmed Instructional Strategy reported that the use of LPIS resulted in better academic performance than other instructional modes when they compared the relative effects of Linear Programmed Instructional Strategy under cooperative, competitive and individualized modes with the traditional textbook method. 125 secondary school science students were used for the study. The instrument used was Cooperative Competitive Individualize Mode Test (CCIMT). Data generated was analyzed using ANOVA. The result showed a significant effect of teaching method on the academic performance of students taught using Linear Programmed Instructional Strategy, which is better than those were taught using Lecture Method. In the study reviewed, it shared same variable that is LPIS and gender but they differed as it used cooperative, competitive, individualized modes and traditional textbook method.

Omoniyi and Olabode (2012) examined Linear Programmed Instructional Strategy (LPIS) a Panacea to students' dwindling interest in Mathematics. A survey research design was adopted for the study. A questionnaire tagged Mathematic Students Interest Questionnaire (MSIQ) was designed to collect data from a sample of seven hundred and fifty (750) respondents which include 700 Students and 50 Teachers from both the Public and Private Secondary Schools in Ado-Ekiti Local Government Area of Ekiti State, Nigeria. Man Whitney test (U-test) was used to analyze the data. The study revealed that the usage of linear programmed instructional strategy helped to beef up curiosity in Mathematics among students and that resulted to greater retention and mastery of the subject matter. In addition, the study revealed that lack of trained personnel to help guide students in the use of programmed books, scarcity of programmed books in the society, high cost of procuring such books and machine and lack of necessary infrastructural facilities have been the factors militating against the implementation of linear programmed instructional strategy in schools. That study differs from the present one because it investigated the dwindling interests in mathematics among students in Ado-Ekiti, while this one looks at the impact of LPIS and anxiety among Biology students in Tarauni, kano.

Vandana and Sujeet (2013) conducted a study on class XI of History subject. In that study, the effects of linear programmed instructional strategy and socialized Recitation method has been observes on the academic achievement level of students of XI Class of History. A quasi-experimental research design was used for the study and History Achievement Test (HAT) was used to collect data. One hundred and two (102) students were selected from the Government Grant-aided Secondary Schools in Rajasthan, India. A Pretest was administered to the selected sample. After that, the sample was divided into

three groups followed by a post-achievement test administration. A t-test was used to analyze the data and the finding showed that the linear programmed instructional strategy and Socialized Recitation methods was effective method in teaching of the History. The present study share the same variable with the one reviewed that is LPIS, but they differ in the subject used. The reviewed study used history while this study used Biology.

Prima and Sinnadurai (2010) investigated the relationship between study anxiety and academic performance among engineering students using quasi-experiment. A total 205 male and female student participated in this test. They were second year students from four engineering faculties at the University Malaysia. The study anxiety level was measured using State Trait Anxiety Inventory (STAI). The test to find out the significant correlation of anxiety and academic performance was carried out among the students. Meanwhile, students' academic performance was measured using Grade Point Average (GPA). The results showed that there was a significant correlation of high-level anxiety and low academic performance among engineering students with a significant correlation (p=0.000) and the correlation coefficient is small with r = .264. Data was analyzed using Pearson Product Moment Coefficient (PPMC). Students with anxiety disorder displayed a passive attitude in their studies such as lack of interest in learning, poor performance in exams and the assignments. The reviewed study shared the same variable with reviewed one that is, anxiety and gender but they differ in the subjects used.

Hassan and Okatahi (2011) investigated the relationship between test anxiety and academic performance among secondary school science students. A quasi-experimental research design was adopted. One Hundred and fifty (150) female and male students participated in the research in which Student Test Anxiety Inventory (STAI) was

administered for data collection. Participants' psychological and physiological experience was discussed before, during, and after taking the test. Mann Whitney (u-test) was used to analyze data in which the result revealed that test anxiety had negative effects on participants' academic performance. The present study shares the same variables with the one reviewed that is, anxiety, academic performance and gender but dissimilar in the sense that this study was carried out in biology while Hassan and Okatahi (2011) worked in the area of Psychology.

Tutut and Ahmad (2011) worked "A Pilot study of pre- post anxiety treatment to improve academic performance among polytechnic engineering students". A Quasi-experiment was designed for the study. The instrument used was Breath per-minute (BPM) and grade point average (GPA). Six male and female engineering students participated in the study. Pretest and posttest treatment was administered to measure the level of anxiety and academic performance for engineering students. They received six sessions of treatment each for two hours of intervention. t-test was used to analyze data. The results show that the number of anxieties was significantly reduced which BPM shows $t(2.5) = 4.788$; $p = .005$

Cassie (2012) has investigated the "Effects of Academic Anxiety on the Performance among secondary school students with and without learning disability and how student can cope with anxiety at school." A survey research design was adopted. A sample size of 300 respondents was used for the research. A Student Test Anxiety Inventory (STAI) on a four point Likert scale was used for data collection with a reliability coefficient of 0.88. Data collected was analyzed using descriptive statistics and Chi-square at 0.05. The findings of his study revealed that anxiety had its impact on academic achievement of students. The results also showed that when anxiety increases, academic achievement decreases both in

the male and female students. It is also noteworthy in the results that there was more impact of anxiety on female students as compared to male students. The reviewed study investigated the effects of academic anxiety on the performance of students with and without learning disability and how learner could cope with anxiety at school. This study investigated the impact of anxiety on the performance of Biology students.

Afolayan (2009) has investigated "The Relationship between Anxiety and Academic Performance of students in the faculty of Nursing, Niger Delta University, Wilberforce Island, Bayelsa State". A descriptive survey was used to obtain data from respondents who gave consent to the study. A Nursing Student Anxiety Questionnaire (NSAQ) was used for data collection. Data obtained was analyzed using Chi square (X^2). The result indicated that generally students expressed anxiety during examination, which is seen as physiological, psychological and behavioral changes and abnormality. The present study shares the same variables with the one, done by Afolayan (2009) that is, anxiety, academic performance and gender but they are dissimilar as the present study was carried out in biology at secondary schools Kano State while the reviewed study was conducted in Faculty of Nursing, Bayelsa State University.

2.10 Implications of Literature Reviewed for the Present Study

This study has reviewed some previous works done on Linear Programmed Instructional Strategy and other methods of teaching to find out their effectiveness in enhancing students' academic performance and how anxiety level affect students' academic performance. Findings of the reviewed work showed that Linear Programmed Instructional Strategy have profound effect as it enhanced students' academic performance by using different subjects and concepts taught. It also reduced anxiety level among students. Researchers have also found out that the use of Linear Programmed Instructional Strategy

enhances academic performance regardless of the educational level or subject matter. Perhaps, the most prominent effects of the Linear Programmed Instructional Strategy on education as a whole is the convergence of the science of learning with the practice of teaching, the point originating from the first discussion of Linear Programmed Instructional Strategy from Skinner (1968) in *The Science of Learning and the Art of Teaching*. However, most of the research works done on the use of Linear Programmed Instructional Strategy that are meant to assist learners were at the international level with only a few done at the national level. Also, most of the research works done on Linear Programmed Instructional Strategy covered areas like Mathematics, Reading, Chemistry (stereochemistry) History and Engineering. The present research therefore differed from those reviewed in the sense that it investigated the Impacts of Linear Programmed Instructional Strategy on Anxiety and Performance among Biology students in relatively a new location using the concepts of Mode of Nutrition and Photosynthesis and a lesson plan using LPIS on frames. All these added a new idea to the existing body of knowledge.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This research study examined the Impact of Linear Programmed Instructional Strategy on Anxiety and Performance among Secondary School Biology Students in Tarauni, Kano State, Nigeria. This chapter presents a general outline used in the methodology of this study under the following sub-heading:

3.2 Research Design

3.3 Population of the Study

3.4 Sample and Sampling Techniques

3.5 Instrumentation

3.6 Validity of the Instruments

3.7 Pilot Study

3.8 Administration of Treatment

3.9 Procedure for Data Collection

3.10 Procedure for Data Analysis

3.2 Research Design

In this study, a quasi-experimental-control group design, involving pretest and posttest as suggested by Kerlinger (1973), was used. The study involved two groups of control and experimental consisting of both male and female students. A pretest was administered to the two groups, before the treatment to determine their ability level. The experimental group was taught the concept Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy. While the control was taught, the same concept

using lecture method. At the end of the treatment period, a posttest was administered to both groups of students in order to determine the effectiveness of the treatment using MNPPT. The treatment was carried out over a period of six weeks. Students Test Anxiety Inventory (STAI) was also administered at the beginning before the treatment to both control and experimental groups. This was to ascertain their level of anxiety before treatment of the both groups. The same STAI was also administered after treatment to see if there was any significant effect of the treatment on the students' anxiety level. Data were analyzed using t-test and Mann Whitney. The research design is illustrated in Figure 3.1 below:

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

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

EG = Experimental Group

CG = Control Group

X_1 = Linear Programmed Instructional Strategy

X_0 = Lecture Method

O_1 = pre-test (MNPPT and STAI)

O_2 = post-test (MNPPT and STAI)

3.3 Population of the Study

The population of the study consisted of all public Senior Secondary (SSII) Biology Students in Tarauni, Kano State. The size of the population is Two thousand Four hundred and Ninety-three students (2493) in which One Thousand Two-hundred (1200) were males and One Thousand Two-hundred and Ninety-three (1293) were female students. Table 3.1

Table 3.1 Population of the Schools

S/N	School	Type of school	Gender	Total
1.	GSS Hausawa Model	Day	Male	120
2.	GSS G/Gyadi	Day	Male	70
3.	GSS Muhammad Nasir	Day	Male	95
4.	GSS U/Uku	Day	Male	178
5.	GASS B/Ila	Day	Male	100
6.	GSS B/giji	Day	Male	100
7.	GSS Darmanawa	Day	Male	116
8.	GSS Kundila	Day	Male	176
9.	GSS Tarauni	Day	Male	120
10.	GSS U/Gano	Day	Male	125
11.	GGSS U/Uku	Day	Female	125
12.	GGS Darmanawa	Day	Female	95
13.	GGSS Daurawa	Day	Female	155
14.	GASS Hausawa	Day	Female	100
15.	GGASS Daurawa	Day	Female	190
16.	GGASS Tahir	Day	Female	100
17.	GGSS Fatima Mohd	Day	Female	180
18.	GGSS Na-maituwo	Day	Female	105
19.	GGJSS Kundila	Day	Female	128
20.	GGSS Hausawa	Day	Female	115
21.	GGSS B/giji	Day	Female	100
Total				2493

Source: Kano State Senior Secondary School Management Board (KSSSSMB) 2014

3.4 Sample and Sampling Technique

Simple random sampling, involving 'balloting method' was used to select four schools out of the twenty-one (21) in the population. This was done by taking the corresponding serial number as they appeared in Table 3.1 and was written on a piece of paper and a child was asked to pick four (4) papers randomly. The schools selected were GSS Kundila, GGSS Fatima Mohd, GSS U/Gano, and GGSS U/Uku as shown in Table 3.2. The schools were assigned into control and experimental groups respectively. From the four (4) schools, one intact class of SSII was selected using balloting method of simple random sampling because

they were found to be equivalent. This gave a total number of four (4) intact classes for the study, which were randomly assigned into control and experiment groups. Thus, the total sample for the study stood at 202. Of this number, males are 104 and the females are 98.

