THE EFFECT OF TEST ANXIETY, ITEM ORDER AND TIME ALLOTTED ON STUDENTS PERFORMANCE IN MATHEMATICS

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DECLARATION

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

NWOSU H.N. (MRS)

CERTIFICATION

This Thesis entitled: "The Effect of Test Anxiety, Item Order and Time Allotted on Students Performance in Mathematics" by **Nwosu Henrietta Ngozi (Mrs)**, meets the regulation governing the award of the degree of Master of Education of Ahmadu Bello University, Zaria, and it is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to my husband Lt. Col. Emmanuel O. Nwosu for patiently waiting for me to complete my studies, to my mother Mrs. Monica Mmakwe for looking after my baby and to my sweet baby Daniel Ogochukwu Nwosu who tried to understand why mummy had been away from home constantly during the period of my studies.

I love you all.

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ABSTRACT

The aim of this study is to investigate the effect of test anxiety, item order and allotted time on students performance in mathematics. The data for the study were collected by administering two forms of tests to 195 SSS3students randomly drawn from three different post primary schools in Zaria Education Zone of Kaduna State. Firstly a modified Spilberger test anxiety inventory was used to identify students with high and low anxiety was administered. Thereafter a 50 item mathematics objective test, arranged in two different orders - Easy to Difficult and Random arrangements, was administered to the students under two different conditions of time limit and no time limit, as decribed in the next paragraph.

The students who were found to have high anxiety were randomly divided into two groups. One group was given the test items that were randomly arranged while the other was given the test items that were arranged from easy to difficult. These two groups of Easy to Difficult and Random arrangement were further sub divided into two groups each with one set answering the test items under a 1 hour 40 minutes time limit and the other set were left to answer the questions under no time limit condition. The same kind of grouping also applied to the low anxiety students.

The independent t-test statistics and planned comparison were used to test the effect of test anxiety, item order and allotted time on the different groups. On the whole, it was found that there were significant differences in performances in each of the following groups compared.

1. There was a significant difference between the mathematics performance of the high anxiety students and the low anxiety students. The low anxiety students perform better in the mathematics test.
2. There was a significant difference between the mathematics performance of the high anxiety students with easy to difficulty mathematics test arrangement and low anxiety students with easy to difficult arrangement. The low anxiety students with easy to difficulty arrangement performed better in the mathematics test.
3. There was a significant difference between the mathematics performance of the high anxiety students with random mathematics test arrangement and the low anxiety students with random mathematics test arrangement. The low anxiety students with random arrangement performed better in the mathematics test.

4. There was a significant difference in mathematics performance between the low anxiety students with time limit on the mathematics test and the low anxiety students with no time limit on the mathematics test. The low anxiety students with time limit performed better in the mathematics test.

5. The was a significant difference in mathematics performance between the high anxiety students with time limit on the mathematics test and the low anxiety students with time limit on the mathematics test. The low anxiety students with time limit performed better in the mathematics test.

Following the findings. It is observed that test anxiety significantly affect students performances in mathematics. Teachers and test administrators are therefore ad-viced to try as much as possible to reduce the anxiety level of students before a test is administers.

The items in a test should be arrange either from most easy to most difficult or randomly. The same result is likely to be arrived at.

Finally time limit which is adequate for majority of the students to attempt all the test items should be given in a test.

LIST OF ABBREVIATIONS

ABREVIATION		MEANING
H	-	High Anxiety
HE	-	High Anxiety with Easy to Difficult Arrangement
HEN	-	High Anxiety with Easy to Difficult Arrangement with No Time Limit Condition.
HET	-	High Anxiety with Easy to Difficult Arrangement with Time Condition.
HN	-	High Anxiety with No Time Limit Condition
HR	-	High Anxiety with Random Arrangement
HRN	-	High Anxiety with Random Arrangement with No Time Limit Condition.
HRT	-	High Anxiety with Random Arrangement with Time Limit Condition.
HT	-	High Anxiety with Time Limit Condition
L	-	Low Anxiety
LE	-	Low Anxiety with Easy to Difficult Arrangement
LEN	-	Low Anxiety with Easy to Difficult Arrangement with No Time Limit Condition.
LET	-	Low Anxiety with Easy to Difficult Arrangement with Time Limit Condition.
LN	-	Low Anxiety with No Time Limit Condition
LR	-	Low Anxiety with Random Arrangement
LRN	-	Low Anxiety with Random Arrangement with No Time Limit Condition.
LRT	-	Low Anxiety with Random Arrangement with Time Limit Condition.
LT	-	Low Anxiety with Time Limit Condition

TABLE OF CONTENT

PAGE

TITLE PAGE..... i

DECLARATION..... ii

CERTIFICATION.....iii

DEDICATION..... iv

ACKNOWLEDGEMENT..... v

ABSTRACT.....vii

LIST OF ABBREVIATIONS.....x

TABLE OF CONTENT.....xi

LIST OF TABLES.....xiv

DEFINATION OF TERMS.....xv

LIST OF FIGURES.....xvii

LIST OF APPENDICES.....xviii

CHAPTER ONE - THE PROBLEM

1.1 Introduction..... 1

1.2 Statement of Problem..... 3

1.3 Hypotheses..... 4

1.4 Objectives of the Study..... 6

1.5 Significance of the Study..... 7

1.6 Assumptions..... 8

1.7 The Scope/Delimitation of the Study..... 8

1.8 Summary..... 8

CHAPTER TWO - REVIEW OF LITERATURE

2.1 Introduction..... 10

2.2 Conceptions of Anxiety..... 10

2.3.1 Effect of Anxiety on General Performance.... 13

2.3.2 Effect of Anxiety on Mathematics Performance..15

2.4 Effect of Item Order on Test Performance..... 19

2.5 Effect of Time Limit on Test Performance.... 22

2.6 Summary..... 27

CHAPTER THREE - RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction..... 29

3.2 Research Design..... 29

3.3 The Population..... 30

3.4 The Sample..... 30

3.5.1 Instrument I..... 31

3.5.2 Instrument II..... 33

3.6 Procedure..... 34

3.7 Collection and Analysis of Data..... 36

3.8.0 Pilot Study..... 37

3.8.1 Validity..... 37

3.8.2 Reliability..... 38

3.8.3 Time..... 38

3.9 Summary..... 39

CHAPTER FOUR - RESULT AND ANALYSES OF DATA

4.1 Introduction..... 40

4.2 Data Analysis and Interpretation of Findings.. 40

4.3 Hypothesis Testing..... 58

4.4 Summary..... 68

CHAPTER FIVE - SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction..... 72

5.2 Summary.....72

5.3 Discussions.....75

5.4 Conclusion.....78

5.5 Recommendations.....79

References.....80

LIST OF TABLES

TABLE		PAGE
3.1	Plan of the Study	30
3.2	Distribution of Population and Sample	31
3.3	Sample of Group Distribution	35
4.1	Frequency Distribution of Scores of the High and Low Anxiety Students	40
4.2	Frequency Distribution of Scores of the High Anxiety Students with Easy to Difficult Arrangement and High Anxiety Students with Random Arrangement	44
4.3	Frequency Distribution of Scores of the Low Anxiety Students with Easy to Difficult Arrangement and the Low Anxiety Students with Random Arrangement	48
4.4	Frequency Distribution of Scores of the Low Anxiety Group with Time Limit and the Low Anxiety Group with No Time Limit	52
4.5	Frequency Distribution of Scores of the High Anxiety Group with Time Limit and High Anxiety Group with No Time Limit	55
4.6	Independent T-test Analysis on Influence of Test Anxiety on Mathematics Performance	58
4.7	Summary of Mean and Standard Diviation of all the Groups the took the Test	59
4.8	Summary of Mean and Standard Diviation of the whole Students that took the test under Time Limit and No Time Limit Conditions.(Irrespective of the Form of Arrangement)	60
4.9	Comparison of the Different Groups Based on the Hypotheses using Planned T-test Analysis	61

DEFINITION OF TERMS

In the course of this study some terms have been used in some special context. The terms are defined below:

High anxiety students - The high anxiety students are those students that scored marks above the median (38) in the Spielberger (1977) test anxiety inventory (TAI) that was administered to the students.

Low anxiety students - The low anxiety students are those students that scored marks below the median (38) in the Spielberger (1977) test anxiety inventory (TAI) that was administered to the students.

Random arrangement - Random arrangement is when the mathematics test items are redistributed without minding the order of difficulty.

Easy to difficulty arrangement - Easy to difficult arrangement is when the mathematics test items are put into serial numbers based on the item difficulty starting with the must easy one to the most difficult one.

Time limit - Time limit is when students are to stop writing and submit their answer scripts after a specified amount of time whether they have finished or not. The specified amount of time for this study was one hour forty minutes.

No time limit - No time limit is when students are left to finish the test item at their own pace and submit their answer scripts any time they finished the test items.

LIST OF FIGURES

FIGURES		PAGE
1.	Distribution of Scores of the High Anxiety Group.....	42
2.	Distribution of Scores of the Low Anxiety Group.....	43
3.	Distribution of Scores of the High Anxiety Group with Easy to Difficult Arrangement....	46
4.	Distribution of Scores of the High Anxiety Group with Random Arrrangement.....	47
5.	Distribution of Scores of the Low Anxiety Group with Easy to Difficult Arrangement....	50
6.	Distribution of Scores of the Low Anxiety Group with Random Arrangement.....	51
7.	Distribution of Scores of the Low Anxiety Group with Time Limit.....	53
8.	Distribution of Scores of the Low Anxiety Group with No Time Limit.....	54
9.	Distribution of Scores of the High Anxiety Group with Time Limit.....	56
10.	Distribution of Scores of High Anxiety Group with No Time Limit.....	57

LIST OF APPENDICES

APPENDIX		PAGE
I	Modified Spilberger Test Anxiety Inventry..	84
IIa	Mathematics Achievement Test in Random Arrangement.....	86
IIb	Solution to the Mathematics Achievement Test in Random Arrangement.....	102
IIIa	Mathematics Achievement Test Arranged from Easy to Difficult.....	103
IIIb	Solution to the Mathematics Achievement test Arrangement from Easy to Difficult...	119
IV	Critical Value for the Dunm Method of Planned Comparisons.....	120

CHAPTER ONE

1.0 THE PROBLEM

1.1 Introduction:

There is the saying "Examination is not the true test of knowledge". Some othrwise brillent students have failed some important examinations, students performances have also fluctuated in examinations of the same standard and teachers have had conflicting assessment results on the same students. All these conditions are pointers that there are extrinsic factors influencing students performances in examinations.

Psychologist (Spielberger, 1966; Sarasen, 1975; Tobias, 1979) have attempted to identify factors that hinder learning generally. One of such identified factors is anxiety. Many other factors such as physical, social and emotional can pose threat and affect a student in examination conditions. Such threat according to Fraser et al (1983) can be caused by friction or competition between students or keeping up with the relationship between students and teachers. Such threat no doubt raises the anxiety level of students in examination condition.

There is a considerable amount of evidence to show that anxiety seriously hampers the total classroom functioning as well as achievement of pupils in their learning. Spielberger (1966), Tobias (1979), Frser et al (1983) all stressed that anxiety seriously hampers the

total classroom functioning as well as the achievement of pupils in their learning. Therefore for an effective teaching, learning situation and positive outcome, it is very important that anxiety in students be reduced to the possible minimum or entirely eliminated if possible (Jegede and Okebukola 1987). The reduction of anxiety in students especially during examinations will definitely lead to an improved performance and bring out the actual knowledge possessed on the subject matter.

Anxiety is expressed in different forms of reaction by different people in different situations. But some broad patterns of reactions could be identified. Mischel (1971) pointed out that most anxious person exhibit same similar reactions like conscious feeling of fear. Other typical reactions include palpitation, perspiration and frequent urination.

Most studies have shown that there is a significant negative correlation between students achievement and anxiety. For example (Liebert and Morris 1967) found an inverse relationship between worry and performance.

Sieber et al (1977) explained that test anxiety is not surprising because examination occupies a vital position in decision making process as it affects the individual student. Examination is employed for evaluative purpose to assess the ability of the students.

It is also seen by the society as one of the determinants of success in life. The results of examinations are seen as the level of the students intellectual ability and as a measure of a students' adequacy for a career (Akinboye 1984). Infact the success or failure of many individuals in life depend on their past examination results. This important position occupied by examination results in our society explains why it leads to so much anxiety.

Since so much importance is attached to examinations results in our society, all factors that will make the students not to do his/her best in examination should be taken care of. Some of such factors according to David and Miller (1976), Tompson et al (1981) include time limit and item arrangement.

1.2 Statement of Problem

The aim of any school examination is to bring out the students true knowledge of the subject. But teachers are sometimes baffled at the poor performances of some students in mathematics who, hitherto had performed well in the class. Some students became psychologically and emotionally disturbed when they have examination to take and this affects their performance in such examination. Paul and Erikson (1964) described such anxious individual as "one who knows the course material but is unable to demonstrate his knowledge in an examination because of anxiety". Moreover the time limit given in some

examinations do not allow some students to express all they know about the test if they are slow thinkers or writers for instance. Furthermore the arrangement of items in a test psychologically disturbs some students facing such examination if they are "thrown off" by the first few questions they come across.

The above implies that failure in an examination may not always be attributed to lack of knowledge; test anxiety, time limit and item arrangement may be possible causes, (Paul and Erikson; 1964; Miller and Weiss, 1976; and Tompson et al 1981.

Thus this research attempts to answer the following questions:-

a) Does the student test anxiety has an effect on his/her performance in a mathematics test?

b) Does item arrangement in a mathematics test affect the students' performance?

c) Does the time allotted for a mathematics test affect the students performance?

1.3 Hypotheses

To identify the effects which test anxiety, allotted time and item order have on students performances in mathematics, the following null hypotheses were tested at 5% level of confidence using SS3 students.

1. There is no statistically significant difference between the mathematics performance of the high anxiety students and the low anxiety students.

2a. There is no significant difference in performance between the high anxiety students with easy to difficult mathematics test arrangement and high anxiety students with random mathematics test arrangement.

2b. There is no significant difference in mathematics performance between the low anxiety students with easy to difficult mathematics test arrangement and low anxiety students with random mathematics test arrangement.

2c. There is no significant difference in mathematics performance between the high anxiety students with easy to difficult mathematics test arrangement and low anxiety students with easy to difficult mathematics test arrangement.

2d. There is no significant difference in mathematics performance between the high anxiety students with random mathematics test arrangement and the low anxiety students with random mathematics test arrangement.

3a. There is no significant difference in performance between the low anxiety students with time limit mathematics test and the low anxiety students with no time limit

mathematics test.

3b. There is no significant difference in mathematics performance between the high anxiety students with time limit on mathematics test and high anxiety students with no time limit on mathematics test.