Table 3.2 Sample for the Study

S/N	Type	School	Male	Female	Total
1.	Experiment	GGSS Fatima Mohd	-	47	47
2.	Experiment	GSS Kundila	54	-	54
3.	Control	GGSS U/Uku	-	51	51
4.	Control	GSS U/Gano	50	-	50
Total			104	98	202

3.5 Instrumentations

The instruments used for the study were Mode of Nutrition and Photosynthesis Performance Test (MNPPT) and Student Test Anxiety Inventory (STAI). MNPPT was adapted from past questions papers of WAEC and NECO and Biology textbooks, which consisted of thirty-five (35) items with multiple choice of letters A-D. MNPPT was used for pre test and posttest in order to measure the level of performance among SSII Biology students (Appendix C). The Student Test Anxiety Inventory (STAI), adapted from Spielberg (1995), consisting of Twenty (20) items, was used to measure the anxiety level among students. (Appendix F)

Table 3.3 Table of Specification for MNPPT based on Bloom's Taxonomy (1956)

Topics	Weight	K	C	A	A	S	E	Total
Mode of nutrition	67%	7	4	5	3	2	3	24
Plant nutrition	14%	3	1	-	-	-	1	4
Mechanism	11%	3	-	1	-	-	-	4
Factors	8%	2	1	-	-	-	-	3
Total	100%	15	6	6	3	2	4	35

Table 3.4 Item Analysis

Topic	K	C	AP	AN	SYN	EVA
Mode of Nutrition	1,4,7,9,17,18, 19	11,13, 14, 16	20,21,22,	5,8,10	12,15	23,24,25
Plant Nutrition	6,25,26,	27,	-	-	-	28,29
Mechanism	29,30,31	-	32	-	-	-
Factors	33,34	35	-	-	-	-

Selection of Biology Concepts used in the Study

Mode of nutrition and photosynthesis was selected to draw the content of the treatment and as well guide the design of the instrument used to measure students' anxiety and academic performance in Biology. The concepts, Mode of Nutrition and Photosynthesis are seen as abstract concept in Biology. This makes the students to hate these concepts. From my observation as a biology teacher, there is no year when question on mode of nutrition and photosynthesis does not feature in both the WAEC and NECO examination.

3.6 Validation of the Instruments

The instrument Mode of Nutrition and Photosynthesis Performance Test (MNPPT) and Student Test Anxiety Inventory (STAI) was validated by two senior lecturers who are PhD holders with a minimum rank of Senior Lecturer in the Department of Science

Education, Ahmadu Bello University, Zaria who were asked to check face and content of the instruments and another senior lecturer in the Department of English and Literary studies of the same institution to check the clarity of language used. They were asked to study the items and certify if questions so framed were out to test what they are meant to test and if they were appropriate for the level of students for which it was intended, and check for possible errors in the answers so provided.

3.7 Pilot Study

In the pilot study, one school, which was not part of the schools for the study from the population, was choose. Forty-two (42) students in an SSII class were use. They have taught mode of photosynthesis using LPIS on frame. The time and duration spent on each frame by the student was determined for effectiveness of the instrument. The time spends on each frame by the student range from 10-13 minutes as each lesson lasted for 40minutes. (Appendix D)

The essence of this pilot study is to:

- obtain reliability coefficient of the instruments;
- determine the appropriateness of the items of the instrument;
- identify the appropriate statistical tools to be used in the main study;
- find out the administrative and logistic problems that may hinder the main study;
- find out the characteristics of the instrument item analysis;
- determine the appropriateness of the length of time required to answer items in the two tests separately; and
- ascertain the appropriate wordings of the two instruments

Reliability of the Instruments

To determine the reliability coefficient of the instruments, a test- retest method was employed. The Mode of Nutrition and Photosynthesis Performance Test (MNPPT) and Student Test Anxiety Inventory (STAI) was administered to a trial-testing group of forty-two (42) students who were not part of the main study but were found to be equivalent in all aspects to the students in the study. After a two-week interval, the second test was administered to the same group of students in line with Tuckman's (1975) recommendation on the use of two-week interval for test-retest method. Pearson Product Moment Correlation Coefficient (PPMCC) was used for the analysis. From the result obtained, reliability of the instrument was found to be 0.75. This signifies that there is strong a positive relationship between the first and second administration of MNPPT.

Items Analysis of MNPPT

a. Item Difficulty Index

Item analysis was carried out from the pilot testing score to determine the item difficulty and discrimination indices. Sambo (2008) has defined item difficulty as a measure of the percentage of the people or candidates who got the item right over the total number of candidates that attempted the item. It is determined by using the formula below:

$$\text{FI} = \frac{R}{T} X\ 100$$

Where: R, is the number of candidates who got the item right

T, is the total number of candidates

Sambo (2008) further recommended that items with difficulty index between 40% to 60% be accepted. For the present study, items with difficulty index of 40% to 60% retained. Item below 40% are consider too easy, and 60% being too difficult. (Appendix F)

b. Item Discrimination Index

` The discrimination index of the test is the ability of the test item to separate between high and low-ranking students in the entire test. This was calculated using the formula given by (Furst in Olorukooba, 2001)

$$DI = \frac{RU - RI}{N}$$

Where: D I = discrimination index of test item

RU = number of candidates that got the item correct in the upper 27% of the group.

RI = number of candidates that got the item correct in the lower 27% of the group

N = number of candidates in the 27%upper or lower part of the group

Sambo (2008) has posited that items of discrimination index of 0.40 and above are very good for the study, 0.30 – 0.39 are reasonably good, 0.20 – 0.29 are marginal items that need improvement, while items with discrimination index of 0.19 and below are poor items to be discarded. Thus in this study, items ranging between 0.40 – 0.60 were accepted for final selecting of MNPAT instrument. (Appendix E)

3.8 Administration of Treatment

There were two groups involved in the study: one experimental group and one control group. Each group had one male and one female school, respectively. The experimental group was taught using the linear programmed instructional strategy while control group was taught using the lecture method.

Experimental Group – Linear Programmed Instructional Strategy

This group was taught using the Linear Programmed Instructional Strategy in the following steps. Originally, a book or a 'teaching machine' was supposed to used, but in this

research, an improvised linear programmed instructional strategy (printed self-instruction) was used.

- The researcher and research assistants presented the material to be learnt to the students in a series of steps, called frames.
- Each frame contained some information and a statement with a blank space that the student filled in.
- The student then uncovered the correct answer before going on to the next fame. If the students' answers were correct, they were positively reinforced by the instructor/research assistants. This made the students to progress to the next frame.
- Each frame may either introduce a new idea or repeat material covered earlier

The researcher and five-research assistants took the teaching responsibility using LPIS. Each student has given a frame according to the sequence shown in Appendix D.

Control Group (Lecture Method)

The control group followed the same graded sequence as in the experimental group. But here the lecture method prevailed as the method of instruction. The lesson has presented by defining the terms or concepts before the explanation. Important points have written on the chalkboard. The students have referred to the relevant Biology textbooks for more information. Students in the control group were evaluating after each lesson as demanded in the lesson plan (Appendix I). After teaching the experimental and control group posttest was administered using MNPPT to both groups. The subject scores were collected for both the control and experimental groups and subdivided into male and female scores to test for gender effect. Later, the data was subjected to analysis.

3.9 Procedure for Data Collection

The MNPPT administered to the sample first as a pretest by the researcher and the research assistants. The MNPPT then administered to the two groups in the form of examination as a posttest. The MNPPT items, was graded by the teacher and the scores were used to determine the level of students' performance. Student Test Anxiety Inventory (STAI) was give before and after treatment in order to measure the anxiety level of the students.

3.10 Procedure for Data Analysis

Mean and standard deviation was use to answer the research questions. The null hypotheses were analyze and tested at $p \leq 0.05$ level of significance.

Null Hypotheses Testing

HO_1 There is no significant difference between the mean scores of students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using the Lecture Method. This hypothesis was analyzed using t-test.

HO_2 There is no significant difference between the mean scores of male and female students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy. This hypothesis was analyzed using t-test.

HO_3 There is no significant difference between the anxiety levels of students taught using the Linear Programmed Instruction Strategy and those taught Mode of Nutrition and Photosynthesis using the Lecture Method. This hypothesis was analyze using Mann Whitney.

HO_4: There is no significant difference between the anxiety level of male and female students taught Mode of Nutrition and Photosynthesis using Linear Programmed Instructional Strategy. This hypothesis was analyzed using Mann Whitney.

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION OF RESULTS

4.1 Introduction

This study aimed at finding the Impact of Programmed Instruction on Anxiety and Academic Performance among Secondary School Biology Students in Tarauni, Kano State, Nigeria. A total of 202 students were used for the study. They were classified into two equal main groups, with both groups assessed in their mean academic performance scores and their anxiety level measured in ranks. The first 101, was subjected to the use of the Linear Programmed Instructional Strategy classified as the experimental group while the second 101 were taught with only the Lecture Method. Their academic performances and anxiety level were recorded. The statistical package of IBM Version 23 was use in the analysis of the data.

4.2 Answering Research Questions

Question One: What is the difference between the performance mean scores of students taught Mode of Nutrition and Photosynthesis using Linear Programmed Instructional Strategy and those taught using Lecture method?

Table 4.1: Descriptive Statistics on difference between the Mean Scores of Students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using the Lecture Method.

Variable	Groups	N	Mean	Std.dev	Std.Err	Mean differences
performance mean scores	Experimental	101	21.9	2.14	.21296	11.4
	Control	101	10.6	2.29	.22883	

Table 4.1 showed that difference existed between the mean scores of students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and

those taught using the Lecture method. The computed performance mean scores for the experimental and control groups are 21.9 and 10.6 respectively, and their mean difference was 11.4. This implies that students in the experimental group had higher mean scores compared to those in the control group.

Question Two: What is the difference between the mean scores of the male and female students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy?

Table 4.2 Descriptive statistics (Mean & Standard Deviation) results of the difference in Academic Performance of male and female taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy

Variable	N	Mean	SD	Mean Difference
Male	54	83.28	8.64	
				13.22
Female	47	70.06	7.33	

Table 4.2 showed that the performance of males in the experimental group with the mean score of 83.28 and standard deviation of 83.64 is higher than the performance of their female counterparts with the mean score of 70.06 and standard deviation of 7.33. The mean difference was 13.22 implying that the male students had higher mean scores because they performed better.

Question Three: What is the difference between the anxiety level among students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using the Lecture method?

Table 4.3 Mean Ranking Statistics between the Anxiety level exhibited among students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using the Lecture Method

Variable	Groups	N	Mean Rank	Sum of Ranks
Anxiety	Experimental	101	51.00	5151.00
	Control	101	152.00	15352.00
	Total	202		

Table 4.3 showed that students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy exhibited reduced anxiety than those taught using Lecture method. The computed mean rank on anxiety was 51.00 and 152.00 for experimental and the control groups respectively. Similarly, their computed sum of mean ranks on anxiety levels was 5151.00 and 15352.00 for the experimental and the control groups respectively. This shows that students in the experimental groups have significantly reduced anxiety level than those in the control groups.

Question Four: What is the difference between the anxiety level of male and female students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy?

Table 4.4 Mean Ranking Statistics of Anxiety level between male and female students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy

Anxiety	N	Mean Rank	Sum of Ranks
Anxiety before treatment	101	53.00	5151.00
Anxiety after treatment	101	52.09	5352.00

Table 4.4 showed that the anxiety level between the males and the females in the experimental group was not significant. The mean rank score of anxiety before treatment was 53.00 and the mean rank score after treatment was 52.09. Thus, the use of the Linear Programmed Instructional Strategy had a positive impact as it has helped to significantly reduces students' anxiety level.

4.3 Testing Null Hypotheses

Hypothesis One: There is no significant difference between the mean scores of students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using the Lecture method.

Table 4.5: Comparison of Posttest Mean Scores of the Experimental and the Control Groups

Variable	Groups	N	Mean	Std.dev	Df	t-cal	P
Performance mean scores	Exp	101	21.95	2.29	200	36.4	0.00
	Control	101	10.58	2.14			

Table 4.5 showed that there was a significant difference between the mean scores of students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using the Lecture method. This is because the calculated p value of 0.000 is lower than the 0.05 alpha level of significance and the calculated t value of 36.4 is higher than the 1.96 t critical value at df 200. This implies that students of the experimental group performed better than their counterpart in the control group. Therefore, null hypothesis one was rejected.

Hypothesis Two: There is no significant difference between the mean scores of male and female students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy.

Table 4.6 t-test Comparison of the Posttest Mean Scores of Male and Female taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy

Variables	N	Mean	SD	Df	t-cal	P	Remark
Male	54	21.28	2.33				*Not
				110	17.51	0.67	significant
Female	47	19.06	2.07				

*Not significant at P≥ 0.05

Table 4.6 showed that the calculated p-value is 0.67 which is greater than the level of significance at = 0.05 with df = 110. This means that there was no significant difference between the posttest scores of male and female students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instruction Strategy. Therefore, hypothesis two was retained.

Hypothesis Three: There is no significant difference between the anxiety levels of students taught using Linear Programmed Instructional Strategy and those taught using Lecture method

Table 4.7: Mann Whitney tests analysis on the difference between the Anxiety levels of students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using the Lecture method.

Variable	Groups	N	Mean Rank	Sum of Ranks	Man Whitney U	Z scores	P
Anxiety	Experimental	101	51.00	5151.00			
					5151.00	12.301	0.00
	Control	101	52.00	15352.00			
	Total	202					

Table 4.7 showed that there was a significant difference between the anxiety levels of students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using the Lecture method. The reason is that the calculated p value of 0.00 was found to be lower than the 0.05 alpha level of significance, while the calculated Man Whitney U scores of 5151.00 is higher than the 12.301 Z scores. The computed Mean Rank on anxiety was 51.00 and 52.00 by students in experimental and control respectively. Similarly, their computed sum of mean ranks on anxiety levels was 5151.00 and 15352.00 by students in the experimental and the control groups respectively. This shows that students in the experimental groups had a significantly reduced anxiety level than those in the control groups. Therefore, null hypothesis three was rejected.

Hypothesis Four: There is no significant difference in the level of anxiety between the male and the female students taught Mode of Nutrition and Photosynthesis using Linear Programmed Instructional Strategy.

Table 4.8 Man-Whitney test Analysis of Mean Scores of level of anxiety between the males and the females taught Mode of Nutrition and Photosynthesis using Linear Programmed Instructional Strategy

Anxiety	N	Mean Rank	Sum of Rank	Mann-Whitney U	Z-value	P-value
Anxiety before treatment	101	50.00	946.00	4946.00	-7.997	0.95
Anxiety after Treatment	101	53.00	2794.00			

Table 4.8 revealed that at 0.05 level of significance p-value of 0.95 was obtain. The p-value obtained is greater than the 0.05 level of significance. This means that there was no significant difference in the anxiety level between the male and the female students in the experimental group. Hence, the null hypothesis four was retained.

4.5 Summary of Major Findings

The followings are the summary of major findings of the study:

i. There was a significant difference between the performance mean scores of students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using the Lecture method in favour of the experimental group. This implies that the significant positive impact existed because of using the Linear Programmed Instructional Strategy in the teaching and learning process.

ii. There was no significant difference between the mean scores of the male and the female students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy in the experimental group.

iii. There was a significant difference between the levels of anxiety of students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using the Lecture method. This shows that males and females in the experimental groups had significantly reduced anxiety level than those in the control groups. Thus, Linear Programmed Instructional Strategy had positive impact as it has helped to significantly reduces students' anxiety level.

iv. There was no significant difference in the anxiety level between the male and the female students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy in the experimental group. This showed that the use of the Linear Programmed Instructional Strategy had a positive impact as it reduce the students' anxiety level irrespective of gender.

4.6 Discussion of Result

Results of the study are discussed below:

The analysis in Table 4.5 shows that a significant difference existed between the mean scores of Students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using the Lecture method. This implies that a significant positive impact exists in favour of the experimental group as a result of teaching Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy. This finding is in agreement with that of Nowell and Quinn (2010) on the effects

of Linear Programmed Instructional Strategy and the traditional textbook methods. Result of their findings show that those taught using Linear Programmed Instructional Strategy performed better than those taught using the lecture method. In the same vein, Colbum (2005) concluded that Linear Programmed Instructional Strategy is more effective in helping students gain understanding of concrete observable phenomenon. Some other researchers (Glas, 1999 and Dee, 2003), however, did not find any significant difference in the performance of students that were exposed to the linear programmed instructional strategy when they carried out investigations on linear programmed instructional strategy and traditional method of teaching. Such researchers reported that using the linear programmed instructional strategy in teaching Mathematics did not yield much significant effect on students' academic performance. Findings of the researcher show that a significant difference existed between students in the experimental and those in the control groups. The above argument could be expected because students who were exposed to the linear programmed instructional strategy may be carried away and overwhelmed with the opportunity given to them to use the instructional media for learning. As such, the Linear Programmed Instructional Strategy makes no accommodation for errors by student because it assumed that student would provide correct responses for nearly every question. Finding of the researcher show that there was a significant difference in the mean scores between students taught Mode of Nutrition and Photosynthesis using LPIS in the experimental and the control groups.

The analysis in Table 4.6 shows that there is no significant difference between the mean scores of the male and the female students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using

the Lecture method. This shows that sex status does not have any significant impact in the mean scores of students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and among those taught using the Lecture method in favour of experimental group. This is because exposing students to the Linear Programmed Instructional Strategy improved performance in science. The finding of the researcher is in agreement with the one of Kurbanoglu, Yavuz and Mustafa (2005) who showed that there was a significant difference between the Linear Programmed Instructional Strategy and the conventional teaching approach on the success level of students' learning stereochemistry. In addition, they found out that female students were more successful than their male counterparts in the experimental group. This finding is in contrast to that finds of Mckeon and Comber (2003) whose research pointed out that female gender is performance in science was not really encouraging. They concluded in their studies that women expressed lack of confidence in science subjects, which has been lingering for years. The same view was upheld by others like (Harden & WhiteLegg, 1997; Aigbomian, 2002) who have said that to boys performed better in science than the girls. Thus, sex plays no significant role in performance in science and technology.

The analysis in Table 4.7 showed that a significant difference existed between the anxiety levels of students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using the Lecture method. This shows that subjects in the experimental groups had significantly reduced anxiety level than those in the control groups. This finding is in agreement with that made by earlier researchers like Prima and Sinnadurai (2010), Tutut and Ahmad (2011) whose studies showed that the level of anxiety was significantly reduced when students were exposed to LPIS. This implies that

the use of the Linear Programmed Instructional Strategy had a positive impact as it has helped significantly reduce students' anxiety level. This is because the Linear Programmed Instructional Strategy as a student-centred teaching and learning approach created positive learning experiences, lower student's anxiety and enhanced higher academic performance.

The analysis of Table 4.8 shows that there was no significant difference between the anxiety level of male and female students taught Mode of Nutrition and Photosynthesis using the Linear Programmed instructional Strategy. This finding is in agreement with the one made by Tutut and Ahmad (2011) whose study showed that the anxiety level had significantly reduced among the male and the female students when they were expose to the LPIS of teaching. In the same vein, the finding of Cassie (2012) revealed that anxiety had its impact on the academic performance of students. The more anxiety increase the more academic performance decreases in both male and female students. The more the level of anxiety decreased, the more academic performance increases in both the male and the female students. However, the finding of the researcher showed that anxiety could be reduce when students are exposed to the Linear Programmed Instructional Strategy as it enhanced academic performance of the subjects.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This research study examined the Impact of Linear Programmed Instructional Strategy on anxiety and performance among Secondary School Biology Students in Tarauni, Kano State, Nigeria. In the previous chapter, data obtained for the study were analyzed and results discussed based on the hypotheses formulated. This chapter is presented under the following sub-headings:

5.2 Summary

5.3 Major findings

5.4 Conclusion

5.5 Recommendation

5.6 Limitation

5.7 Contributions to Knowledge

5.8 Suggestions for Further Study

5.2 Summary

This study examined the Impact of Linear Programmed Instructional Strategy on Anxiety and Performance among Secondary School Biology Students in Tarauni, Kano State, Nigeria. The population of the study consisted of all public Senior Secondary (SSII) Biology students in the study area. Available literature relevant to the study were reviewed.