3c. There is no significant difference in mathematics performance between the high anxiety students with time limit on mathematics test and low anxiety students with time limit on mathematics test.

3d. There is no significant difference in mathematics performance between the high anxiety students with no time limit on mathematics test and the low anxiety students with no time limit on mathematics test.

1.4 Objectives of the study

The objectives of this study are as follows.

1. To find out whether the levels of anxiety of students effect the students performance in mathematics test.
2. To find out whether item arrangement in a test has any significant effect on students performance in mathematics test.
3. To determine whether the time allotted for a test

has effect on the students performance in mathematics test.

From the result of this study, suggestions will be made for test administrators and policy makers on how best to present mathematics questions to students in order to really know how much knowledge of what is tested upon the students posses. This may perhaps help to arose students interest in mathematics rather than the subject frightening them.

1.5 Significance of the study

The significance of this study is that the knowledge of the effect of test anxiety, item order and allocated time will help examiners to appreciate the problems of students in examinations. Also the knowledge of the role of anxiety in examination performance calls for a need to render help to test anxious students in realization of the position accorded mathematics in particular and examination in general in our developing nation. The findings of this study should enlighten school administrators, teachers and counsellors on the implication of high test anxiety, time and item order on examination performance. This will enable them to improve on the method of assessing the students performance to the general advancement of mathematics in particular and education in general.

1.6 Assumptions

This study assumes that:

1. The students have covered their mathematics syllabus up to SSS3 level.
2. The capabilities of teachers teaching mathematics in the sampled schools are comparable.
3. Spielberger test anxiety inventory is capable of measuring the level of anxiety of SSS3 students.
4. The students took the test seriously and did their best.

1.7 The Scope/Delimitation of the study

This study was conducted using three randomly sampled schools in Zaria educational zone of Kaduna State namely:

1. Government Girls Secondary School, Samaru.
2. Government Secondary School, Chindit.
3. Government Secondary School, Bassawa

Therefore the results of this study is only generalizable to Sabon Gari Local Government Area of Zaria Educational zone of Kaduna State.

1.8 Summary

This chapter stated the problem and the purpose of the present study. The problem being the conflicting assessment results of some students and the poor performances of some students especially in external

examinations despite the many wars that has been lunched against poor achievement in mathematics by Mathematical Association of Nigeria.

The sole aim of this study therefore is to find the effect of test anxiety, item order and allotted time on students performances in mathematics. The result of which will help to identify ways of presenting mathematics test to students for better achievement.

CHAPTER TWO

2.0 REVIEW OF LITERATURE

2.1 Introduction

This chapter is concerned mainly with the review of literature relevant to the effect of test anxiety, item order and allotted time on students performances. This review enabled the researcher to know what was found out by previous investigators on the topics related to the present study. It is relevant to point out at the onset that the literature review are not only on performances in mathematics. The literature available in other subject area were reviewed as well. The assumption underling such review is that the information thus gathered could provide useful insight into the problem of mathematics.

The related studies were viewed under the following subheadings.

a) Conceptions of anxiety.

b) Effect of test anxiety on general performance.

c) Effect of test anxiety on mathematics performance.

d) Effect of item order on performance.

e) Effect of time limit on performance.

2.2 Conceptions of anxiety

Psychologist have put forward various theories on anxiety. Spielberger (1966) sees anxiety as a "State" and

"trait". According to him, anxiety refers to a transitory state or condition of the individual that is characterized by feeling of tension, apprehension and heightened nervous systems activity while trait anxiety implies individual's differences in anxiety proness. The difference in these two types of anxiety is illustrated by the following statements.

1. John is anxious. This sentence reflects a transitory state of apprehension, fearfulness and nervousness.
2. John is an anxious person. This second sentence reflects a more permanent state of event. All individuals can have state anxiety i.e. capable of anxiety arousal under stress.

Anxiety is seen by Sarasen (1975) as a state of mind characterized by tension, fear and worry which may sometimes be over specific object or situation. At other times it may be vague and generalized as regards the object or situation involved. It is a general feeling of apprehension, discontent, distress some times stemming from specific frustration of failure.

Liebert and Morries (1967) distinguished between two types of test anxiety. Cognitive and emotional test anxiety. According to them, the causes of arousal of emotional test anxiety is found in the physical environment of the classroom which reminds the subject of

the feelings of the previous failures in the same setting and the harsh behaviour of the instructor while conducting the test. On the other hand the cognitive component comprises of worry, fear and self critical thinking which is aroused by failure threat, difficulty of items and performance expectancies held by students.

Mischel (1971) viewed anxiety as reaction to stress. To him the event that arouses anxiety in individuals vary. The more the stress, the greater and more upsetting the persons reaction to it. He added that the intensity of the anxiety is directly related to the proximity of the danger and objective probability of being injured.

Finally, Sieber et al (1977) concluded that anxiety is not a pathological state that should be cured. Rather, it is essential and complex feeling that does not always function in a totally facilitating manner. Thus anxiety may be helpful or facilitative in learning and performing simple tasks. While in contrast anxiety is often detrimental and debilitating to performance of complex tasks.

From the different conceptions of anxiety, it can be concluded that mild anxiety is desirable. It also seem apparent that the causes of emotional test anxiety is found in the physical environment which can be reduced to enhance performance.

2.3.1 Effect of anxiety on general performance

Many studies have been conducted to investigate the relationship between anxiety, worry and performance of certain arts and its effect on test performances. Most of these studies show that anxiety hampers learning generally (Morrison and Fulmer, 1976; Deffenbacher, 1978; Tobias, 1979; Fraser et al, 1983).

Morrison and Fulmer (1976) use two psychological stress factors commonly employed in the investigation of the effect of anxiety on intellectual academic performance. The stress factors used are:

i. Ego - Involving instruction emphasising the evaluative relevance of the experimental task and

ii. Negative Feed Back or failure instruction.

They found that the effect of both of these manipulation is debilitative in nature by arousing anxiety. Anxiety thus aroused according to them stimulates competiting task, irrelevant responses which are thought to be self evaluative in nature and which interfere with performance because they direct attention away from the task at hand.

Deffenbacher (1978) supported the findings of Morrison and Fulmer (1976). His Study was on three different groups namely high anxiety high evaluation stress group, high anxiety low evaluation stress group and low anxiety high evaluation stress group. He found

that the high anxiety high evaluation stress group reacted more negatively to testing, experienced greater interference from anxiety and that they reported greater attention to worrisome thoughts, heighten physiological arousal and task generated inteferance than did either the high anxiety low stress or low anxiety high stress groups.

Tobias (1979) studied the interaction of anxiety and instructional strategies. He found that there are three points where anxiety can have largest effect on learning from instruction. These are:

a) Pre-Processing.

b) During Processing

c) After processing and just before out put.

According to him anxiety affect learning during the pre-processing stage by interfering in the degree to which external stimulation has been internally registered. He suggested that anxious students divide their attention between the demands of the task and pre-occupation with negative thoughts. Tobias (1979) concluded that less anxious students generally performed better than their more anxious counterparts because they devote more of their attention to task demands and less concerned to task that are irrelevant. He also concluded that:

i. difficulty of the task

ii. reliance on memory and

iii. organization of the tasks could arouse anxiety which will affect the cognitive operation of the pre-processing stage and thereby hinder learning.

He also reported the interference of anxiety in retrieving content mastered during instruction after the processing of instructural input. This type of interference is reported by students who claim to have studied diligently yet did not perform well in the test.

Furthermore, Fraser et al (1983) found that anxiety had negative correlation with achievement. They explained that anxiety leads to sympathetic over activity of the brain with the resultant depression in learning. They recommended that teachers should avoid events such as emphasizing competition that could boost the anxiety level of students.

From the above review it seems obvious that too much worry has a negative effect on performance. Anxiety to my believe is not entirely harmful. But too much of everything as the saying goes is bad.

2.3.2 Effect of anxiety on mathematics performance

There seem to be some relationship between general anxiety and mathematics anxiety. Richarson and Suinn (1972) pointed out that "Mathematics anxiety even exists

among many individuals who do not ordinarily suffer from any other tension". So even though mathematics anxiety is related to other types of anxiety many people who are not generally anxious are anxious about mathematics.

A consistent negative relationship has been found between anxiety and mathematics achievement such that high achievement is related to low anxiety (Szetela, 1973; Betz, 1978). Szetela (1973) in his study on effect of test anxiety and success/failure on mathematics performance found that as anxiety about mathematics test increased, performance in mathematics decreased. He concluded that mathematics test anxiety is consistently related to mathematics achievement.

In a study by Betz (1978) he examined the effect of mathematics anxiety on achievement among three groups of students which consisted of students in low level mathematics course. The second group being from more advance courses and the third group consisted of students in introductory psychology course. The result of the study suggested that mathematics anxiety is a problem for many students including many in advance classes. Also the level of mathematics anxiety reported was related to the scores on a standardised mathematics achievement test. People with high achievement scores tended to report low mathematics anxiety.

Mathematics anxiety has also been found to be

strongly related to mathematics confidence. Fennema and Sherman (1976) reported that students high in mathematics confidence tend to be low in mathematics anxiety and vice versa with confidence been a positive manifestation and anxiety a negative manifestation.

Many investigators have also studied the relationship between confidence and mathematics achievement. Among these are (Fennema and Sherman, 1977; Dowling, 1978; Reyes and Fennea, 1980). Fennema and Sherman (1977) in their study on sex related differences in mathematics achievement in middle and high school used confidence as one of the variables in their study. The main purpose of the study was to gain insight into sex related difference in mathematics achievement. The second purpose was to gain information about the various factors including confidence that was associated with sex related difference in mathematics achievement. The result of the study showed that when sex related difference in achievement in favour of males was found, it was accompanied by a sex related difference in confidence in favour of males. And sex related difference in confidence were found when there was no difference in mathematics achievement.

Dowling (1978) also studied the relationship between confidence and mathematics achievement. She found that students who had taken more years of high school

mathematics expressed more confidence and performed better than students who had taken few years in high school mathematics.

Reyes and Fennena (1980) also focused on confidence and mathematics achievement. In this study students who scored above the mean on a standardized test of mathematics achievement were divided into two groups: Students high in confidence and students low in confidence. The high and low confidence students were observed for fifteen days in their regular mathematics class to see the type of interaction they had with their mathematics teacher. It was found that high confidence students approached the teacher to talk about their mathematics work more frequently than low confidence students did. It was also found that high confidence students tended to have more of the high cognitive level interaction with the teacher than did the low confidence students. And in the class examination also it was found that the high confidence students performed better than the low confidence students.

From the above literature all the studies agree that anxiety has negative effect on mathematics performance. In addition, confidence in mathematics which is also related to anxiety has been found to be related to students achievement in mathematics. In all it is my view that mild anxiety is still desirable for a better

performance in mathematics because anxiety can also function in a facilitating manner (Sieber et al 1977).

2.4 Effect of item order on performance

Thompson et al (1981) investigated the effect of item arrangement, (easy - hard, hard - easy and random) knowledge of test arrangement on performance using 48 item multiple choice mathematics test. The subjects for their study were college sophermore volunteers from a general educational psychology class who had not been motivated to achieve on the mathematics test. In the direction which were developed to accompany each test booklet, half contained additional information explaining the order of the test items. In the other half of the book-let the direction omitted reference to the arrangement of the items. Thus there were six experimental form developed in all. The test questions were administered to the subjects with a time period of 75 minutes in a random fashion. The result showed that students performed significantly better in the easy to hard ordering. This was followed by the random arrangement. But there was no significant knowledge of ordering effect.

Plake et al (1982) investigated the effect of item arrangement and knowledge of arrangement in test performance using motivated subjects. Their instrument was a 48 item multiple choice mathematics test. Three

test forms were developed from the test. Half of the direction developed to accompany the test booklet had additional information explaining the order of the items while the information was omitted in the other half.

The test was administered to 170 high school students within the time period of 75 minutes and the questions were distributed in a random fashion to the students. Additional questions were added at the end of each form to assess the students perception of the test difficulty and their expected performance.

The analysis of the result showed that.

1. Males out performed females in mathematics test (xm = 27.6, xf = 21.5).
2. For the easy-hard ordering of the mathematics items males performed significantly better than the females with a mean of 33.40 for males as against 20.56 for females.
3. Males also scored better than the females in the random item ordering with a mean of 25.12 for male and 20.32 for females.
4. No significant effect for sex was found in the hard to easy ordering with mean for male as 25.75 and mean for female 23.62.
5. Perceived performance showed a significant sex effect with mean for male as 2.10 and mean for female as 1.39. Males therefore viewed the

test regardless of item arrangement as slightly easier than most test. Female on the other hand viewed the test as being more difficult than their male counterparts.

6. There was no significant order effect for both perceived performance and perceived difficulty.

In English Kammeenie and Dauglass (1982) in their study on the effect of test construction and instruction procedure used two separate experiment involving elementary pupils. The experiment addressed the following comprehension issues.

a) Whether substituting difficult words for easy words in a test makes the test difficult to comprehend.

b) Whether learning the meaning of difficult words facilitated test comprehension.

c) Whether embedding redundant information specific to difficult vocabulary word significantly contributes to test comprehension.

d) Whether a passage integration vocabulary training strategy is more effective than a vocabulary training strategy that does not include passage integration.

Measures used included multiple choice test and retail scores. In both experiments it was found that:

1. Substituting easy vocabulary words for

difficult vocabulary words in a passage made the test significantly easier to comprehend.

2. Information in a test significantly contributed to successful test comprehension.
3. Instructions on difficult vocabulary facilitate comprehension.
4. Children receiving passage integration training scored higher than those who did not receive integration training.

All the studies reviewed seem to agree with each other. They all showed that item arrangement appear to be an important variable which can influence performance in a test. It s also obvious that when they are three forms of arrangements (easy to difficult, random and difficult to easy) students performances are worst in the difficult to easy ordering. From the above findings I feel that items in a test should not be arranged from difficult to easy. And students seen to perform better when items are simplified.

2.5 Effect of time limit on test performance

In a study designed to investigate individual differences in test taking behaviour undertime limit and no time limit condition Miller and Weiss (1976) used 72 undergraduate students volunteers. They were told prior to the experimental testing that they would be taking a multiple choice test of verbal ability and that they

would receive a penny for every correct answer. They were first given an untimed pretest consisting of 100 multiple choice vocabulary items. This test was used to block the testees into two ability groups. The testees scoring above the median on the pretest were assigned to a high ability group and those scoring below the median on the pretest were assigned to the low ability group. Testees from each ability groups were then assigned randomly to one of the administrative conditions. Under the time limit condition, testees were told that there was a 25 minutes time limit and that the test contained 250 items. They were told to answer on the average 10 items per minute in order to finish the test. Under the no time limit condition the testees were told that there was no time limit and that the test contained 250 items. Students in both groups were told they would receive a penny for each item answered correctly. When the result was analysed the following were the findings.