Most of the works concluded that Linear Programmed Instructional Strategy enhances academic performance and reduce anxiety level among students.

The research design employed for the study was quasi-experimental. It involved pretest, posttest control and experimental groups. The size of the population was Two thousand Four hundred and Ninety-three students (2493). One thousand two-hundred (1200) male, and one thousand two-hundred and ninety-three (1293) female students were used for the study. Four (4) schools were selected for the study because they were found to be equivalent in their pretest scores. The sample of the study was two hundred and two (202) subjects. An intact class of SS II was picked out of the arms in the schools using simple random sampling of balloting because they were found to be equivalent. The schools were divided into the experimental and the control groups respectively.

The instruments used for the study were Mode of Nutrition and Photosynthesis Performance Test (MNPPT) adapted from past questions papers of the WAEC and NECO, consisting of thirty-five (35) items with multiple choices of letters A-D. MNPPT was designed to measure the level of performance among SSII Biology students. A Student Test Anxiety Inventory (STAI) adapted from Spielberger (1995), consisting of Twenty (20) items was also used to measure the anxiety level among the students. The experimental group was taught using LPIS while the control group was taught using lecture method.

The data collected were analyzed using t-test and Mann Whitney to test three hypotheses formulated. The results and discussions are as presented in chapter four of this study. A confidence limit of 0.05 level of significant was adopted for retaining or rejecting the hypotheses.

5.3 Major Findings

The followings are the major findings from this study:

i. There was a significant difference between the performance mean scores of students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using the Lecture method in favour of the former.

ii. There was no significant difference between the mean scores of male and female students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy.

iii. There was a significant difference between the anxiety levels of students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy and those taught using the Lecture method. This shows that males and females in the experimental groups have significantly reduced anxiety level than those in control groups. Thus, Linear Programmed Instructional Strategy has positive impact as it had helped to significantly reduces students' anxiety level.

iv. There was no significant difference in the anxiety levels between the males and the females students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy in the experimental group. This showed that the use of Linear Programmed Instructional Strategy has positive impact as it reduces student's anxiety level.

5.4 Conclusion

The following conclusions are reached from the results of the analysis:

i. Students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy had significantly higher mean scores than their counterparts taught using the Lecture Method.

ii. Both the male and the female students had the same mean scores when taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy. Therefore, LPIS is gender friendly.

iii. Students taught Mode of Nutrition and Photosynthesis using the Linear Programmed Instructional Strategy exhibited remarkable reduced anxiety levels when compared with their counterparts taught using the Lecture Method.

5.5 Recommendations

Based on the findings of this study, the followings recommendations a made:

i. Curriculum planners should examine the effectiveness of LPIS, and consider its suitability for teaching science concepts since it has the potential of bringing about meaningful learning and improving academic performance.

ii. Organizations such as the STAN, the NERDC should organize seminars, workshops and conferences on the LPIS for Biology teachers at the secondary school level for better implementation of the method.

iii. The LPIS should be incorporated into the Biology teacher training curricula at NCE and BSc. Ed Bio program in order to produce teachers who are able to handle LPIS in the teaching and learning process.

iv. The Federal and State Ministries of Education should provide adequate funds to sponsor biology teachers for training on the LPIS, procurement of Teaching Machines/CAI or programmed textbooks at all levels of education for better students' academic performance.

5.6 Limitations

The limitations of this study are:

i. That only four senior secondary schools were sample and used which limited the scope of generalization.

ii. The samples used for the study were limited to only schools owned by the Kano State Government. Private and Federal Government Schools were not involved in the study. May be if such schools were involved, the results of findings would have been different from the one obtained. This is therefore a limitation on the scope of generalization of the findings.

iii. The concept used for this is mode of nutrition and photosynthesis. If a different concept used such as evolution or genetic was used different results might have been obtained.

iv. The research assistants that used to help in the study were not familiar with the Linear Programmed Instruction Strategy for learning. Therefore, much time was spent on explaining, clarifying and involving them in the study.

5.7 Contributions to knowledge

i. The Linear Programmed Instructional Strategy has added to the existing body of knowledge as a teaching strategy that enhanced students' academic performance and reduced anxiety among biology students in Tarauni in Kano State, Nigeria.

ii. Lesson plan using the LPIS on frames has added to the existing body of knowledge on how Biology lesson could be taught.

5.8 Suggestions for Further Studies

i. In order to increase the scope of generalization, the study should be replicated in many other states in Nigeria.

ii. There is the need to study the impact of LPIS in the private schools, Federal Govt. schools with a group of students from privileged background and average income homes to see whether the same or better results will emerge.

iii. Since using the LPIS had been established as a strategy that brings about improved academic performance, other difficult areas in Biology or any other science subject should be investigated using LPIS.

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APPENDIX A

MODEL OF LINEAR PROGRAMMED INSTRUCTIONAL STRATEGY

Model of Linear Programmed instructional Strategy allow students to advance through the instructional process in a particular order as they provide correct answers. Students are provide with specific pieces of information in a series of frames and asked to recall or apply this information during frequent tests of comprehension. Frames here imply small unit of instruction presented to students at a time. Each frame contains small information and a statement with a blank that the students fill in. The students then uncover the correct answer before going to the next frame (Anderson &Fretzin, 2004)



Adapted from B.F Skinner (1954)

In linear programming, all students complete the same sequence of frames. If a student provides a correct response, the student moves to the next frame. Linear programs make no accommodation for errors by the student because it is assume that a student will provide correct responses for nearly every question.

APPENDIX B

MODE OF NUTRITION AND PHOTOSYNTHESIS PERFORMANCE TEST (MNPPT) ON FRAMES

Frame 1

Definition of Nutrition

Nutrition is one of the characteristics of living thing. It is the processes by which living organisms obtain utilize materials from external environment for metabolic activities such as respiration, growth, excretion and reproduction.

Food

Food is any substance which when absorbed into the body cells yield energy and materials for growth, repairs of damaged tissues and regulation of body processes without harming the living organisms.

Question

1. One of the characteristic features of living organism is …….
2. Any substance that can be absorbed into the body cells to yield energy and other materials for growth, repair tissues without harming is called……

Frame 2

Answers F.1

1. Nutrition
2. Food

Mode of Nutrition

Living organisms have evolved different modes of nutrition. However, organisms can be classified into two major groups based on their mode of feeding. These are autotrophic feeder (self-feeders) and hetotrophic feeders (dependent-feeders).

Questions

3. Organisms that are said to be self-feeders are called……..
4. Organisms that are said to be dependent-feeders are called …….

Answers F.2

3. Autotrophic feeders

4.Heterotrophic feeders

Frame 3

Autotrophic Mode of Nutrition

Autotrophic mode of nutrition is carried out by green plants through the process called photosynthesis and some certain bacteria through chemosynthesis process.

Photosynthesis (Holophytic) Nutrition

Green plant are capable of manufacturing their own organic food from simple inorganic substance through photosynthetic process, in the presence of carbon (IV) oxide, water, sun light and chlorophyll.

$$6CO_2 + 6H_2O \xrightarrow[chlorop\ hyll]{sun\ lig\ ht\ energy} C_6H_{12}O_6 + 6O_2$$

From the simple sugars formed other food substances such as proteins, oils and vitamins are manufacture.

Question

5. Green plants are capable for manufacturing their own food through the process called……
6. Photosynthesis is an example of ……..nutrition.

Frame 4

Answers F.3

5. Photosynthesis

6. Holophytic

Chemosynthetic Nutrition

Certain bacteria are autotrophic in nutrition. They are capable of manufacturing their own food from simple inorganic substance such as carbon (IV) oxide, water and hydrogen sulphide using energy released during chemical reaction. This process is called chemosynthesis. These bacteria do not depend upon the sunlight energy. They have enzymes system capable of trapping the chemical energy. For example, the sulphide bacteria in the soil can oxidize hydrogen sulphide around it to produce energy.

Question

7. The process in which certain bacteria synthesize their own food is called…….
8. ……..synthesize hydrogen sulphide around it to produce energy.

Answers F.4

7. Chemosynthesis

8. Sulphur bacteria

Frame 5

Heterotrophic Nutrition

This is a type of nutrition carried out by organisms that are not capable of manufacturing their own food from simple inorganic substances. Organisms that practice heterotrophic nutrition are called heterotrophs. Animal such as mammal that take large food items which need the aid of teeth to break down before entering the digestive gut are called macrophagous feeders. Other heterotrophs who take tiny food particles into their gut without breaking with teeth are called microphagous.

Question

9. Organisms that are not capable of manufacturing their own food from simple inorganic substances are called……..

10. ……are animals that can take large food items and break it down with aid of teeth before entering digestive gut.

Frame 6

Answers F.5

9. Heterotrophs

10. Macrophagous

Holozoic Nutrition

This is the type of nutrition in which food is obtain as a solid organic material, eaten, digested and absorbed into the body. Holozoic animals have to constantly search for their food and catch them, therefore, holozoic animals have developed sensory, nervous and muscular structures to enable them search and catch their food.

Different efficient digestive systems have been develop to digest the solid food materials into simple materials for absorption into the body. Nearly all animals are holozoic in nutrition.

Question

11. …… is a mode of nutrition in which food is obtained as solid organic material, digested and absorbed into the body.

12. Holozoic animals developed efficient …….that allow them materials to be absorbed into the body.

Answers F.6

11. Holozoic
12. Digestive system

Frame 7

Saprophytic Nutrition

This is a type of nutrition, which non-green plants feed on dead and decaying organic matter. Enzymes are secreting from the cells to the dead organic matter and the digestion take place outside the cells (extracellular digestion) of the saprophytic plant. Organisms, which feed saprophytically are known as saprophyte. Most fungi (e.g. mucor, mushroom and yeast) and bacteria are example.

Question

13. Saprophytic organisms are usually feeds on …….of organic matter.
14. Digestion of organic matter in saprophytic organism take place outside the cell is also known as …….

Answers F.7

13. Dead and decay

14. Extracellular digestion

Frame 8

Symbiotic Nutrition

This is type nutrition in which two organisms of different species live together to take advantage of each other's. This type of association is called symbiosis. For example the association between an alga and fungus in lichen is matualistic. Fungus provides moisture (water) mineral salt and support for the alga in which the alga uses in manufacturing food by photosynthesis for the fungus and itself.

Question

15. Association in which both organisms of different species befits each other is called ……

16. The association between alga and fungus in lichen is called…..

Answers F.8

15. Symbiosis

16. Matualitic

Frame 9

Parasitic Nutrition

This is a type of nutrition in which one organism obtains food from another organism and during the feeding process one organism is harmed and does not benefit. The organism gain food and shelter is called parasite while the organism is being harmed and provide food and shelter is called host. Parasites are of two type those live outside the body are called ectoparasites and those live inside the body are called endoparasites. Example tick and hookworm.

Question

17. The association between organisms in which one is benefit while the other is harm is called……..

18. The name of the organism being harm is called …….while the one benefit is called ……

Answers F.9

17. Parasite

18. Host,
    Parasite

Frame 10

Parasitic nutrition in flowering plant

Dodder plant (*Cassyth filiformis*) is a parasitic plant. It has small-scale leave, which are not green. The stem is thin and rope-like and coils round the stem of a host plant. Dodder develops haustoria (suckers) which are sent to the vascular bundles of the host plant from which it obtains food and water it require for its metabolism.

Question

19. Scientific name of dodder parasitic plant is called…….

20. The name of the structure, which dodder plant develops and sent into the vascular bundle of host plant is called……..

Answers F.10

19. *Cassythafi liformis*

20. Haustoria

Frame 11

Parasitic nutrition in animal

Hookworm (*Ancylostoma duodanale*) inhibits the small intestine of its host (man). It has teeth-like structures or cutting plates in its mouth, which it uses to cut holes into the intestinal walls and by means of its sucking pharynx, it sucks blood and other fluid from its host. To prevent the blood from clothing, it secretes anticoagulant from its mouth, after meal, it leaves bleeding wounds.

Question

21. *Ancylostoma duodenale* inhabits the …….of its host (man).

22. To prevent the blood from clothing, hookworm secrete……..from its mouth.

Answers F.11

21. Small intestine

22. Anticoagulant

Frame 12

Carnivorous mode of nutrition in plants

A few green plans supplement their nutrients with organic food by trapping insects and other small animals. The trapped insects are digested and the amino acids are absorbed. Often such carnivorous plant grows in soil poor in nitrogen and therefore, animal proteins are needed to supply the nitrogenous compounds requirement of the plant. Example of insectivorous plant include sundew (*Drosera rotundifolis*) and venus's flytrap (*Dionaea muscipula*)

Question

23. ……are absorbed after trapped insects are digested in carnivorous plant.

24. Carnivorous plant grows in soil poor in ……compound.

Answers F.12

23. Amino acids

24. Nitrogen compound

Frame 13

Plant Nutrition

Photosynthesis is the process by which carbohydrates or sugars are manufactured in the green part of the plant containing chlorophyll by combination of carbon (IV) oxide and water with the aid of radiant energy of sunlight and water while oxygen is given out as by-product. It is a very important process which provides food not only for green plants but also plant which lack green pigment.

Question

25. During the process of photosynthesis…….is given out as by-product.

26. In photosynthesis process…….or……..are manufacture in the green part containing chlorophyll

Answers F.13

25. Oxygen
26. Carbohydrates or sugars

Frame 14

Green pigment (chlorophyll)

The green pigments called chlorophyll when concentrated into structures are known as chloroplast. Chlorophylls are only structures capable of trapping the sun energy or other form of light energy. Chloroplasts are also present in every young part of stems and herbaceous plants enabling them to carry out photosynthesis.

Question

27. The green pigments that give leaves a unique color is called…….
28. ……..are the only structures capable of trapping the sun energy or other form of light energy.

Answers F.14

27. Chlorophyll

28. Chlorophylls

Frame 15

Mechanism of photosynthesis

The mechanism of photosynthesis is complex. It involves series of enzymes present in the plant. Two reactions called light and dark are involved.

1. Light reaction: it is called light reaction because it occurs only in the light. In the light reaction, four steps are involve

a. Step 1. Chlorophyll is energized
b. Step 2. Photolysis of water
c. Step 3. Hydrogen is transferred by NADP
d. Step 4. Formation of ATP (Adenosine triphosphate)

Question

29. Two reactions involve in the process of photosynthesis are……..and……

30. In the light reaction……steps are involve.

Answers F.15

29. Light and dark

30. Four

Frame 16

Dark reaction

It is called dark reaction because it does not require light energy. Carbon (iv) oxide is reduce by combining with two atoms of hydrogen provided by a coenzyme ($NADP_2$) to form sugars after undergoing a series of stepwise reactions. The energy needed for the formation of sugars is provided by ATP from light reaction. The production of glucose is not the end of photosynthesis activities.

Question

31. In the second stage of photosynthesis…….energy is not require.

32. The energy need for the formation of sugar is provided by…..from light reaction.

Answers F.16

31. Light

32. ATP

Frame 17

Factors, which affect photosynthesis

Photosynthesis is affected by the following factors

1. Light intensity
2. Carbon (iv) oxide
3. Water
4. Temperature
5. Chlorophyll
6. High concentration of oxygen
7. Inhibitors
8. Pollution

Question

33. The most important factor affecting photosynthesis are number…., ……, ……., and……

Answers F.17

33. 1,2,3 and 5

Frame 18

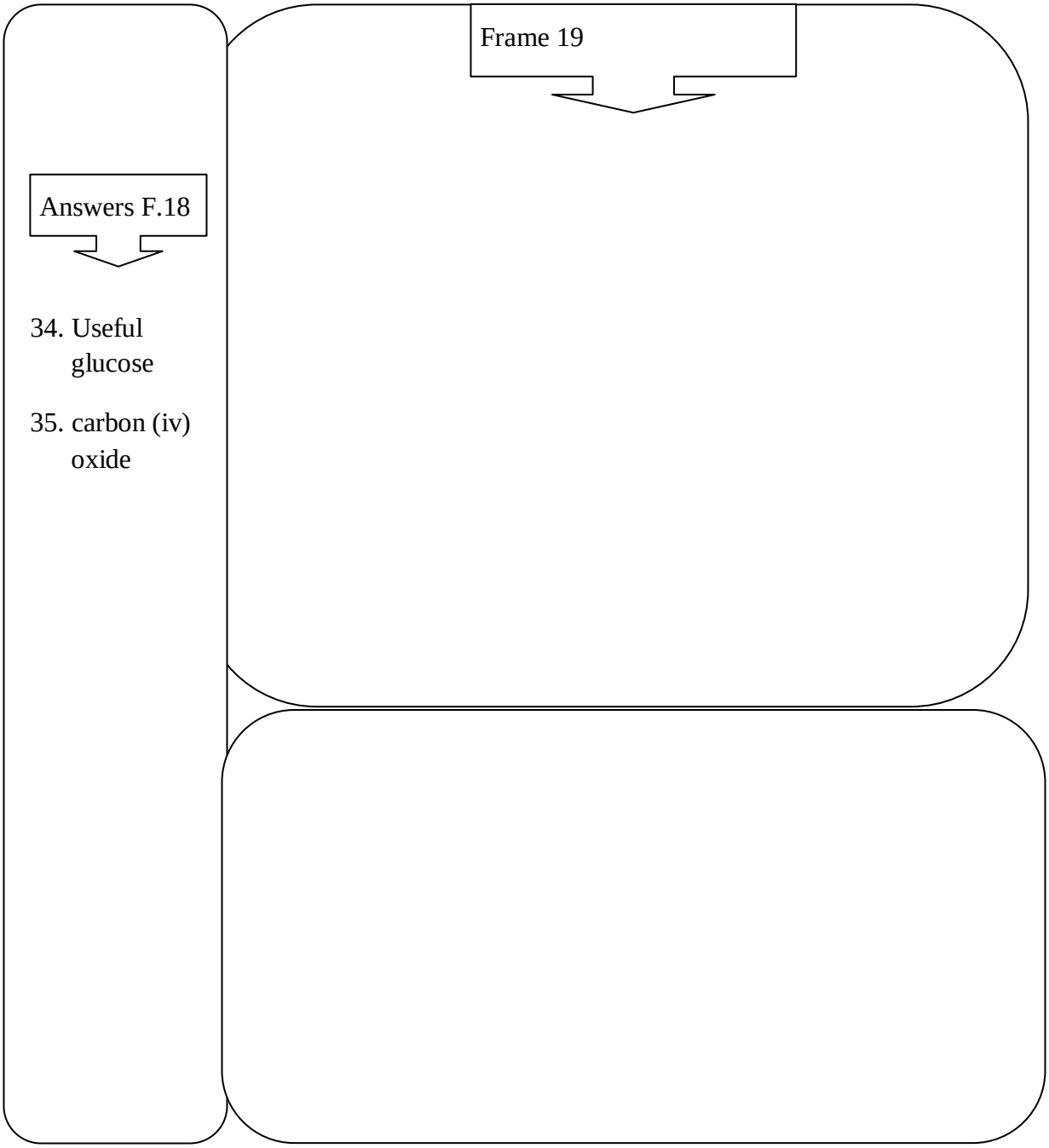
The importance of photosynthesis in nature

All living thing require energy for growth and other metabolic activities. Useful energy is stored in form of glucose which both plant and animal use during respiration is a product of photosynthesis. Oxygen, which is a by-product of the photosynthesis, is necessary for aerobic respiration. Photosynthesis purifies the atmosphere by constant removal of carbon (IV) oxide.

Question

34. Photosynthesis is important because energy from the sun is converted into…….which plant and animal use during respiration.

35. Atmosphere is constant be purifies because……is remove during the process of photosynthesis


Frame 19
Answers F.18
34. Useful glucose
35. carbon (iv) oxide

Appendix C

Distribution of the topics covered in the concepts Mode of Nutrition and Photosynthesis according to the weeks and duration in both experimental and control groups.