1. The mean response rate under the time limit condition (8.56) was significantly higher than the mean response rate under no time limit condition (5.77).
2. The mean response rate for high ability group (7.61) was significantly higher than the mean response rate for the low ability group (6.75).
3. The difference between the response accuracies

under time limit versus no time limit condition was not significant.

4. The testees spent proportionately less time in responding to more difficult items under a time limit condition.

They concluded that time limit condition favour a higher response rate. There were no significant difference in response accuracies between time limit and no time limit condition.

David and Miller (1976) also designed a study to investigate intra individual variability in rate and accuracy of response. They used 30 undergraduate students in two experimental tests consisting of 75 mathematics items each. Each student received two 75 item tests in succession with one test administered under a time limit condition and the other under no time limit condition. Each testee was randomly assigned to one condition. Fifteen testees received the time limit condition first while the other fifteen received the no time limit condition. Under the time limit condition testees were told that the number of items in the test and that there was a 15 minutes time limit. Under the no time limit condition testees were told there was no time limit but they were not told the number of the items in the test. The testing session were terminated at the end of 15 minutes regardless of the testing condition. When the

results of the tests were analysed the following observations were made.

1. The mean response rate under the time limit condition was higher than the mean response rate under the no time limit condition.
2. The order of administration of testing did not have a significant effect by itself, but the interaction between the order of administration and the testing conditions was significant. For testees receiving the no time limit conditions first the correlation (r) between time limit and no time limit response rate was 0.88.
3. There was no significant mean effect of time limit or no time limit or interaction between these for the testees. The correlation (r) between time limit and no time limit response accuracies was 0.98 for those receiving the no time limit condition first and the correlation (r) between time limit and the no time limit response accuracies was 0.86.

Combining the data from both orders of administration, time limit response rate correlated 0.08 with time limit response accuracies while no time limit response rate correlated 0.31 with no time limit response accuracies. While the correlation of 0.08 under time limit condition was not significant, the correlation of 0.31 under no time limit condition was significant at

0.05 level of alpha.

Finally Nwogu (1988) investigated the effect of time limit on students performance in mathematics. His subjects were 120 JSS I students. The main purpose of the study being to investigate whether the time allotted for examination affect a student performance and also whether the actual time spent in answering test items has effect on the students performance.

The instrument for the study was a 40 mathematics test items covering all the topics JSS I students are supposed to have studied in their elementary school. The students were randomly put into two groups with 60 of them answering the 40 items under a time limit of one hour while the other 60 students were left to answer the questions at their own pace. But the time that each student submitted his/her script was recorded.

When the result was analysed, it was found that the difference between the mean performance of the time limit group (28.07) and the no time limit group (28.4) was not significant. It was also found that the actual time the student spent on the mathematics test (50.36) significantly affect the performance 28.24. The more time that is spent the less the score obtained by the students. The correlation between the actual time used and the performance in mathematics test was found to be -.22.

The findings in the studies reviewed above show that higher response rate were observed under the time limit condition. But the difference in the response accuracies were not statistically significant. Moreover it was also observed that when more than necessary time is spent in a mathematics test the less the score obtained by the student.

Despite the monetary incentive offered by Miller and Weiss (1976) in their study the difference between the response accuracies under time limit verse no time limit was not significant. Nwogu (1988) also observed that the more than necessary time spent in a mathematics test the less the score likely to be obtained. In view of the above findings I believe that adequate time limit should be given in a test since no time limit may even have a negative effect on performance.

2.6 Summary

This chapter reviewed the related literature to the present study. The review examined the various components in the topic. The effect of test anxiety, item order and allotted time on students performance in mathematics. The review was examined under the following sub headings.

a) Conceptions of anxiety.

b) Effect of anxiety on general performance

c) Effect of anxiety on mathematics performance

d) Effect of item order on performance

e) Effect of time limit on performance.

The literature revealed that test anxiety and item order are important factors that affect performance in mathematics. Time limit affects response rate but not necessarily response accuracy.

The literature review provided insight that helped in deciding on the method of conducting this research.

CHAPTER THREE

3.0 RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter describes the research design. It also describes the nature and selection of subjects, the instrument and the procedure for the study.

3.2 Research design

In this study, the repeated measure design was used. The design according to Kadzin (1980) involves the combination of classes of variable in a single study. The variables involved in this study are anxiety, item order and time. The 2 x 2 x 2 factorial design was used. This means that the subjects were first divided into two broad groups with the help of the first instrument which is the anxiety test. Then each of the two groups was again sub divided into two by the use of the second instrument which is the mathematics test arranged either randomly or from easy to difficult. Then lastly each of this two forms of arrangement was again given under a time limit or no time limit condition.

This is shown in the table below.

TABLE 3.1 **Plan of the Study**

HIGH ANXIETY				LOW ANXIETY			
Random Arrangement		Easy to Difficult Arrangement		Random Arrangement		Easy to Difficult Arrangement	
Time Limit Condition	No Time Limit Condition	Time Limit Condition	No Time Limit Condition	Time Limit Condition	No Time Limit Condition	Time Limit Condition	No Time Limit Condition

3.3 The population

The population for this study were the students of Government Post Primary Schools in Zaria educational zone of Kaduna State. There are a total of 38 government post primary institutions in the zone with a total population of 28,971 students as revealed by Ministry of Education, Zaria zonal office 1995.

Three schools were sampled from the zone for the study using the simple random sampling.

These schools were:

1. G.G.S.S. Samaru which has a total population of 1,027 students.
2. G.S.S. Chindit with a total population of 3,106 students.
3. G.S.S. Bassawa with a total population of 954 students.

3.4 The sample

The SSS3 students in the above three schools were the subject for the study. These set of students were

chosen because they were the next set of students to take the Senior School Certificate Examination (SSCE). So they were expected to have covered all the topics from where the questions in the instrument were drawn.

A representative sample of the student from the population of (SSS3) students in the selected schools were drawn using Morgan and Krejcie (1970) table for determining sample size. Thus in G.G.S.S Samaru 52 students were randomly drawn out of a population of 105 (SSS3) students. At GSS Chindit 97 students were randomly drawn out of a population of 197 (SSS3) students. While at GSS Bassawa 46 students were randomly selected out of a population of 93 (SSS3) students.

TABLE 3.2: Distribution of Population and Sample

NAMES OF SCHOOL	POPULATION OF SCHOOL	POPULATION OF SSS3	SAMPLE FOR STUDY
1. G.G.S.S., Samaru	1,027	105	52
2. G.S.S. Chindit	3,016	197	97
3. G.S.S Bassawa	954	93	46
Total	4,997	395	195

Thus a sample of 195 students were randomly drawn from a population of 395 students. All of them were offering mathematics in their senior school certificate examination (S.S.C.E).

3.5.1 Instrument I

The student's test anxiety was measured using the modified version of Spielberger (1977) Test Anxiety

Inventory (TAI). The Spielberger (1977) TAI was modified by Ihejiahi (1991) (from where it was got for this presnt study) for easier comprehension by the subject since the instrument was originaly developed for American students. It is a self report scale to measure test anxiety in college students. It was used to identify the high and low anxiety students. This instrument consists of 20 items alluding to anxiety reactions in evaluative situation. The subjects reported how frequently they experienced some specific symptoms of anxiety before, during and after examination using a four point scale.

Spielberger (1977) has a test retest reliability coefficient of 0.80 after two weeks and 0.62 for a group of high school students who were retested after 6 months as computed using "Kudar Richardson formula 20". It has an internal consistency reliability of 0.92 for both male and female groups and the correlation of the TAI with Sarasan Test anxiety scale TAS is 0.83 for female and 0.82 for male (Iheijiahi 1991).

In order to also check the students faithfulness and seriousness in filling the inventory items some of the items were recasted to indicate the inverse notion i.e. (confidence dimension) of other statement items in the test. The scores for the reversed items with confidence dimensions were also reversed in the four point scale.

For the test anxiety inventory (TAI) items in non confidence dimension the scores were as follows:

Never - This indicates a low test anxiety and was scored 1

Sometimes -This was scored 2

Often - This was scored 3

Always - This indicates high test anxiety and was scored 4.

while the test anxiety inventory (TAI) items in confidence dimension were scored as follows:

Never - This indicates a high test anxiety and was scored 4

Sometimes -This was scored 3

Often - This was scored 2

Always - This indicates low test anxiety and was scored 1.

Since, each response in the TAI was weighted 1 to 4, the minimum score was 20 while the maximum score was 80. The median score of the students (which was 38) was used to divide the students into two broad groups of high and low anxiety students.

3.5.2 Instrument II

The second instrument used in the study is a fifty item multiple choice mathematics test. This was selected from past West African Examination Council question papers (WAEC). The test items were constructed by West African Examination Council (WAEC). The questions were tested in pilot schools by WAEC and found valid before they were administered at the National level. Each test

items had five options of which the students were expected to choose the right answer. Each correct answer was scored 1. Therefore the maximum score obtainable was 50.

The fifty (50) items mathematics test was put into two different arrangements based on expert determination of item difficulty. This was based on the response to the questions by students of F.G.G.C., Zaria. One set of the question was arranged from easy to difficult, while the other was a random arrangement. This test was administered under two different conditions of time limit and no time limit conditions.

3.6 Procedure

The first instrument which is the test anxiety inventory was first administered and scored. The scores obtained in the anxiety test helped to group the students into two broad groups of high and low anxiety groups. The student that scored above the median (38) formed a high anxiety group while the students that scored below the median formed the low anxiety group.

Then for instrument II which is the mathematics achievement test, the students in each of the anxiety groups were randomly put into two groups. Thus the high anxiety group was divided into two and the low anxiety group was also divided into two thus forming four groups. One of each of this sub-divisions of the anxiety groups

was given the mathematics test items that were randomly arranged while the other was given the test items arranged from easy to difficult.

Then these four groups formed were also subdivided into two groups each. One of which was given the test under time limit condition and the other under no time limit condition. Thus in all there were eight sub groups. Four of which in each school were combined and given the test under time limit condition while the other four groups were combined and given the test under no time limit condition. The distribution in each school is shown in the Table 3.3 below.

TABLE 3.3: Sample of the group distribution

	HIGH ANXIETY				LOW ANXIETY				
	Random Arrangement		Easy to Difficult Arrangement		Random Arrangement		Easy to Difficult Arrangement		
	Time Limit Condition	No Time Limit Condition	Time Limit Condition	No Time Limit Condition	Time Limit Condition	No Time Limit Condition	Time Limit Condition	No Time Limit Condition	
SCH.									TOTAL
GGSS Samaru	6	7	7	6	7	6	6	7	52
GSS Chindi	12	12	12	12	12	12	13	12	97
GSS Bassawa	6	6	6	5	5	6	6	6	46
TOTAL	24	25	25	23	24	24	25	25	195

This arragement was previously done by the researcher after marking the anxiety test items before administering the second test in the schools. The students were not told the forms of the arrangement. But they were made to know that they ware taking the same test.

3.7 Collection and analysis of data

The scores obtained in the mathematics test served as the main data for the study. These data was compiled and analysed using the statistics of Means, Standard Diviation, Independent T-Test and Planned T-Test comparison. The independent t-test was used for hypothesis I while the Planned T-test comparison was used for the other hypotheses.

Independent T-test has the formula

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1-1} + \frac{S_2^2}{n_2-1}}}$$

While the planned t-test comparison has the formula

$$t(s) = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{MSW}{n_1} + \frac{MSW}{n_2}}}$$

Where (MSW) the mean square within

$$= \frac{d_{f1}S_1^2 + d_{f2}S_2^2 + \ldots + d_{fk}S_k^2}{N-K}$$

After calculating the t(s) above, then use table A-14 (Appendix iv) to check for the critical value of planned t-test comparism with N-K degrees of freedom. Where N is the total number of subjects and K is the number of comparisons made.

3.8.0 Pilot study

A pilot study as conducted to test the reliability of the instrument for the study. Government girls secondary school Dogon Bauchi, Zaria was used for the pilot study. Thirty students were sampled from SS3 students for the study.

The thirty students were first given the modified Spielbeger (1977) test anxiety inventory (TAI). The result of the (TAI) helped to group the students into low and high anxiety groups. There were fifteen students in each of the anxiety groups. Eight students from the low anxiety groups were given the mathematics test items that were arranged from most easy to most difficult. Four students out of these were given the test under a time limit condition (1hr 30min). While the other four did the test under no time limit condition.

The remaining seven students under the low anxiety group were given the mathematics test items that are randomly arranged. Four students out of this set did the test under time limit condition while the remaining three

students did the test under no time limit condition.

This same arrangement for the low anxiety group was also applied to the high anxiety group. The analyses of the result showed that:

1. the low anxiety students performed better than those with high anxiety.
2. There was no significant difference in the performance of those with easy to difficult arrangement and those with random arrangement.
3. Majority of those under the time limit condition were not able to respond to all the test items.
4. All the students under the no time limit condition responded to all the test items within two hours.

3.8.1 Validity

A table of specification was drawn to make sure that questions selected for the study covered the different aspects of mathematics syllabus. The instrument was content and face valid because the items were similar to those used by West African School Certificate Examination (WAEC) based on mathematics syllabus.

The Test Anxiety Inventory (TAI) has also been found to be a valid instrument. It has an internal consistency reliability of 0.92 for both male and female groups and the correlation of the TAI with Sarason (1962) Test Anxiety Scale (TAS) is 0.83 for female and 0.82 for male (Iheijiahi 1991).

3.8.2 Reliability

From the result of the pilot study the researcher used Kuder Richardson formula to estimate the reliability of instrument II. The instrument was found to have a reliability co-efficient of 0.66 which was significant at 0.05 alpha level. Thus the instrument was appropriate for the study.

The test anxiety inventory also has a test retest reliability coefficient of 0.80 after two weeks and 0.62 for a group of high school students who were retested after 6 months as computed using Kuder Richardson formula (Ihejiah 1991).

3.8.3 Time

From the pilot study it was found that some of the students could not respond to the 50 questions within the time limit of one hour thirty minutes (1hr 30mins). For those who were on no time limit condition, it was also found that they all responded to the 50 questions within two hours. But majority of them finished within one hour forty minutes. The above findings suggests that time limit of at least one hour forty minutes should be given for the 50 item questions rather than the one hour thirty minutes to enable majority of the students to respond to all the items. Therefore a time limit of one hour forty minutes was adopted for the study.

3.9 Summary

In this chapter, the researcher presented the procedure employed in the study. Central to the procedure was the construction of the instrument and the pilot testing of the instrument. The instrument which comprised of 50 item mathematics test was tested for validity before the administration on respondents.

Before administering the instrument to the final population, a pilot study was conducted with a total of 30 respondents. Following the pilot study modification was made on time variable before the final form was administered on the total population of 195 respondent. The respondents were SSS3 students of three post primary schools in Zaria educational zone of Kaduna State.

The t-test analysis of mean, standard deviation and planned comparison were used to analyse the data. A summary of these data follows in the next chapter.

CHAPTER FOUR

4.0 RESULT AND ANALYSES OF DATA

4.1 Introduction

This chapter contains the result and analyses of data collected for the study. It also gives general description of the data, hypothesis by hypothesis analysis and interpretation of findings. All hypotheses were tested at 0.05 level of significance.

4.2 Data analysis and interpretation of findings

The data obtained in the study are shown in the tables below. Graphs (histograms) are also used to describe the results in the tables.

TABLE 4.1: Frequency distribution of scores of the high and low anxiety students.

SCORE INTERVAL	HIGH ANXIETY (Frequency)	LOW ANXIETY (Frequency)
45.5 - 50.5	0	0
40.5 - 45.5	0	0
35.5 - 40.5	0	1
30.5 - 35.5	0	3
25.5 - 30.5	9	15
20.5 - 25.5	21	38
15.5 - 20.5	55	39
10.5 - 15.5	12	2
5.5 - 10.5	0	0
0.5 - 5.5	0	0
TOTAL	97	98

Table 4.1 above shows the frequency distribution of scores of the high and low anxiety groups. No Student in the high anxiety group scored marks above 30, while 4

students (4.7%) in the low anxiety group scored above 30. Even though it is observed that the modal class interval for both groups is 15.5-20.5, there are 55 students (56.7%) in the high anxiety group in this interval. Where as there are 39 students (39.8%) in the low anxiety group in this interval. In the high anxiety group 30 students (30.9%) scored marks above the modal group. While in the low anxiety group 57 students (58.16%) scored marks above the modal group.

Graphs of the Distribution in Table 4.1

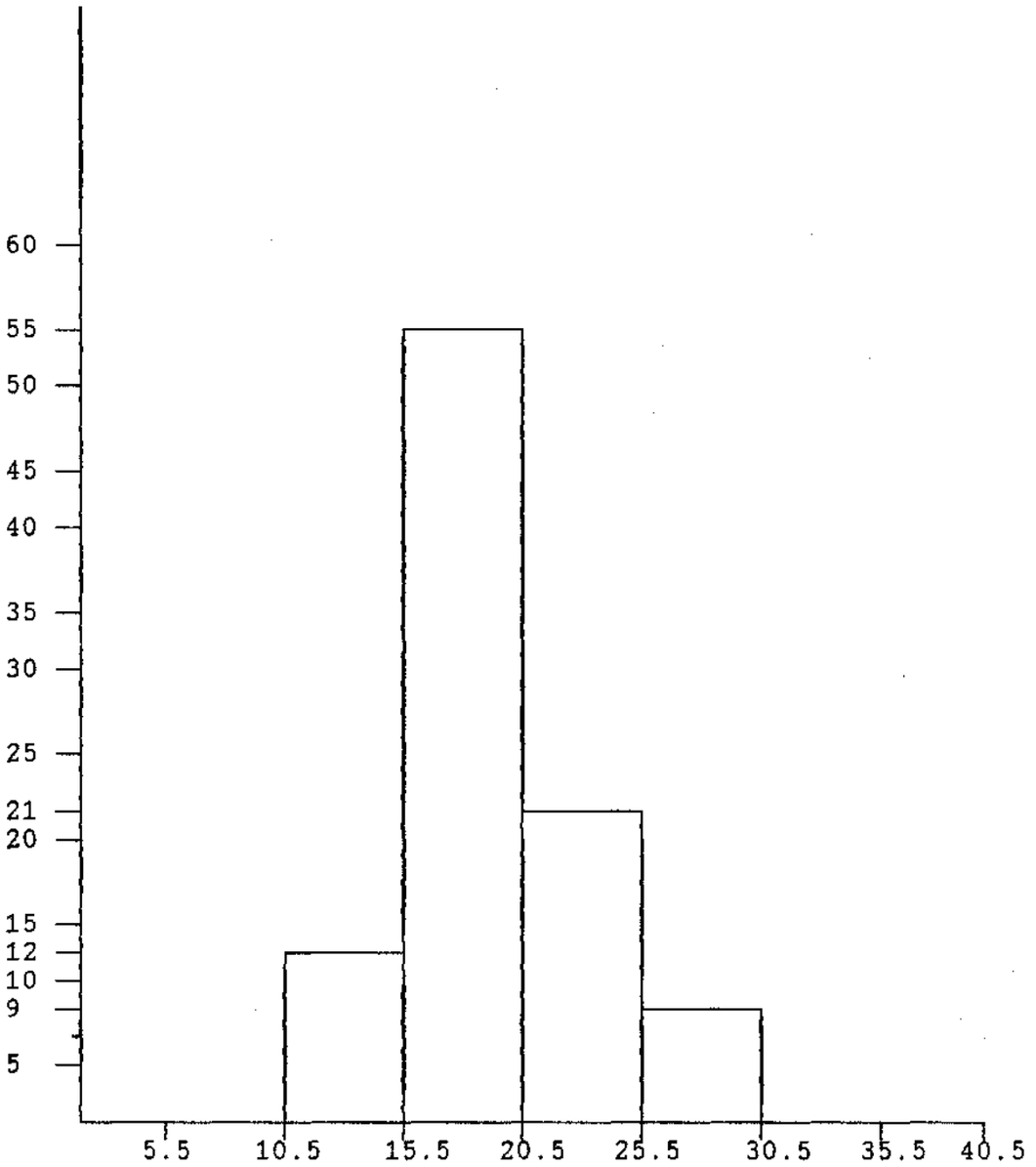


Fig. 1: Distribution of Scores of the High Anxiety Group.

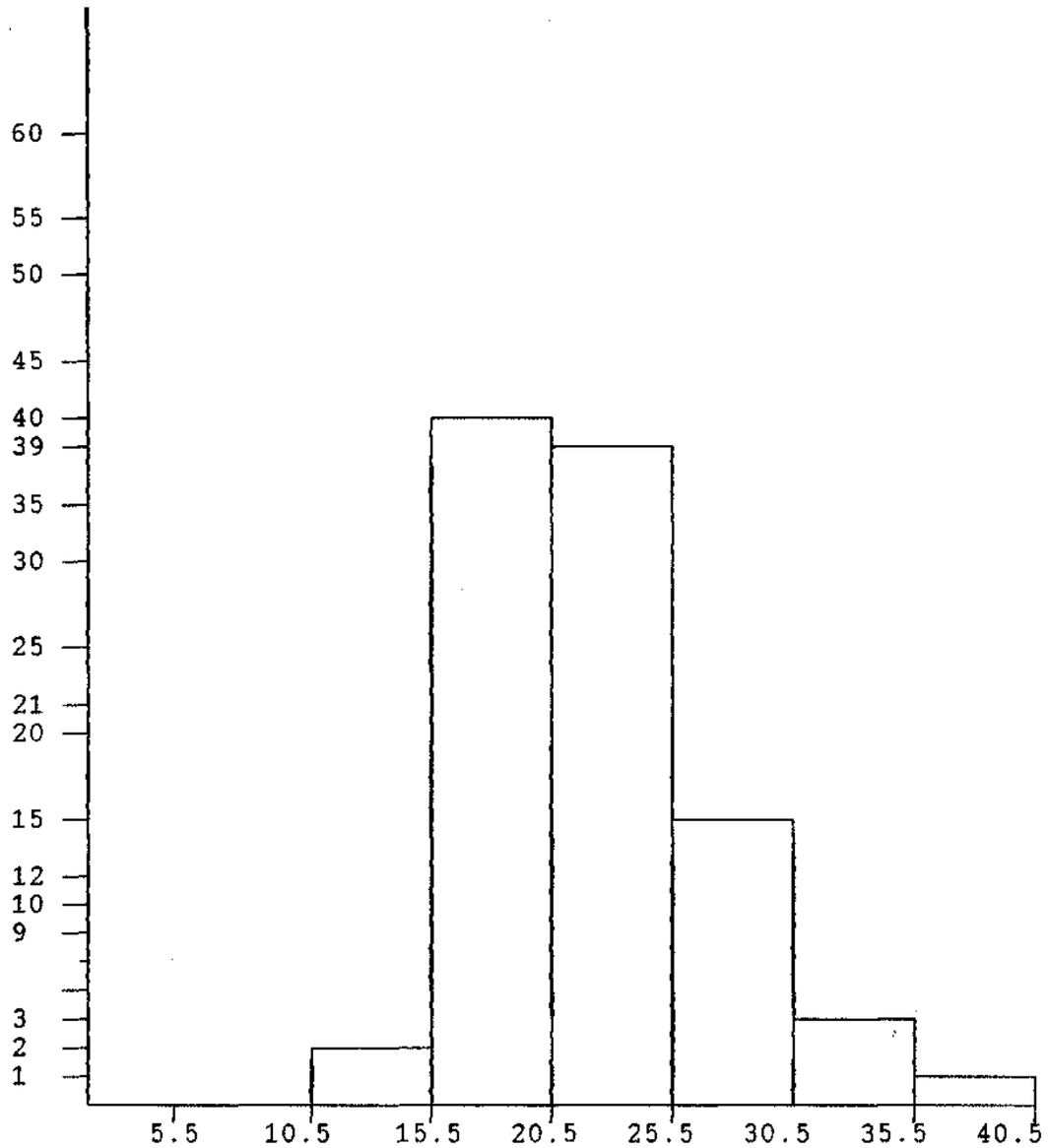


Fig. 2: Distribution of Scores of the Low Anxiety Group.

Figs 1 and 2 shows the distribution of scores of the high and low anxiety groups respectively. Fig has a very sharp peak which show that most of the members of the group scored marks that fall within one score interval. But the scores of the low anxiety group i.e. fig 2 are fairly spread apart and the graph does not have a sharp peak.

TABLE 4.2: Frequency distribution of scores of the high anxiety students with easy to difficult arrangement and high anxiety students with random arrangement.

SCORE INTERVAL	EASY TO DIFFICULT (Frequency)	RANDOM (Frequency)
45.5 - 50.5	0	0
40.5 - 45.5	0	0
35.5 - 40.5	0	0
30.5 - 35.5	0	0
25.5 - 30.5	6	3
20.5 - 25.5	12	9
15.5 - 20.5	26	29
10.5 - 15.5	4	8
5.5 - 10.5	0	0
0.5 - 5.5	0	0
TOTAL	48	49

Table 4.2 shows the frequency distribution of scores of the high anxiety group with easy to difficult arrangement and the high anxiety with random arrangement. No students in both groups score marks above 30. Even though the modal class interval for both groups is 15.5-20.5, in the easy to difficult arrangement there are 26

students (54.2%) in this group while in the random arrangement there are 29 students (59.2%) in the class interval. In the easy to difficult arrangement 18 students (37.5%) scored marks above the modal group while in the random arrangement 12 students (24.5%) scored marks above the modal group.

Graphs of the Distribution in Table 2.

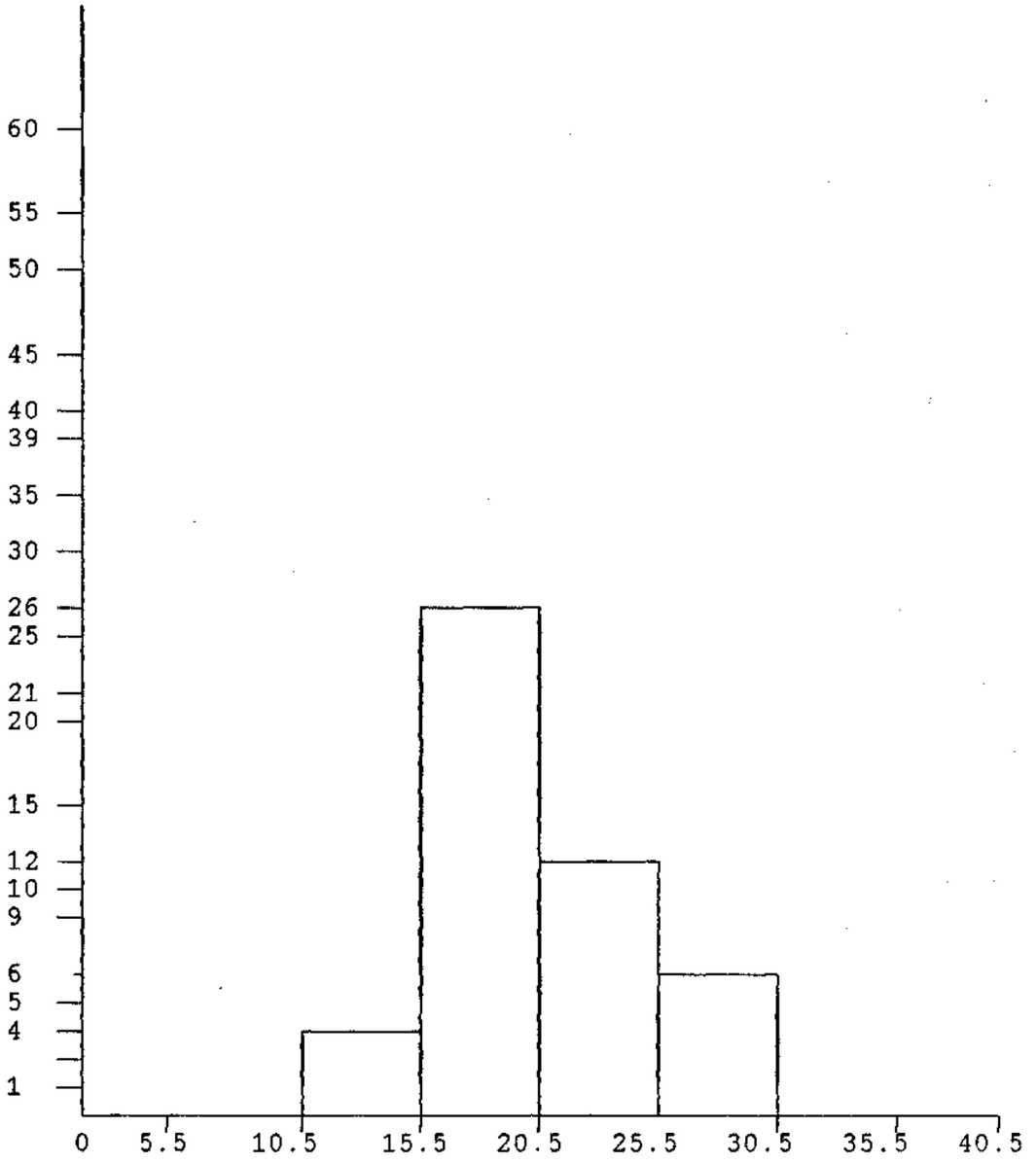


Fig. 3: Distribution of Scores of High Anxiety with Easy to Difficult Arrangement