Week	Topic	Duration (time)
1st week	➢ Definition of Nutrition ➢ Mode of Nutrition ➢ Autotrophic and Heterotrophic Mode of Nutrition	40 minutes
2nd week	➢ Autotrophic Mode of Nutrition ➢ Photosynthesis (Holophytic) Nutrition ➢ Chemosynthetic Nutrition ➢ Heterotrophic Nutrition	40 minutes
3rd week	➢ Saprophytic Nutrition ➢ Symbiotic Nutrition ➢ Parasitic Nutrition	40 minutes
4th week	➢ Parasitic nutrition in flowering plant ➢ Parasitic nutrition in animal ➢ Plant Nutrition	40 minutes
5th week	➢ Green pigment (chlorophyll) ➢ Mechanism of photosynthesis ➢ Light reaction	40 minutes
6th week	➢ Dark reaction ➢ Factors which affect photosynthesis ➢ The importance of photosynthesis in nature	40 minutes

APPENDIX D

MODE OF NUTRITION AND PHOTOSYNTHESIS PERFORMANCE TEST (MNPPT)

1. One of the characteristic features of living organism is …….
    a. nutrition.
    b. chemical.
    c. animal.
    d. atom.
2. Any substance that can be absorbed into the body cells to yield energy and other materials for growth, repair tissues without harming is **called**……
    a. air.
    b. breath.
    c. food.
    d. metabolic.
3. Organisms that are said to be self-feeders are **called**……..
    a. heterotrophic feeders.
    b. autotrophic feeders.
    c. parasitic feeders.
    d. symbiosis feeders.
4. Organisms that are said to be dependent-feeders are **called** …….
    a. heterotrophic feeders.
    b. autotrophic feeders.
    c. plant feeders.
    d. shrub feeders.

5. Green plants are capable for manufacturing their own food through the process called……

    a. geotrophism.

    b. hydrotrophism.

    c. metabolism.

    d. photosynthesis.

6. Photosynthesis is an example of ……..nutrition.

    a. holozoic

    b. holophytic

    c. matualistic

    d. parasitic

7. The process in which certain bacteria synthesize their own food is called……

    a. hydrotrophism.

    b. geotrophism.

    c. photosynthesis.

    d. chemosynthesis.

8. ……..synthesize hydrogen sulphide around it to produce energy.

    a. Nitrogen bacteria

    b. Sulphur bacteria

    c. Carbon bacteria

    d. Hydrogen bacteria

9. Organisms that are not capable of manufacturing their own food from simple inorganic substances are **called**……

    a. autotrophs.

    b. chemotrophs.

    c. heterotrophs.

    d. phototrophs.

10. ……are animals that can take large food items and break it down with aid of teeth before entering digestive gut.

    a. Microphagous

    b. Macrophagous

    c. Holophagous

    d. Holozoic

11. …… is a mode of nutrition in which food is obtained as solid organic material, digested and absorbed into the body.

    a. Holophytic

    b. Holozoic

    c. Symbiosis

    d. Commensalism

12. Holozoic animals developed efficient …….that allow them materials to be absorbed into the body.

    a. respiratory system
    b. digestive system
    c. execratory system
    d. reproductive system

13. Saprophytic organisms are usually feeds on …….of organic matter.

    a. decay and dead
    b. dead and decay
    c. dead and delay
    d. delay and dead

14. Digestion of organic matter in saprophytic organism take place outside the cell is also known as …….

    a. intracellular digestion.
    b. intercellular digestion.
    c. entercellular digestion.
    d. extracellular digestion.

15. Association in which both organisms of different species befits each other is **called** .....

    a. parasitic.
    b. matualistic.
    c. haustoria.
    d. symbiosis.

16. The association between alga and fungus in lichen is **called**……..

    a. association.
    b. commensalism.
    c. matualistic.
    d. symbiosis.

17. The association between organisms in which one is benefit while the other is harm is **called**……..

    a. holozoic.
    b. parasitic
    c. symbiosis
    d. holophytic.

18. The name of the organism being harm is **called** ……., while the one benefit is **called** ……

    a. parasite, host.
    b. host, parasite.
    c. parasite, germ.
    d. germ, parasite.

19. Scientific name of dodder parasitic plant is **called** …….

    a. *Drosera rotundifolis*
    b. *Dionaea muscipula*
    c. *Cassytha filiformis*
    d. *Ancylostoma duodanale*

20. The name of the structure which dodder plant develops and sent into the vascular bundle of host plant is **called**……..

    a. host.
    b. acid.
    c. parasite
    d. haustoria.

21. *Ancylostoma duodenale* inhabits the …….of its host (man).

a. large intestine

b. small intestine

c. colon

d. liver

22. To prevent the blood from clotting, hookworm secrete……..from its mouth.

a. amino acids

b. nuclear acids

c. anticoagulant

d. pyrubic acid

23. …… absorbed after trapped insects are digested in carnivorous plant.

a. Sulphur acid

b. Amino acid

c. Nitrogen

d. Compound

24. Carnivorous plant grows in soil poor in ……compound.

a. carbon

b. potassium

c. manganese

d. nitrogen

25. During the process of photosynthesis ……. is given out as by-product.

a. nitrogen

b. water

c. oxygen

d. carbon

26. In photosynthesis process ……. or……..are manufacture in the green part containing chlorophyll.

a. carbohydrates or protein

b. protein or carbohydrates

c. carbohydrates or sugar

d. sugar or carbohydrates

27. The green pigments that give leaves a unique green color is **called**…….

a. xentophyll.

b. chlorophyll.

c. mesophyll.

d. casinogen.

28. …….. are the only structures capable of trapping the sun energy or other form of light energy.

a. Mesophyll

b. Granules

c. Mitochondrion

d. Chlorophylls

29. Two reactions involve in the process of photosynthesis

are……..and……

a. light and white.

b. dark and bright.

c. light and bright.

d. light and dark.

30. In the light reaction……steps are involve.

a. five

b. three

c. four

d. six

31. In the second stage of photosynthesis…….energy is not require.

a. dark

b. bright

c. light

d. brown

32. The energy need for the formation of sugar is provided by…..from light reaction.

a. ADPH

b. ATP

c. ATPH

d. ADHP

33. The following are factor affecting photosynthesis **except**

    a. Chlorophyll

    b. Water

    c. Carbon dioxide

    d. Nitrogen

34. Photosynthesis is important because energy from the sun is converted into…….which plant and animal use during respiration.

    a. useful amino acid

    b. useful glucose

    c. useful protein

    d. useful salt

35. Atmosphere is constant be purifies because……is constantly remove during the process of photosynthesis.

    a. oxygen

    b. nitrogen

    c. carbon(iv)oxide

    d. sulfur

APPENDIX E

MARKING SCHEME OF MNPPT

1.a	6.b	11.b	16.c	21.b	26.a	31.c
2.c	7.d	12.b	17.b	22.a	27.b	32.b
3.b	8.b	13.b	18.a	23.c	28.d	33.d
4.a	9.c	14.a	19.c	24.d	29.d	34.b
5.d	10.b	15.d	20.d	25.c	30.c	35.c

1. Nutrition	6. Holophytic	11. Holozoic	16. Matualitic	21. Small intestine	26. Carbohydrates or sugars	31. Light
2. Food	7. Chemosynthesis	12. Digestive system	17. Parasite	22. Anticoagulant	27. Chlorophyll	32. ATP
3. Autotrophic feeders	8. Sulphur bacteria	13. Dead and decay	18. Host, Parasite	23. Amino acids	28. Chlorophylls	33. 1, 2, 3 and 5
4. Heterotrophic feeders	9. Heterotrophs	14. Extracellular digestion	19. *Cassytha filiformis*	24. Nitrogen compound	29. Light and dark	34. Useful glucose
5. Photosynthesis	10. Macrophagous	15. Symbiosis	20. Haustoria	25. Oxygen	30. Four	35. Carbon (IV) oxide

APPENDIX F

Students Test Anxiety Inventory (STAI)

Dear respondent,

Below are the lists of items designed to investigate the degree of anxiety while answering questions on test/exam.

All information provide in this exercise will be used strictly for the research exercise only, and will be treated under stick confidentiality. Your honest responses will be appreciated.

Please note, this key provided

- Strongly agree SA
- Agree A
- Undecided UD
- Disagree D
- Strongly disagree SD

S/N	Statement	SA	A	UN	DA	SD
1	While taking the test I had an uneasy, upset feeling					
2	I felt very jittery when taking the test.					
3	Even when I am well preparing for a test, I feel very nervous about it.					
4	I will start feeling uneasy just before getting my test scores back.					
5	During the test, I was so tense that my stomach got upset.					
6	During the test, I felt very tense.					
7	After the test was over I tried to stop worrying about it, but I just couldn't.					
8	Thoughts of doing poorly interfered with my concentration on the test.					
9	I seem to defeat myself while working on tests					
10	During the test, I found myself thinking about the consequences of failing.					
11	During the test, I got so nervous that I forgot facts I					

	really knew.					
12	I felt unsure and tense while taking the exam					
13	I felt very panicky when I took the test.					
14	Thought of doing poorly interferes with my performance:					
15	Thinking of things unrelated to the actual study material:					
16	Usually get very depressed after taking an examination:					
17	I do better of when I am not anxious in an examination than in the once that I am anxious:					
18	Feel very panicky when I have to take on an examination:					
19	I wish examination did not bother me so much					
20	Feel anxious even when prepared					

Source: Adapted from Spielberger (1995)

APPENDIX G

Right Answers, Facility (FI) and Discrimination (D) Indices for Mode of Nutrition and Photosynthesis Achievement Test (MNPPT)

	Right answers	**Right scores**	**RU**	**RI**	**Facility Index** $\mathbf{FI} = \frac{R}{T}\mathbf{X}\frac{100}{1}$	**Item Discriminations** $\frac{RU - RI}{1/2N}$
1	Nutrition	17	11	3	37.77	.356
2	Food	23	12	4	51.1	.356
3	Autotrophic feeders	18	12	3	40.0	.40
4	Heterotrophic feeders	18	13	2	42.0	.488
5	Photosynthesis	20	14	3	44.44	.488
6	Holophytic	21	15	3	46.6	.533
7	Chemosynthesis	29	14	5	64.4	.40
8	Sulphur bacteria	26	11	4	57.7	.31
9	Heterotrophs	31	15	7	68.8	.356
10	Macrophagous	28	14	4	62.2	.44
11	Holozoic	27	16	5	60.0	.48
12	Digestive system	24	14	5	53.3	.40
13	Dead and decay	24	14	2	53.3	.53
14	Extracellular digestion	30	19	9	66.6	.44
15	Symbiosis	25	12	3	55.5	.48
16	Matualitic	32	15	83	71.11	.40
17	Parasite	29	18	6	64.44	.31
18	Host, Parasite	26	14	4	57.7	.53
19	*Cassytha filiformis*	33	20	6	73.3	.44
20	Haustoria	30	15	4	66.6	.53
21	Small intestine	23	10	2	51.5	.48
22	Anticoagulant	28	17	5	51.1	.356
23	Amino acids	26	13	5	62.2	.44
24	Nitrogen compound	21	14	4	57.7	.40
25	Oxygen	21	14	5	46.6	.40
26	Carbohydrates or sugars	25	12	3	55.5	.44
27	Chlorophyll	29	15	4	64.4	.40
28	Chlorophylls	32	14	5	71.11	.311
29	Light and dark	25	11	2	55.5	.356
30	Four	25	12	4	55.5	.53
31	Light	21	14	2	46.6	.53
32	ATP	22	15	3	48.88	.31
33	1, 2, 3 and 5	30	11	4	66.66	.40
34	Useful glucose	28	13	4	62.2	.44
35	Carbon (IV) oxide	34	16	6	75.5	.48

Key:

Items of discrimination index (DI)

0.40 and above are very good for the study,

0.30 – 0.39 are reasonably good,

0.20 – 0.29 are marginal items that need improvement,

0.19 and below are poor items to be discarded.