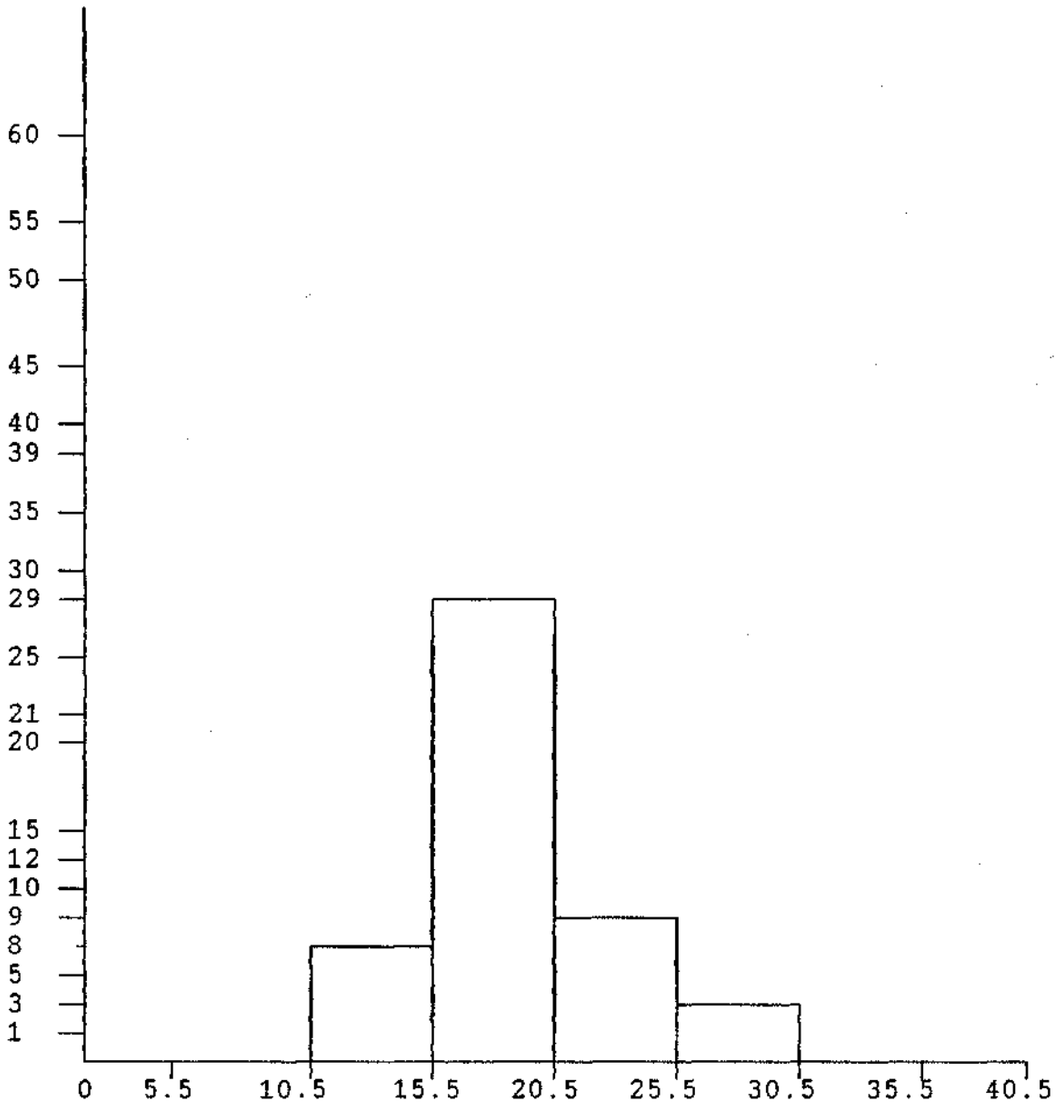


Fig. 4: Distribution of Scores of the High Anxiety Group with Random Arrangement.

Figs 3 and 4 show the graph of the high anxiety group with easy to difficult arrangement and the high anxiety group with random arrangement respectively. The graphs look symmetrical though not perfectly symmetrical. This shows that there was not much difference in the scores of the high anxiety with easy to difficult and that of the high anxiety with random arrangement.

TABLE 4.3: Frequency distribution of scores of the low anxiety students with easy to difficult arrangement and low anxiety students with random arrangement.

SCORE INTERVAL	EASY TO DIFFICULT (Frequency)	RANDOM (Frequency)
45.5 - 50.5	0	0
40.5 - 45.5	0	0
35.5 - 40.5	1	0
30.5 - 35.5	3	0
25.5 - 30.5	11	4
20.5 - 25.5	13	25
15.5 - 20.5	20	19
10.5 - 15.5	2	0
5.5 - 10.5	0	0
0.5 - 5.5	0	0
TOTAL	50	48

Table 4.3 shows the frequency distribution of scores of the low anxiety group with easy to difficult arrangement and the low anxiety group with random arrangement. The modal group for those with the easy to difficult arrangement is in the class interval 15.5-20.5. There are 20 students (40%) in this class interval. While

the modal score for those that took the random arrangement is in the interval 20.5-25.5 and there are 25 students (51.1%) in this class interval. For those that took the easy to difficult arrangement 28 students (56%) scored marks above the modal group while only 4 students (8.3%) scored marks above the modal group in the random arrangement. And 19 students (39.6%) score marks below the modal score in the random arrangement whereas only 4 students (4%) scored marks below the modal group for those that took the easy to difficult arrangement.

Graphs of the Distribution in Table 4.3.

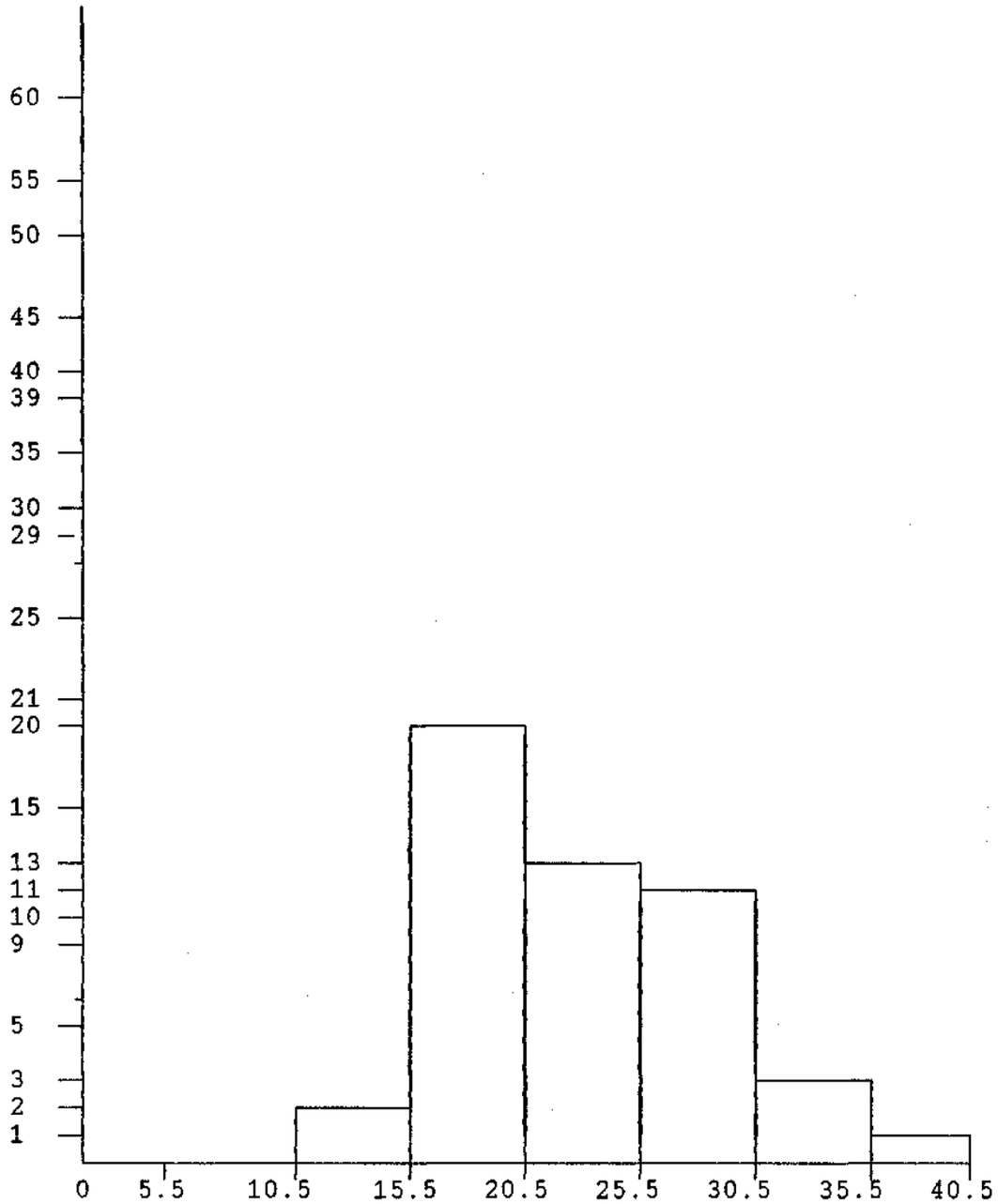


Fig. 5: Distribution of Scores of the Low Anxiety Group with Easy to Difficult Arrangement

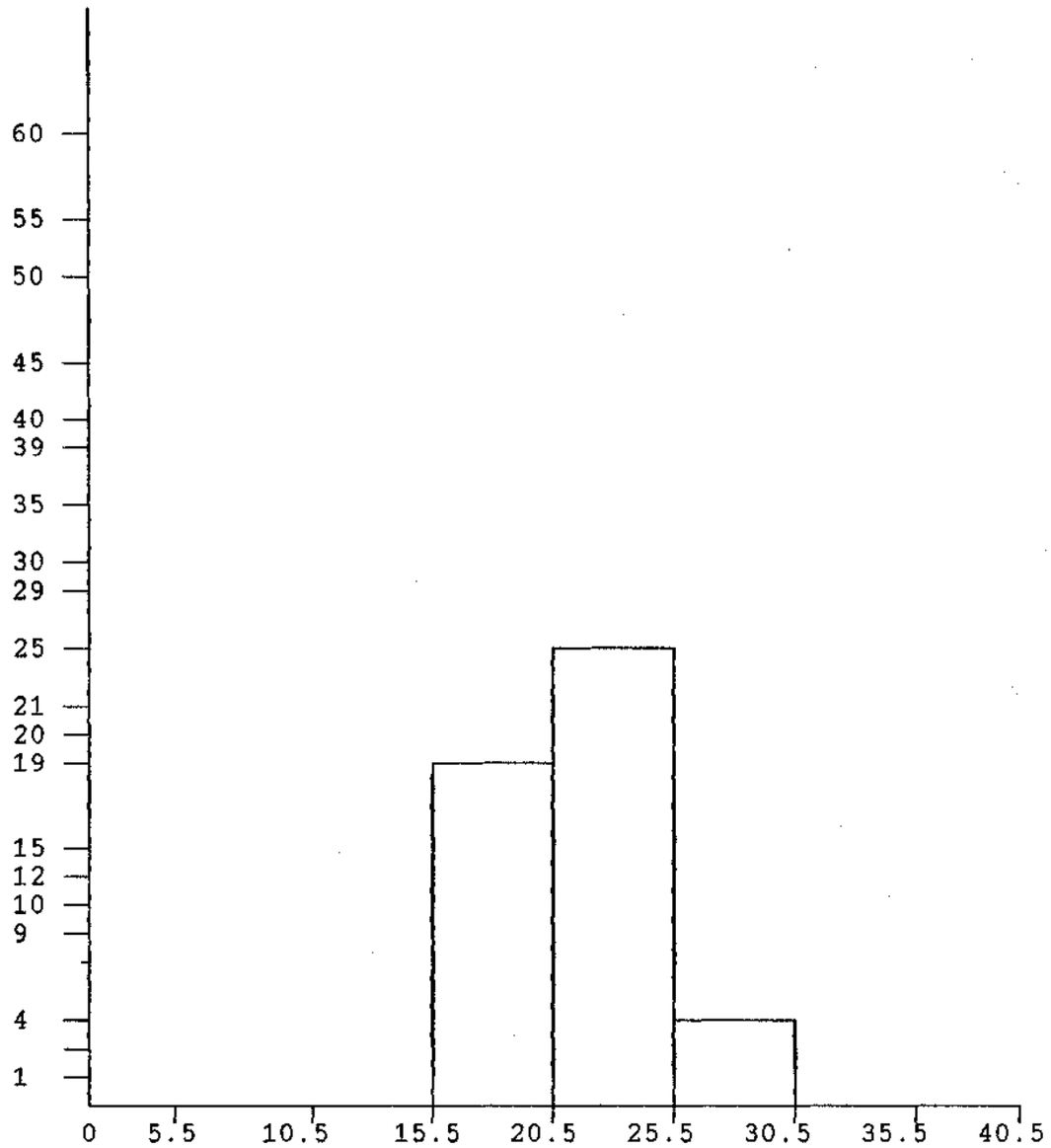


Fig. 6: Distribution of Scores of the Low Anxiety Group with Random Arrangement

Figs 5 and 6 show the graph of the distribution in Table 4.3 Fig 5 which is for the low anxiety group with easy to difficult arrangement have the scores spread apart but the graph is positively skewed. While Fig 6 have the scores clustered together.

TABLE 4.4: Frequency distribution of scores of the low anxiety group with time limit and the low anxiety group with no time limit.

SCORE INTERVAL	TIME LIMIT (Frequency)	NO TIME LIMIT (Frequency)
45.5 - 50.5	0	0
40.5 - 45.5	0	0
35.5 - 40.5	1	0
30.5 - 35.5	2	1
25.5 - 30.5	13	2
20.5 - 25.5	17	21
15.5 - 20.5	15	24
10.5 - 15.5	1	1
5.5 - 10.5	0	0
0.5 - 5.5	0	0
TOTAL	49	49

In Table 4.4 the modal group for those with time limit is in the class interval 20.5-25.5. There are 17 students (34.7%) in this group. But the modal group for those with no time limit is in the class interval 15.5-20.5 and there are 24 students (49%) in this interval. For the time limit 16 students (32.6%) scored marks above the modal group. While also 16 students (32.6%) score marks below the modal group. For the no time limit 24 students (49%) scored marks above the modal group. While only 1 student (2%) scored mark below the modal group in the no time limit condition.

Graphs of the Distribution in Table 4.6

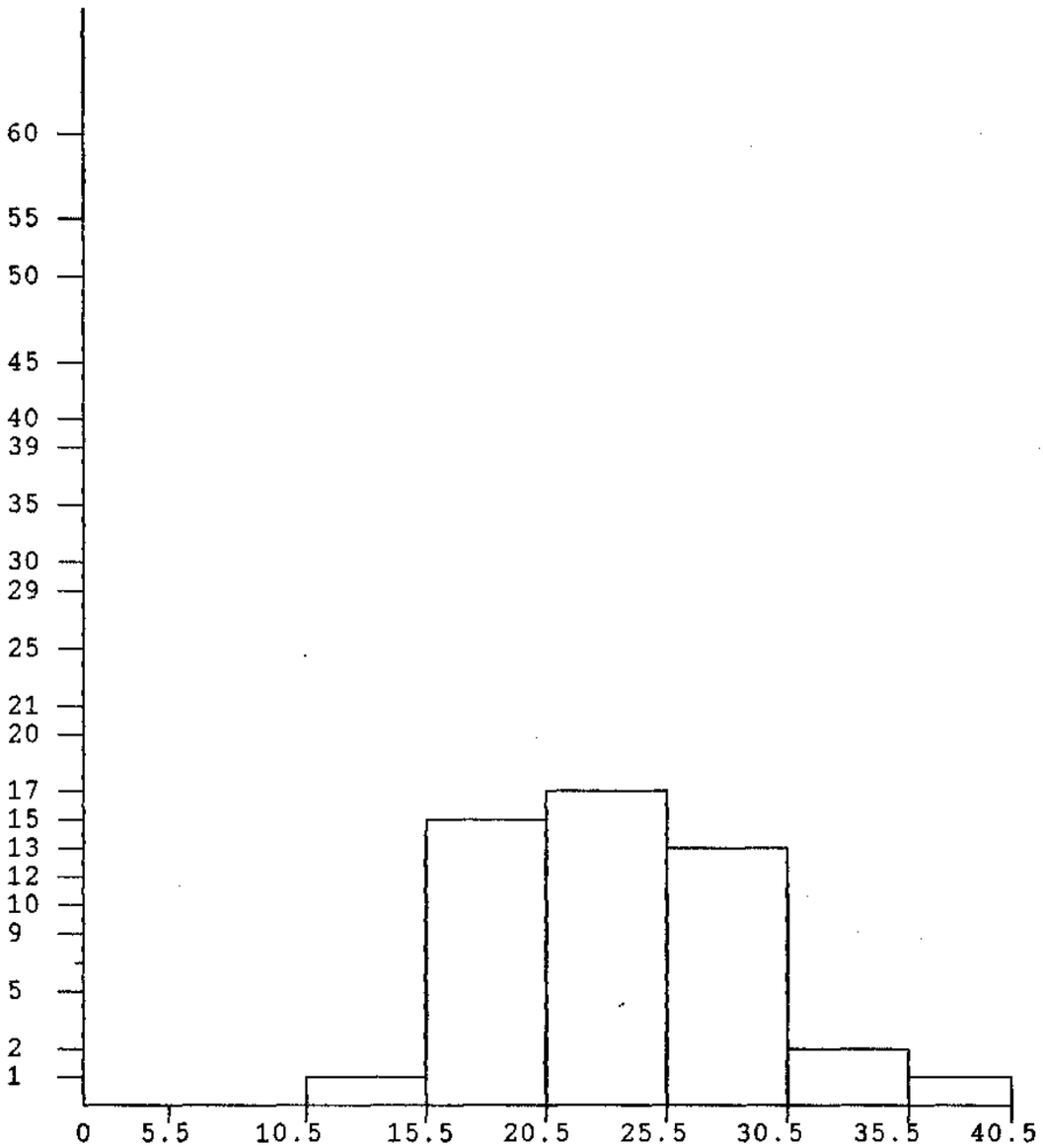


Fig. 7: **Distribution of Scores of the Low Anxiety Group with Time Limit**

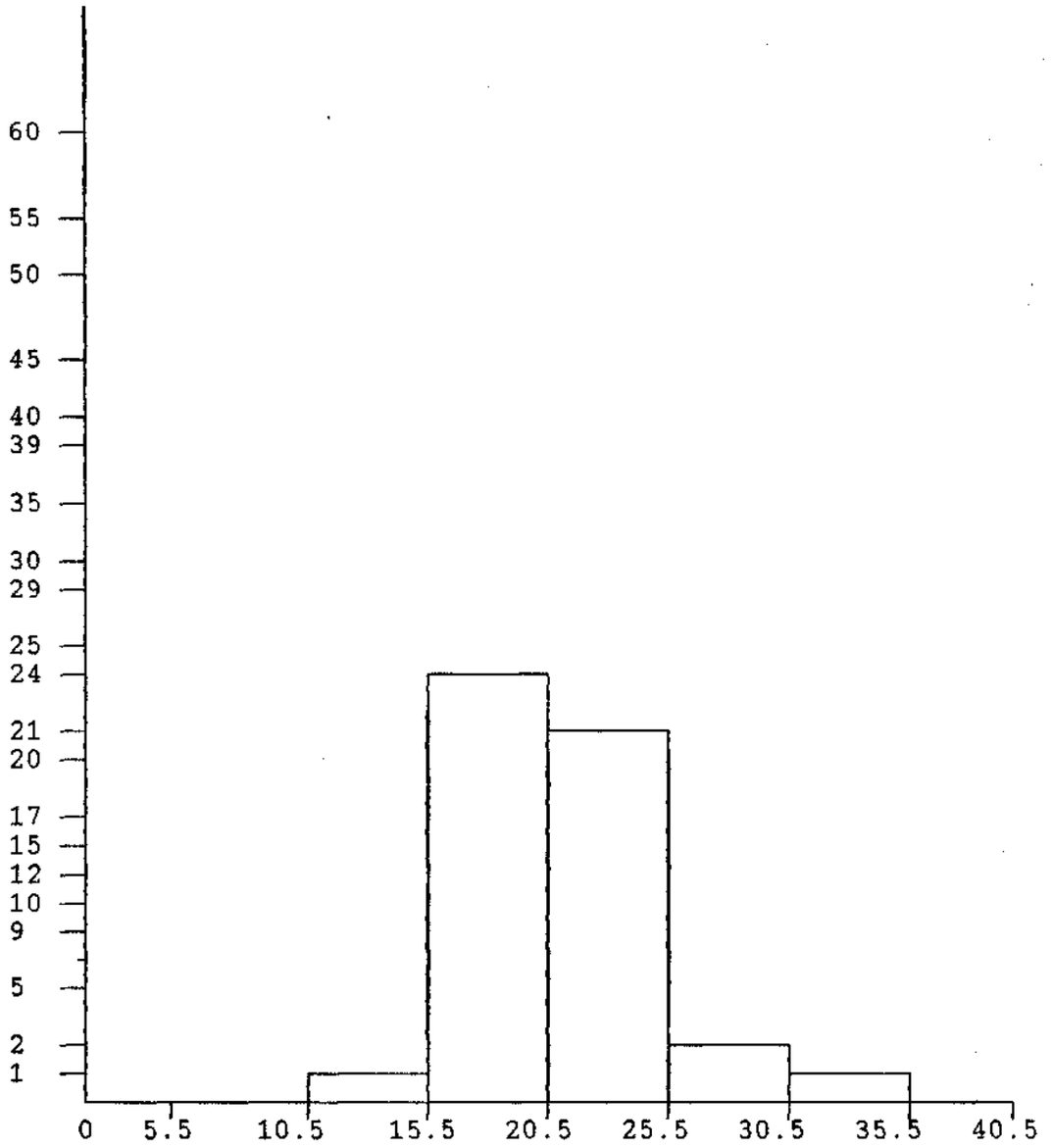


Fig. 8: Distribution of Scores of the Low Anxiety Group with No Time Limit

Fig. 7 which shows the distribution of scores of the low anxiety group with time limit is nearly tri-modal. While Fig. 8 which shows the distribution of score of the low anxiety group with no time limit is nearly bi modal.

TABLE 4.5: Frequency distribution of scores of the high anxiety group with time limit and high anxiety group with no time limit

SCORE INTERVAL	TIME LIMIT (Frequency)	NO TIME LIMIT (Frequency)
45.5 - 50.5	0	0
40.5 - 45.5	0	0
35.5 - 40.5	0	0
30.5 - 35.5	0	0
25.5 - 30.5	4	5
20.5 - 25.5	11	10
15.5 - 20.5	29	26
10.5 - 15.5	5	7
5.5 - 10.5	0	0
0.5 - 5.5	0	0
TOTAL	49	48

In Table 4.5 the modal score for both groups is in the class interval 15.5-20.5. There are 29 students (59.2%) is the time limit group while there are 26 students (54.2%) is the no time limit group. 15 students (30.6%) scored marks above the modal group in the time limit group while also 15 students (31.3%) score marks above the modal group in the no time limit group. 5 students (10.2%) got marks below the modal group in the time limit group whereas 7 students (14.5%) scored marks below the modal group in the no time limit group.