APPENDIX H

LESSON PLAN FOR EXPERIMENTAL GROUP 1(USING PROGRAMMED INSTRUCTION TO TEACH MODE OF NUTRITION CONCEPTS)

LESSON PLAN I

Subject: Biology

Topic: Mode of Nutrition

Class – SS II

Duration 40 minutes

Average Ages – 15 years

Instructional Materials: Printed self-Instruction

Entry Behaviour: students have learnt digestive enzymes

Behavioral Objective(s) – At the end of the lesson, the students are expected to:

1. Define what is of nutrition
2. List mode of nutrition

Introduction: The lesson will be introduce by asking the students some questions

1. What is food?
2. How do we get food?

Presentation: lesson will be presented the in the following steps in which the student go through the frame

Step I: Student will read about the definition of nutrition and food on Frame 1

Definition of Nutrition

Nutrition is one of the characteristics of living thing. It is the processes by which living organisms obtain utilize materials from external environment for metabolic activities such as respiration, growth, excretion and reproduction.

Food

Food is any substance which when absorbed into the body cells yield energy and materials for growth, repairs of damaged tissues and regulation of body processes without harming the living organisms.

Step II: Students will read about mode of nutrition by themselves on Frame 2

Mode of Nutrition

Living organisms have evolved different modes of nutrition. However, organisms can be classified into two major groups based on their mode of feeding. These are autotrophic feeder (self-feeders) and hetotrophic feeders (dependent-feeders).

Step III; Students will read about autotrophic and heterotrophic mode of nutrition

Autotrophic and Heterotrophic Mode of Nutrition

Autotrophic mode of nutrition is carried out by green plants through the process called photosynthesis and some certain bacteria through chemosynthesis process. Heterotrophic Nutrition. This is a type of nutrition carried out by organisms that are not capable of manufacturing their own food from simple inorganic substances. Organisms that practice heterotrophic nutrition are called heterotroph.

Evaluation: Students evaluates themselves by answering the followings questions on the frame and ensure the correct answer is written before proceed to the next frame:

1. One of the characteristic features of living organism is ……
2. Any substance that can be absorbed into the body cells to yield energy and other materials for growth, repair tissues without harming is called……
3. Organisms that are said to be self-feeders are called……..
4. Organisms that are said to be dependent-feeders are called …….

Summary and Conclusion: Teacher will crosscheck the work of the students and highlight main points of the lesson

LESSON PLAN II

Subject: Biology

Topic: Mode of Nutrition (cont'n) autotrophic and heterotrophic mode of nutrition

Class – SS II

Duration 40 minutes

Average Ages – 15 years

Instructional Materials: Printed self-instruction

Entry Behaviour: student have learnt about mode of feeding

Behavioral Objective(s) – At the end of the lesson, the students are expected to:

1. Define autotrophic mode of feeding
2. Define heterotrophic mode of feeding
3. Explain the process of photosynthesis/chemosynthesis

Introduction – The lesson will be introduced by asking students some question as:

1. Does plant eat food?
2. Where do they get it?

Presentation: The lesson will be presented in the following steps as students read the frames:

Step I: Students will read by themselves the about Autotrophic mode of nutrition on frame as follow:

Autotrophic Mode of Nutrition

Autotrophic mode of nutrition is carried out by green plants through the process called photosynthesis and some certain bacteria through chemosynthesis process.

Step II: Students will read by themselves the about the process of photosynthesis on frame as follow:

Photosynthesis (Holophytic) Nutrition

Green plant are capable of manufacturing their own organic food from simple inorganic substance through photosynthetic process, in the presence of carbon (IV) oxide, water, sun light and chlorophyll.

$6CO_2 + 6H_2O \xrightarrow[chlorophyll]{sun\ light\ energy} C_6H_{12}O_6 + 6O_2$

From the simple sugars formed other food substances such as proteins, oils and vitamins are manufacture.

Step III: Students will read by themselves about the chemosynthetic mode of nutrition on frame 4 as follow:

Chemosynthetic Nutrition

Certain bacteria are autotrophic in nutrition. They are capable of manufacturing their own food from simple inorganic substance such as carbon (IV) oxide, water and hydrogen sulphide using energy released during chemical reaction. This process is called chemosynthesis. These bacteria do not depend upon the sunlight energy. They have enzymes system capable of trapping the chemical energy. For example, the sulphide bacteria in the soil can oxidize hydrogen sulphide around it to produce energy.

Step IV: Students will read by themselves about the holozoic mode of nutrition on frame 5 as follow:

Heterotrophic Nutrition

This is a type of nutrition carried out by organisms that are not capable of manufacturing their own food from simple inorganic substances. Organisms that practice heterotrophic nutrition are called heterotrophs. Animal such as mammal that take large food items which need the aid of teeth to break down before entering the digestive gut are called macrophagous feeders. Other heterotrophs who take tiny food particles into their gut without breaking with teeth are called microphagous.

Evaluation: students evaluate themselves by answering the followings questions on the frame and ensure the correct answer is written before proceed to the next

1. Organisms that are said to be self-feeders are called……..
2. Organisms that are said to be dependent-feeders are called …….
3. Green plants are capable for manufacturing their own food through the process called……
4. Photosynthesis is an example of ……..nutrition.
5. The process in which certain bacteria synthesize their own food is called…….
6. ……..synthesize hydrogen sulphide around it to produce energy

Summary and Conclusion: Teacher will crosscheck the work of the students and highlight main points of the lesson

LESSON PLAN III

Subject: Biology

Topic: Mode of Nutrition (cont'n) autotrophic and heterotrophic mode of nutrition

Class – SS II

Duration 40 minutes

Average Ages – 15 years

Instructional Materials: Printed Self-Instruction

Entry Behaviour: student have learnt about mode of feeding

Behavioral Objective(s) – At the end of the lesson, the students are expected to:

1. Define symbiotic mode of feeding
2. Define parasitic mode of feeding in plant and animal
3. List organisms involve in the above mentioned mode of feeding

Introduction – The lesson will be introduced by asking students some question as:

1. Is there any feeding relationship among organisms?
3. How does this relationship occur?

Presentation: The lesson will be presented the in the following steps in which the student go through the frame

Step I: Students will read by themselves about the saprophytic mode of nutrition on frame 8 as follow:

Saprophytic Nutrition

This is a type of nutrition in which non-green plants feed on dead and decaying organic matter. Enzymes are secreted from the cells to the dead organic matter and the digestion take place outside the cells (extracellular digestion) of the saprophytic plant. Organisms which feed saprophytically are known as saprophyte. Most fungi (e.g. mucor, mushroom and yeast) and bacteria are example.

Step II: Students will read by themselves about the symbiotic mode of nutrition on frame 7 as follow:

Symbiotic Nutrition

This is type nutrition in which two organisms of different species live together to take advantage of each others. This type of association is called symbiosis. For example the association between an alga and fungus in lichen is matualistic. Fungus provides moisture (water) mineral salt and support for the alga in which the alga uses in manufacturing food by photosynthesis for the fungus and itself.

Step III: Students will read by themselves about the parasitic mode of nutrition on frame 9 as follow:

Parasitic Nutrition

This is a type of nutrition in which one organism obtains food from another organism and during the feeding process one organism is harmed and does not benefit. The organism gain food and shelter is called parasite while the organism is being harmed and provide food and shelter is called host. Parasites are of two type those live outside the body are called ectoparasites and those live inside the body are called endoparasites. Example tick and hookworm.

Evaluation: students evaluate themselves by answering the followings questions on the frame and ensure the correct answers are written before proceed to the next frame:

1. Organisms that are not capable of manufacturing their own food from simple inorganic substances are called……..
2. Association in which both organisms of different species befits each other is called ……
3. The association between alga and fungus in lichen is called…..
4. The association between organisms in which one is benefit while the other is harm is called……..
5. The name of the organism being harm is called …….while the one benefit is

Summary and Conclusion: Teacher will crosscheck the work of the students and highlight main points of the lesson.

LESSON PLAN IV

Subject: Biology

Topic: Plant Nutrition (photosynthesis)

Class – SS II

Duration 40 minutes

Average Ages – 15 years

Instructional Materials: Printed self-Instruction

Entry Behaviour: student have learnt about mode of feeding

Behavioral Objective(s) – At the end of the lesson, the students are expected to:

1. Define photosynthesis
2. State the function of chlorophyll in plant
3. Explain the process involve in photosynthesis

Introduction – The lesson will be introduced by asking students some question as:

1. Is there any feeding relationship among organisms?
2. How does this relationship occur?

Presentation: The lesson will be presented the in the following steps in which the student go through the frame

Step I: Students will read by themselves about the parasitic mode of nutrition in flowering plant with example of Dodder plant (*Cassyth filiformis*) on frame 10 as follow:

Parasitic nutrition in flowering plant

Dodder plant (*Cassyth filiformis*) is a parasitic plant. It has small-scale leave, which are not green. The stem is thin and rope-like and coils round the stem of a host plant. Dodder develops haustoria (suckers) which are sent to the vascular bundles of the host plant from which it obtains food and water it require for its metabolism.

Step II: Students will read by themselves about the parasitic mode of nutrition in animal on frame 11 with example of Hookworm (*Ancylostoma duodanale*) as follow:

Parasitic nutrition in animal

Hookworm (*Ancylostoma duodanale*) inhibits the small intestine of its host (man). It has teeth-like structures or cutting plates in its mouth, which it uses to cut holes into the intestinal walls and by means of its sucking pharynx, it sucks blood and other fluid from its host. To prevent the blood from clothing, it secretes anticoagulant from its mouth, after meal it leaves bleeding wounds.