Graphs of the distribution in table 4.7

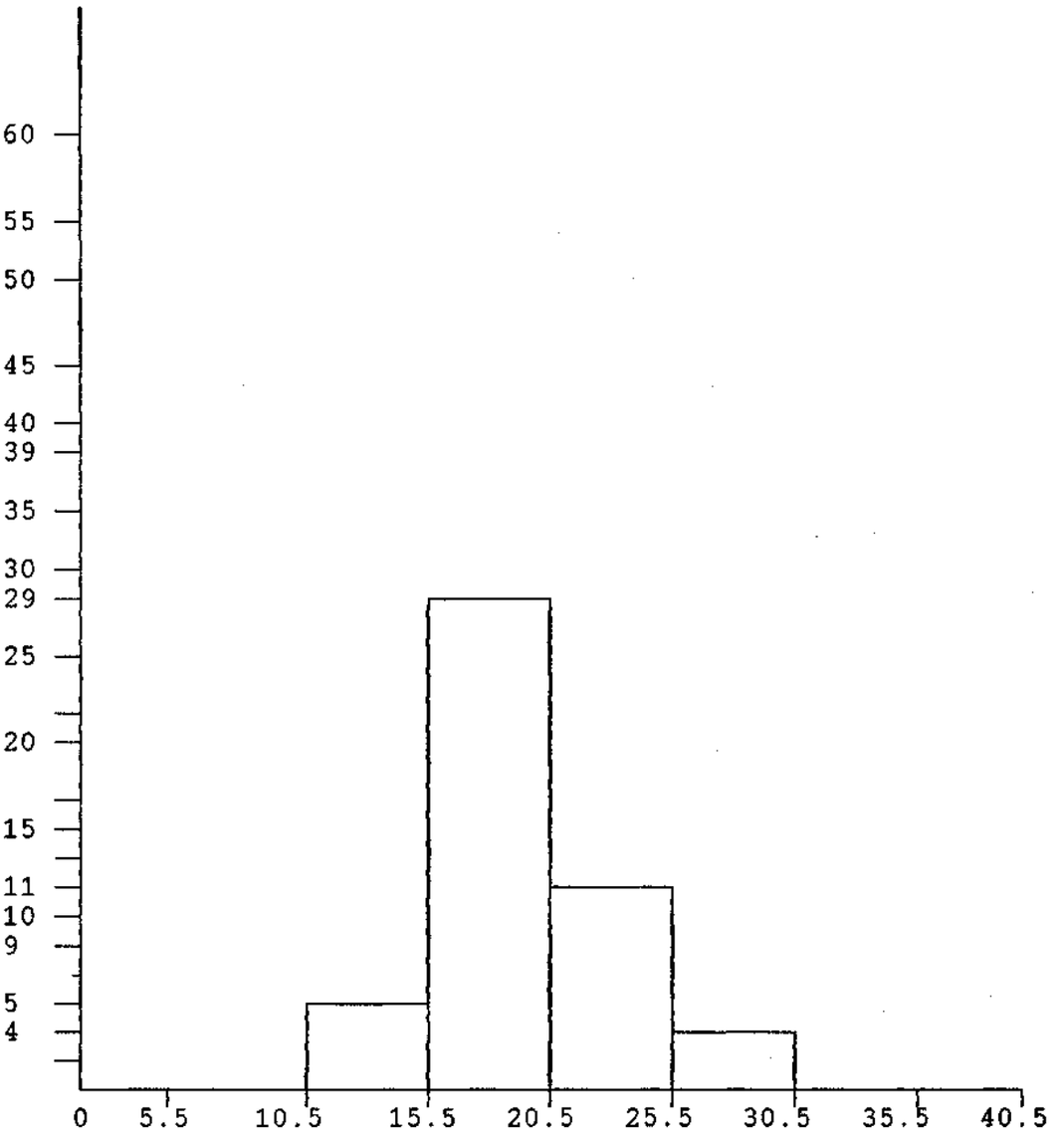


Fig. 9: **Distribution of Scores of the High Anxiety Group with Time Limit**

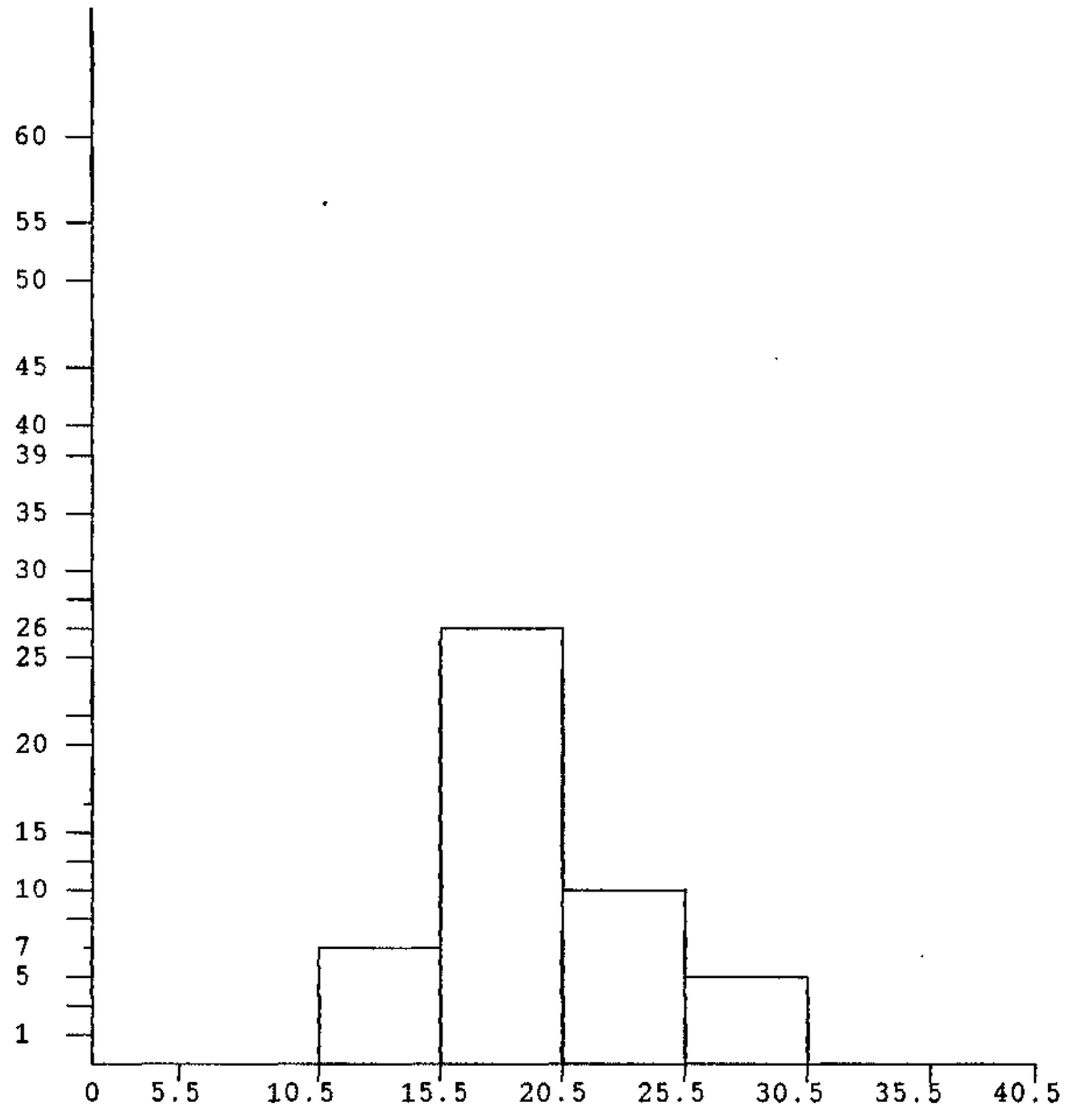


Fig. 10: Distribution of Scores of the High Anxiety Group with No Time Limit

Fig. 9 and 10 which show the distribution of scores of the high anxiety group with time limit and high anxiety group with no time limit conditions respectively are nearly alike. They are both peaked. The two graphs show that there is not much difference between the high anxiety with time limit and their counterpart with no time limit.

4.3 Hypothesis testing

Hypothesis I:

There is no significant difference between the mathematics performance of the high anxiety students and low anxiety students.

TABLE 4.6: Independent t-test analysis on influence of test anxiety on mathematics performance

ANXIETY GROUP	N	$\bar{X}$	SD	DF	T-VALUE	T-CRITICAL
High	97	19.39	3.99			
				193	4.6	1.96
Low	98	22.03	4.5			

To test hypothesis I, independent t-test Statistics was used. The summary of the computation was contained in table 4.6. The mean score for the high anxiety group is 19.39 with 3.99 as standard deviation. While the low anxiety group has a mean of 22.03 and standard deviation of 4.5. The computed t-value was found to be 4.6. At alpha level of 0.05 with 193 degrees of freedom, the

critical value of t was found to be 1.96. Thus the calculated t-value is greater than the critical t-value. Hence the difference is significant. Thus the null hypothesis is rejected. It could therefore be concluded that there is a significant difference between the Mathematics performance of the high and the low anxiety students. Therefore the low anxiety group perform better in the mathematics test.

TABLE 4.7 Summary of mean and standard deviation of all the groups of students that took the test

	HIGH ANXIETY				LOW ANXIETY			
N	97				98			
$\bar{X}$	19.39				22.03			
SD	3.99				4.5			
Group	H E		H R		L E		L R	
N	48		49		50		48	
$\bar{X}$	20.08		18.72		22.60		21.44	
SD	4.08		3.80		5.495		3.07	
Group	HET	HEN	HRT	HRN	LET	LEN	LRT	LRN
N	25	23	24	25	25	25	24	24
$\bar{X}$	20.20	19.96	18.63	18.80	25.00	20.20	21.54	21.33
SD	3.76	4.34	3.60	3.91	5.66	4.02	3.39	2.79

Table 4.7 shows the computed mean and Standard Deviation of all the groups that took the test. From the table it can be observed that the mean (25.00) of the low anxiety students with easy to difficult arrangement and with time limit condition is highest with Standard

Deviation as 5.66. The high anxiety students with random arrangement, and with time limit condition had the lowest mean of 18.63 with standard deviation of 3.60.

TABLE 4.8: Summary of mean and standard deviation of the whole students that took the test under time limit and no time limit conditions (irrespective of the form of arrangement)

	HIGH ANXIETY		LOW ANXIETY	
	H T	H N	L T	L N
N	49	48	49	49
$\bar{X}$	19.43	19.36	23.31	20.75
SD	3.77	4.195	4.97	3.48

From table 4.8 it is seen that the low anxiety students with time limit condition had the highest mean of 23.31 with 4.97 as standard deviation. The high anxiety students with no time limit condition had the lowest mean of 19.36 and a standard deviation of 4.195.

TABLE 4.9: Comparison of the different groups based on the hypotheses using planned t-test analysis

GROUPS	$d(\bar{x}_i - \bar{x}_j)$	$SE(\bar{X}) = \sqrt{\frac{MSW}{n_1} + \frac{MSW}{n_2}}$	T(S)-Calculated	df	T-Critical	Decision
HE VS HR	1.36	0.816	1.67	187	2.74	Not Significant
LE VS LR	1.16	0.812	1.43	187	2.74	Not Significant
HE VS LE	2.52	0.812	3.10	187	2.74	Significant
HR VS LR	2.72	0.816	3.33	187	2.74	Significant
LT VS LN	2.56	0.812	3.15	187	2.74	Significant
HT VS HN	0.07	0.816	0.09	187	2.74	Not Significant
LT VS HT	3.88	0.812	4.78	187	2.74	Significant
HN VS LN	1.39	0.816	1.70	187	2.74	Not Significant

Hypothesis 2a

There is no significant difference in performance between the high anxiety students with easy to difficult mathematics test arrangement and high anxiety students with random mathematics test arrangement.

To test this hypothesis planned comparison was used. The summary of the calculation is contained in tables 4.7 and 4.9. The mean score for the high anxiety group with easy to difficult arrangement is 20.08 with 4.08 as standard deviation. While the high anxiety group with

random arrangement has a mean of 18.72 with standard deviation of 3.80(Table 4.7). The computed t(s)-value was found to be 1.67. At alpha level of 0.05 with 187 degrees of freedom, the critical t-value was found to be 2.74. All these values were indicated in table 4.9 (HE VS HR). Thus the calculated t-value is less than the critical t-value. Hence the difference is not significant. Thus the null hypothesis is accepted. It could therefore be concluded that there is no significant difference in performance between the high anxiety students with easy to difficult mathematics test arrangement and high anxiety students with random mathematics test arrangement.

Hypothesis 2b

There is no significant difference in mathematics performance between the low anxiety students with easy to difficult mathematics test arrangement and the low anxiety students with random mathematics test arrangement.

To test this hypothesis planned comparison was used. The summary of the calculation is contained in tables 4.7 and 4.9. The mean score for the low anxiety group with easy to difficult arrangement is 22.60 with standard deviation of 5.495. While the low anxiety group with random arrangement has a mean of 21.44 with 3.07 as standard deviation (Table 4.7). The computed t(s)-value

was found to be 1.43. At alpha level of 0.05 with 187 degrees of freedom the critical t-value was found to be 2.74. All these values were indicated in table 4.9 (LE VS LR). Thus the calculated t-value is less than the critical t-value. Hence the difference is not significant. Thus the null hypothesis is accepted. It could therefore be concluded that there is no significant difference in mathematics performance between the low anxiety students with easy to difficult mathematics test arrangement and the low anxiety students with random mathematics test arrangement.

Hypothesis 2c

There is no significant difference in the performance of high anxiety students and low anxiety students with the easy to difficult mathematics test arrangement.

To test this hypotheses planned comparison was used. The summary of the computations were contained in tables 4.7 and 4.9. The mean score for the high anxiety group with easy to difficult arrangement is 20.08 with 4.08 as standard deviation. While the mean score for the low anxiety with easy to difficult arrangement is 22.60 and standard deviation of 5.495 (Table 4.7). The computed t(s) value was found to be 3.10. At alpha level of 0.05 with 187 degrees of freedom, the critical value of t was found to be 2.74. All these values were indicated in

tables 4.9 (HE VS LE). Thus the calculated t-value is greater than the critical t-value. Hence the difference is significant. Thus the null hypothesis is rejected. It could therefore be concluded that there is a significant difference in the performance of the high anxiety students and low anxiety students with the easy to difficult mathematics test arrangement in favour of the low anxiety students.

Hypothesis 2d

There is no significant difference in mathematics performance between the high anxiety students with Random arrangement and the low anxiety students with random arrangement.

To test this hypothesis planned comparison was used. The summary of the computations were contained in tables 4.7 and 4.9. The mean score for the high anxiety group with random arrangement is 18.72 and standard deviation as 3.80. While the mean score for the low anxiety group with random arrangement is 21.44 and 3.07 as standard deviation (Table 4.7). The computed t(s) value was found to be 3.33. At alpha level of 0.05 with 187 degrees of freedom, the critical t-value was found to be 2.74. All these values were indicated in tables 4.9 (HR VS LR). Thus the calculated t-value is greater than the critical t-value. Hence the difference is significant. Thus the null hypothesis is rejected. It could therefore be

concluded that there is a significant difference in the performance between the high anxiety students with random arrangement and the low anxiety students with random mathematics test arrangement in favour of the low anxiety students.

Hypothesis 3a

There is no significant difference in performance between the low anxiety students with time limit mathematics test and the low anxiety students with no time limit mathematics test.

To test this hypothesis, planned comparison was used. The summary of the computations were contained in tables 4.8 and 4.9. The mean scores for the low anxiety students with time limit is 22.31 with standard deviation of 4.97. While the mean score of the low anxiety students with no time limit is 20.75 and 3.48 as standard deviation (Table 4.8). The computed t(s) value is 3.15. At alpha level of 0.05 with 187 degrees of freedom, the critical value of t was found to be 2.74. All these values were indicated in table 4.9 (LT VS LN). Thus the calculated t(s)-value is greater than the critical t-value. Hence the difference is significant. Thus the null hypothesis is rejected. It could therefore be concluded that there is a significant difference in performance between the low anxiety students with time limit mathematics tested the low anxiety students with no time

limit mathematics test. Therefore the low anxiety students with time limit performed better than the low anxiety students with no time limit.

Hypothesis 3b

There is no significant difference in Mathematics performance between the high anxiety students with time limit mathematics test and the high anxiety students with no time limit mathematics test.

To test this hypothesis, planned comparison was used. The summary of the computations were contained in table 4.8 and 4.9. The mean score for the high anxiety students with time limit is 19.43 with 3.77 as standard deviation. While the mean score of the high anxiety students with no time limit is 19.36 and standard deviation as 4.195(Table 4.8). The computed t(s)-value is 0.09. At alpha level of 0.05 with 187 degrees of freedom the critical t-value was found to be 2.74. All these were indicated in table 4.9 (HT VS HN). Thus the calculated t(s)-value is less than the critical t-value. Hence the difference is not significant. Thus the null hypothesis is accepted. It could therefore be concluded that there is no significant difference in mathematics performance between the high anxiety students with time limit mathematics test and the high anxiety with no time limit mathematics test.

Hypothesis 3c

There is no significant difference in mathematics performance between the high anxiety students with time limit on mathematics test and the low anxiety students with time limit on mathematics test.

To test this hypothesis planned comparison statistics was used. The summary of the computations are contained in tables 4.8 and 4.9. The mean score of the high anxiety group with time limit is 19.43 with 3.77 as standard deviation while the mean score for the low anxiety group with time limit is 23.31 and standard deviation as 4.97 (Table 4.8). The computed t(s)-value is 4.78. At alpha level of 0.05 with 187 degrees of freedom, the critical value of t was found to be 2.74. All these were contained in table 4.9 (HT VS LT). Thus the calculated t-value is greater than the critical t-value. Hence the difference is significant. Thus the null hypothesis is rejected. It could therefore be concluded that there is a significant difference in mathematics performance between the high anxiety students with time limit and the low anxiety students with time limit mathematics test.

Hypothesis 3d

There is no significant difference in mathematics performance between the high anxiety students with no time limit and the low anxiety students with no time

limit on mathematics test.

To test the hypothesis planned comparison was used. The summary of the calculation is contained in tables 4.8 and 4.9. The mean score for high anxiety group with no time limit is 19.36 with 4.195 a standard deviation while the low anxiety students with no time limit has a mean of 20.75 with standard deviation of 3.48. (Table 4.8) The computed t(s)-values was found to be 1.70. At alpa level of 0.05 with 187 degrees of freedom. The critical t-value was found to be 2.74. All these value were indicated in table 4.9 (HN VS LN). Thus the calculated t-value is less than the critical t-value. Hence the difference is not significant. Thus the null hypothesis is accepted. It could therefore be concluded that there is no significant difference in performance between the high anxiety student with no time limit and the low anxiety student with no time limit on mathematics test.

4.4 Summary

The findings of this study showed that.

1. The difference in the mean performance of the low anxiety students and the high anxiety students is significant at 0.05 alpha level. The study also showed that the low anxiety students performed better with a mean of 22.03 as against 19.39 for the high anxiety students.
2. The study also showed that there is no significant

difference in the mathematics performance of the high anxiety students with easy to difficult mathematics test arrangement and the high anxiety students with random mathematics test arrangement. Although the high anxiety students with easy to difficult test arrangement has a higher mean of 20.08 as against their counterpart with random arrangement who has mean of 18.72.

3. The study showed that there is no significant difference in mathematics performance of the low anxiety students with easy to difficult mathematics test arrangement and the low anxiety students with random arrangement. Though the low anxiety students with easy to difficult arrangement has a higher mean of 22.60 as against their colleague with random arrangement with a mean of 21.44.
4. The study showed that there is a significant difference in performance of the high anxiety students with easy to difficult mathematics test arrangement and the low anxiety students with easy to difficult mathematics test arrangement. The low anxiety students performed better than the high anxiety students with the same easy to difficult arrangement with a mean of 22.60 as against 20.08.
5. The difference in the mean performance of the low anxiety students with random mathematics test

arrangement and the high anxiety students with random mathematics test arrangement was also significant at 0.05 alpha level. The low anxiety students with random arrangement had a mean of 21.44 while the high anxiety student had a mean of 18.72.