Step III Students will read by themselves about the concept of plant nutrition (photosynthesis) on frame 13 as follow:

Plant Nutrition

Photosynthesis is the process by which carbohydrates or sugars are manufactured in the green part of the plant containing chlorophyll by combination of carbon (IV) oxide and water with the aid of radiant energy of sunlight and water while oxygen is given out as by-product. It is a very important process which provides food not only for green plants but also plant which lack green pigment.

Evaluation: students evaluate themselves by answering the followings questions on the frame and ensure the correct answer is written before proceed to the next frame:

1. Scientific name of dodder parasitic plant is called…….
2. The name of the structure which dodder plant develops and sent into the vascular bundle of host plant is called……..
3. *Ancylostoma duodenale* inhabits the …….of its host (man).
4. To prevent the blood from clothing, hookworm secrete……..from its During the process of photosynthesis…….is given out as

Summary and Conclusion: Teacher will crosscheck the work of the students and highlight main points of the lesson.

LESSON PLAN V

Subject: Biology

Topic: Plant Nutrition (photosynthesis)

Class – SS II

Duration 40 minutes

Average Ages – 15 years

Instructional Materials: Printed self-Instruction

Entry Behaviour: student have learnt about mode of feeding

Behavioral Objective(s) – At the end of the lesson, the students are expected to:

4. Define photosynthesis
5. State the function of chlorophyll in plant
6. Explain the process involve in photosynthesis

Introduction – The lesson will be introduced by asking students some question as:

3. Is there any feeding relationship among organisms?
4. How does this relationship occur?

Presentation: The lesson will be presented the in the following steps in which the student go through the frame

Step I: Students will read by themselves about the concept of Green pigment (chlorophyll) on frame 14 as follow:

Green pigment (chlorophyll)

The green pigments called chlorophyll when concentrated into structures are known as chloroplast. Chlorophylls are only structures capable of trapping the sun energy or other form of light energy. Chloroplasts are also present in every young part of stems and herbaceous plants enabling them to carry out photosynthesis.

Step II: Students will read by themselves about the mechanism of photosynthesis (light reactions) on frame 15 as follow:

Mechanism of photosynthesis

The mechanism of photosynthesis is complex. It involves series of enzymes present in the plant. Two reactions called light and dark are involved.

Light reaction: it is called light reaction because it occurs only in the light. In the light reaction, four steps are involve

Step 1. Chlorophyll is energized
Step 2. Photolysis of water
Step 3. Hydrogen is transferred by NADP

Step III: Students will read by themselves about the mechanism of photosynthesis (dark reactions) on frame 15 as follow:

Dark reaction

It is called dark reaction because it does not require light energy. Carbon (iv) oxide is reduce by combining with two atoms of hydrogen provided by a coenzyme ($NADP_2$) to form sugars after undergoing a series of stepwise reactions. The energy needed for the formation of sugars is provided by ATP from light reaction. The production of glucose is not the end of photosynthesis activities.

Evaluation: students evaluate themselves by answering the followings questions on the frame and ensure the correct answer is written before proceed to the next frame:

1 The green pigments that give leaves a unique color is called…….
2. . ……..are the only structures capable of trapping the sun energy or other form of light energy.
3. Two reactions involve in the process of photosynthesis are……..and……
4. In the light reaction……steps are involve.
5. In the second stage of photosynthesis…….energy is not require.. The energy need for the formation of sugar is provided by…..from light reaction

Summary and Conclusion: Teacher will crosscheck the work of the students and highlight main points of the lesson.

LESSON PLAN VI

Subject: Biology

Topic: Plant Nutrition (photosynthesis) con't

Class – SS II

Duration 40 minutes

Average Ages – 15 years

Instructional Materials: Printed self-Instruction

Entry Behaviour: student have learnt about mode of feeding

Behavioral Objective(s) – At the end of the lesson, the students are expected to:

1. List factors affecting photosynthesis
2. Explain the importance of photosynthesis in nature

Introduction – The lesson will be introduced by asking students some question as:

1. What process involve in light and dark reaction?
2. How does chlorophyll function during photosynthesis?

Presentation: The lesson will be presented the in the following steps in which the student go through the frame

Step I: Students will read by themselves about the factors affecting photosynthesis on frame 17 as follow:

Factors, which affect photosynthesis
Photosynthesis is affected by the following factors

1. Light intensity
2. Carbon (iv) oxide
3. Water
4. Temperature
5. Chlorophyll
6. High concentration of oxygen
7. Inhibitors
8. Pollution

Step II: Students will read by themselves about the importance of photosynthesis on frame 18 as follow:

The importance of photosynthesis in nature

All living thing require energy for growth and other metabolic activities. Useful energy is store in form of glucose which both plant and animal use during respiration is a product of photosynthesis. Oxygen which is a by-product of photosynthesis is necessary for aerobic respiration. Photosynthesis purifies the atmosphere by constant removal of carbon (IV) oxide.

Evaluation: students evaluate themselves by answering the followings questions on the frame and ensure the correct answers are written before proceed to the next frame:

1. The most important factor affecting photosynthesis are number…., ……, ……., and……
2. Photosynthesis is important because energy from the sun is converted into…….which plant and animal use during respiration.
3. Atmosphere is constant be purifies because……is remove during the process of photosynthesis

Summary and Conclusion: Teacher will crosscheck the work of the students and highlight main points of the lesson.

APPENDIX I

LESSON PLAN FOR CONTROL GROUP (USING LECTURE METHOD TO TEACH MODE OF NUTRITION AND PHOTOSYNTHESIS CONCEPTS

LESSON PLAN I

Subject: Biology

Topic: Mode of Nutrition

Class – SS II

Duration 40 minutes

Average Ages – 15 years

Instructional Materials: Textbook

Entry Behaviour: student have learnt about cell and its physical properties

Behavioral Objective(s) – At the end of the lesson, the students are expected to:

1. Define what is of nutrition
2. List mode of nutrition

Introduction – The teacher will introduce the lesson by asking the students some questions on

1. What is food?
2. How do we get food?

Presentation: Teacher presents the lesson in the following steps:

Step I: Definition of nutrition as one of the characteristic feature of living things

Step II: Teacher will tell the student about autotrophic and heterotrophic mode of feeding

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

1. What is nutrition?
2. List two mode of nutrition.

Summary and Conclusion: Teacher will highlight main points of the lesson.

LESSON PLAN II

Subject: Biology

Topic: Mode of Nutrition (cont'n) autotrophic and heterotrophic mode of nutrition

Class – SS II

Duration 40 minutes

Average Ages – 15 years

Instructional Materials: textbook

Entry Behaviour: student have learnt about mode of feeding

Behavioral Objective(s) – At the end of the lesson, the students are expected to:

1. Define autotrophic mode of feeding
2. Define heterotrophic mode of feeding
3. Explain the process of photosynthesis/chemosynthesis

Introduction – The teacher will introduce the lesson by asking students some question as:

1. Does plant eat food?
2. Where do they get it?

Presentation: Teacher presents the lesson in the following steps:

Step I: teacher will explain what autotrophs (self-feeders) is and heterotrophs (dependent-feeder)

Step II: Teacher will introduce the concept of photosynthesis as a process by which plant manufacture their own food

Step III: Teacher will introduce the concept of chemosynthesis as a process by which certain bacteria manufacture their own food through chemical process

Step IV: teacher will explain holozoic mode of nutrition

Step V: teacher will explain saprophytic nutrition

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

1. What is autotrophs?
2. What is heterotroph?
3. How does plant manufacture their own food?

Summary and Conclusion: Teacher will highlight main points of the lesson.

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LESSON PLAN III

Subject: Biology

Topic: Mode of Nutrition (cont'n) autotrophic and heterotrophic mode of nutrition

Class – SS II

Duration 40 minutes

Average Ages – 15 years

Instructional Materials: textbook

Entry Behaviour: student have learnt about mode of feeding

Behavioral Objective(s) – At the end of the lesson, the students are expected to:

1. Define symbiotic mode of feeding
2. Define parasitic mode of feeding in plant and animal
3. List organisms involve in the above mentioned mode of feeding

Introduction – The teacher will introduce the lesson by asking students some question as:

1. Is there any feeding relationship among organisms?
2. How does this relationship occur?

Presentation: Teacher presents the lesson in the following steps:

Step I: teacher will explain what symbiotic nutrition is

Step II: Teacher will explain parasitic nutrition

Step III: Teacher will explain parasitic nutrition in animal with example of hookworm

Step IV: teacher will explain carnivorous mode of nutrition in plant with reference to dodder plant

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

1. What is symbiosis?
2. What is parasitism?

Summary and Conclusion: Teacher will highlight main points of the lesson.

LESSON PLAN IV

Subject: Biology

Topic: Plant Nutrition (photosynthesis)

Class – SS II

Duration 40 minutes

Average Ages – 15 years

Instructional Materials: textbook

Entry Behaviour: student have learnt about mode of feeding

Behavioral Objective(s) – At the end of the lesson, the students are expected to:

1. Define photosynthesis
2. State the function of chlorophyll in plant
3. Explain the process involve in photosynthesis

Introduction – The teacher will introduce the lesson by asking students some question as:

1. Is there any feeding relationship among organisms?
2. How does this relationship occur?

Presentation: Teacher presents the lesson in the following steps:

Step I: teacher will explain the concept of photosynthesis

Step II: Teacher will explain function of chlorophyll in plant

Step III: Teacher will explain mechanism of photosynthesis (light and dark reactions)

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

1. What is photosynthesis?
2. What is chlorophyll?

Summary and Conclusion: Teacher will highlight main points of the lesson.

LESSON PLAN VI

Subject: Biology

Topic: Plant Nutrition (photosynthesis) con't

Class – SS II

Duration 40 minutes

Average Ages – 15 years

Instructional Materials: textbook

Entry Behaviour: student have learnt about mode of feeding

Behavioral Objective(s) – At the end of the lesson, the students are expected to:

1. List factors affecting photosynthesis
2. Explain the importance of photosynthesis in nature

Introduction – The teacher will introduce the lesson by asking students some question as:

1. What process involve in light and dark reaction?
2. How does chlorophyll function during photosynthesis?

Presentation: Teacher presents the lesson in the following steps:

Step I: teacher will mention the factors affecting photosynthesis.

Step II: Teacher will explain in detail how these factors affect the rate of photosynthesis

Step III: Teacher will explain the importance of photosynthesis in nature

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

1. What are factors affects photosynthesis?
2. What is the importance of photosynthesis in nature?

Summary and Conclusion: Teacher will highlight main points of the lesson.