6. The difference in the mean performance of the low anxiety students with time limit and the low anxiety students with no time limit was significant. The low anxiety students with time limit condition has a higher mean of 23.31 as against their counterpart with no time limit condition who has a mean of 20.75.
7. The study also showed that there is no significant difference in the mathematics performance between the high anxiety students with time limit mathematics test and the high anxiety students with no time limit mathematics test. The high anxiety students with time limit has a mean of 19.43 while their counterpart with no time limit has a mean of 19.35.
8. The study showed that the difference in the mean performance of the high anxiety students with time limit 19.43 as against 23.31 for the low anxiety students with time limit was significant at 0.05 alpha level.

9. Finally the study showed that there is no significant difference in the mathematics performance between the high anxiety students with no time limit and the low anxiety students with no time limit.

CHAPTER FIVE

5.0 SUMMARY, FINDINGS, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter contains the summary of the procedure and findings of the study. Discussions and Recommendations are also made on how to carry out further studies on the effect of test anxiety, item order and allotted time on students performance in mathematics.

5.2 Summary

This study was an attempt to find out the effect of test anxiety, item order and allotted time on students performance in mathematics test. The students selected for the study were SSS3 students from three government post primary schools in Zaria educational zone of Kaduna State. There are:

1. Government Girls Secondary School, Samaru.
2. Government Secondary School, Chindit.
3. Government Secondary School, Bassawa.

A representative random sample of the students were selected using Morgan and Krejcie (1970). Sampling distribution table. A modified Spilberger (1977) test-anxiety inventory was used to identify students with high and low anxiety. Also a 50 item mathematics test was put into two different forms of arrangement (easy to difficult and Random) based on the item difficulty. These

tests were administered to the students under two different conditions of time limit and no time limit.

When the result was analysed using the Statistics of Mean, Standard Deviation, Independent T-test and Planned Comparison, the following were revealed.

1. Test anxiety significantly affect students performance in mathematics test. Therefore the null hypothesis of no significant difference in mathematics performance of the high anxiety students and low anxiety students is rejected.
2. Item arrangement does not significantly affect the performance of the high anxiety students in mathematics test. Thus the null hypothesis that there is no significant difference in mathematics performance of the high anxiety students with easy to difficult and high anxiety students with random arrangement is accepted.
3. Item arrangement does not significantly affect the performance of the low anxiety students in mathematics test. Thus the null hypothesis that there is no significant difference in performance of the low anxiety students with easy to difficult arrangement and low anxiety students with random arrangement is accepted.
4. There was a significant difference in the performance of the low anxiety students with easy

to difficult mathematics arrangement and the high anxiety students with easy to difficult mathematics test arrangement. Thus the null hypothesis of no significant difference in mathematics performance of the low anxiety students and the high anxiety students with easy to difficult mathematics test arrangement is rejected.

5. There was a significant difference in the performance of the low anxiety students with random mathematics test arrangement and the high anxiety students with random mathematics test arrangement. Therefore the null hypothesis of no significant difference in performance of the low anxiety students and the high anxiety students with random mathematics test arrangement is rejected.
6. Time limit significantly affect the mathematics performance of the low anxiety students. The null hypothesis of no significant difference in performance between the low anxiety students with time limit and the low anxiety students with no time limit is rejected.
7. Time limit does not significantly affect the performance of the high anxiety students. Thus the null hypothesis of no difference in mathematics performance between the high anxiety with time limit and high anxiety with no time limit is

accepted.

8. The low anxiety students on time limit performed significantly better then the high anxiety students with time limit condition.

9. Lastly there was no significant difference in the mathematics performance of high anxiety students with no time limit and the low anxiety students with no time limit. The null hypothesis of no significant difference in performance of the high anxiety students with no time limit and the low anxiety students with no time limit is accepted.

It seems from the study that once enough time is given in a test, the students who spend more than the necessary time in the test do not perform better than those who spend just the enough time given for the test.

5.3 Discussions

The findings of this study reveal that test anxiety significantly affect performance in mathematics test. The second aspect of the study showed that item order does not significantly affect performance in mathematics test. Lastly the study showed that time limit significantly affect the mathematics performance of low anxiety students but does not significantly affect the performance of the high anxiety students.

The findings obtained in this study agree with the

finding of Betz (1978) who in his study reported that the level of anxiety exhibited was related to the score obtained in a standardised mathematics test (the higher the anxiety level the less the score obtained). Some other investigators like (Szetela, 1973; Tobias, 1979; Fraser et al, 1983), have reported significant relationship between test anxiety and academic performance.

The second aspect of this study showed no significant difference between item arrangement and mathematics performance. This means that whether items are randomly arranged or are arranged from easy to difficult it does not affect students performance. Though the finding in this study contradicts that obtained by Tompson and Lawre (1981) who in their research on effect of item arrangement and knowledge of test arrangement came out with the result that there was a significant order effect. It can not be said with emphasis that item arrangement does not affect performance. The reason being that since there was no condition requiring the students to answer the questions serially the way it was numbered, some of them who skimmed through the whole questions before answering must have answered the easy ones first despite the order of the arrangement.

The last aspect of this study showed that time limit significantly affect mathematics test performance of the

low anxiety students which was in favour of the low anxiety students on time limit condition. But time limit does not significantly affect the performance of the high anxiety students. The findings, on the part of the high anxiety student agree with that of Miller and Wiess (1976) who in their study found that the difference between the mean response accuracies under time limit and no time limit condition was not significant. The Findings also agrees with that of Nwogu (1988) who found no significant difference between the mean performance of the time limit group and the no time limit group in his study. Nwogu (1988) also found a negative correlation (-.22) between the actual time used and performance in mathematics. This also conforms with the significant difference observed in the performance of the low anxiety students on time limit and the low anxiety students with no time limit in favour of the low anxiety students on time limit.

The likely reason for the findings of this study about time limit might be that enough time was given for the test. This result showed that so far adequate time limit is given in a test, the student who spend more than necessary time on the test is not likely to perform better than the counterpart who spends just the adequate time limit given.

5.4 Conclusion

The results of this study showed that test anxiety significantly affect students performance in mathematics test. To this effect teachers and test administrators are adviced to as much as possible try to reduce the students anxiety level before any test is administered particularly mathematics test in other to make them perform at their best.

The result of the study showed that item order does not significantly affect students performance. This result suggests that a teacher is at liberty to use either the easy to difficult arrangement or random arrangement and would probably come out with the same result.

Lastly the result of the study showed that there is no significant difference between the performance of high anxiety students with time limit on mathematics test and high anxiety students with no time limit on mathematics test. But there was a significant difference in performance of the low anxiety students with time limit and low anxiety students with no time limit which was in favour of the low anxiety students with time limit. This implies that so long a teacher gives a reasonable amount of time for a test, he is likely to get the best result from his students than when no time limit is allowed and that students who spend more than the necessary time are

not likely to perform better. Teachers and test administrators are therefore adviced to give time limit for their tests which should be adequate for majority of the students to attempt all the test items.

5.5 Recommendations

The researcher has the following recommendations for those who might be interested in conducting a research along this line.

1. A similar research should be conducted using different sample and different set of questions and time.
2. If the result of a similar study are the same with that reported in the study, then the next step would be to widen the scope of the investigation by including other variables like sex and age.

The following recommendations are also made for test administrators and teachers in other to bring out the best from the students.

1. Try as much as possible to reduce the anxiety level of the students before a test is administered.
2. The items in a test should be arranged either from most easy to most difficult one or randomly. The same result is likely to be arrived at.
3. Time limit which is adequate for majority of the students to attempt all the test items should be given in a test.

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APPENDIX I

MODIFIED SPIELBEGER 1977 TEST ANXIETY INVENTORY

NAME:..... TIME: 20 Mins.

INSTRUCTION: A number of statement which people have used to describe themselves are given below. Read each statement and tick the word which best describes how you generally feel. There are no right or wrong answers. Do not spend too much time on any statement but give the answer which seems to describe how you generally feel.

		NEVER	SOME-TIMES	OFTEN	ALWAYS
1.	I feel confident and relaxed while taking test.				
2.	I feel anxious while taking examination.				
3.	Thinking about my grade in any subject interferes with my work on the test.				
4.	I become afraid while taking examination.				
5.	During examination I find myself thinking about whether I will ever get through school.				
6.	The harder I work on taking a test the more confused I get.				
7.	Thought of doing poorly interfere with my concentration on the test.				
8.	I feel very relaxed while taking an important examination.				

		NEVER	SOME-TIMES	OFTEN	ALWAYS
9.	Even when I am well prepared for a test I feel very nervous.				
10.	I start feeling very uneasy just before getting a test paper back.				
11.	During test I feel very relaxed.				
12.	Examination do not bother me so much.				
13.	During test, I feel so nervous that my stomach gets upsets.				
14.	While writing examinations I do have the feeling that I will not perform well.				
15.	I get so frightened that I can not think clearly while taking examination.				
16.	I do not worry a great deal before taking an important examination.				
17.	During test I find myself thinking about the consequences of failing.				
18.	I feel my heart beating very fast during important test.				
19.	After an examination is over I try to stop worrying about it but just can't.				
20.	During examinations I feel so relaxed that I do not forget facts I really knew.				

APPENDIX IIa

MATHEMATICS ACHIEVEMENT TEST IN RANDOM ARRANGEMENT

NAME:.....

DO NOT START UNTIL YOU ARE TOLD TO:

While you are waiting, read the instruction very carefully.

1. Write your name in the space provided.
2. Answer all 50 questions.
3. Read each question carefully. There are five options A to E. Circle the one you think is the correct answer to the question.

Note: Do not choose more than one option for a question.

1. Evaluate $(101.5)^2 - (100.5)^2$

   a) 1

   b) 2.02

   c) 20.02

   d) 202

   e) 2020

2. Express the product of 0.06 and 0.09 in standard form.

   a) 5.4×10^{-3}

   b) 5.4×10^{-2}

   c) 5.4×10^{-1}

   d) 5.4×10^{2}

   e) 5.4×10^{3}

3. Simplify $36^{\frac{1}{2}} \times 64^{-1/3} \times 5^{0}$

   a) 0

   b) 1/24

   c) 2/3

   d) $1\frac{1}{2}$

   e) $7\frac{1}{2}$

Use the following for Question 4 to 6

Score	0	1	2	3	4	5
Frequency	2	3	4	2	7	2

4. Find the Mode

   a) 2

   b) 3

   c) 4

   d) 5

   e) 7

5. Find the mean score.

   a) 1.75

   b) 2

   c) 2.5

   d) 2.75

   e) 3

6. The median score is:

   a) 0

   b) 2.5

   c) 3

   d) 5

   e) 7

7. Points P and Q are respectively 24m North and 7m East of Point R. Calculate IPQI in metres.

   a) 20

   b) 24

   c) 25

   d) 31

   e) 84

8. Simplify $(27^{1/3})^2$

   a) **4½**

   b) 6

   c) 9

   d) 18

   e) 81

9. A Sales-girls gave a change of N1.15 to a customer instead of N1.25. Calculate her percentage error.

   a) 10%

   b) 8.7%

   c) 8.0%

   d) 2.4%

   e) 0.10%

10. Factorize $5y^2 + 2ay - 3a^2$

    a) $(5y - a)(y + 3a)$

    b) $(5y + a)(y - 3a)$

    c) $5y^2 + a(2y - 3a)$

    d) $(y - a)(5y + 3a)$

    e) $(y + a)(5y - 3a)$.

11. If $\text{Log}_{10} a = 4$, what is a?

    a) 0.4

    b) 40

    c) 400

    d) 1,000

    e) 10,000

12. A student measured the length of a room and obtained the measurement of 3.99m. If the percentage error of his measurement was 5% and his own measurement was smaller than the length, what is the true length of the room?

    a) 3.78m

    b) 3.80m

    c) 4.18m

    d) 4.20m

    e) 4.788m

13. A cone is made from a sector of a circle of radius 14cm and angle of 90^0. What is the area of the curved surface of the cone? (Take $\pi = 22/7$).

    a) $22cm^2$

    b) $38.5cm^2$

    c) $77cm^2$

    d) $154cm^2$

    e) $308cm^2$

14. If Q = (all perfect squares less than 30) and

    P = (all odd numbers from 1 to 10)

    Find Q n P

    a) (1, 4, 9, 16, 25)

    b) (1, 3, 4, 5, 7, 9, 16, 25)

    c) (1, 3, 5, 7, 9)

    d) (1, 9)

    e) ø

15. Correct 5.065777 to three significant figures.

    a) 5.10

    b) 5.07

    c) 5.06

    d) 5.066

    e) 5.065

16. Evaluate: $\text{Log}_4\ 256$

a) 64

b) 32

c) 16

d) 8

e) 4

17. If a = 4, b = -5 and c = -2 Evaluate $\dfrac{a + bc}{b + c}$

a) -8

b) -7

c) -5

d) -2

e) 10

18. Find the value of P if 1/P = 1/4.5 + 1/5.5

a) 40/99

b) 1/5

c) 4/99

d) 2 19/40

e) 4 9/20

19. If $3^Y = 81^{1/3}$, find y

a) -27

b) -4/3

c) -1/12

d) 3/4

e) 4/3

20. In a factory, 2kg bags of flour are weighed. The machine rejects filled bags which have an error of more than 2%. Find the difference in weight between the lowest and highest acceptable weights.

a) 800g

b) 400g

c) 80g

d) 40g

e) 8g

21. Find the range of the following observations: 8, 9, 2, 2, 7, 5, 18, 4, 6, 12.

a) 24

b) 20

c) 18

d) 16

e) 2

22. Let the universal set E = (all positive integers less than 11). If P = (1, 2, 4, 5, 7)

Q = (3, 4, 5, 7, 8, 9). Find $P' \cap Q'$

a) (1, 2, 3, 6, 8, 9, 10)

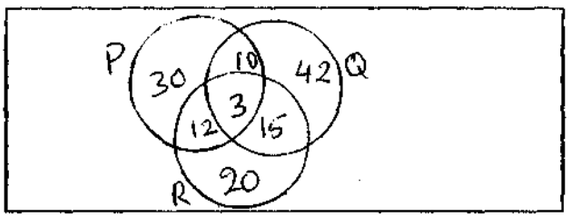
b) (1, 2, 6, 10)

c) (6, 10)

d) (3, 6, 8, 9, 10)

e) (8, 9.)

Using the venn diagram below answer question 23 and 24



23. P ∩ Q ∩ R is

a) (10, 3, 12, 15)

b) (30, 42, 20)

c) (3)

d) (10)

e) (10, 12, 15)

24. The set P is

a) (30)

b) (10, 12, 3)

c) (30, 10)

d) (30, 10, 12, 3)

e) (30, 12, 3)

25. If the bearing of X from Y is 247, Find the bearing of Y from X.

a) 023^0

b) 067^0

c) 113^0

d) 157^0

e) 203^0

26. Convert 77 in base 10 to base two

    a) 1001101

    b) 111001

    c) 100110

    d) 10101

    e) 10011

27. The nth term of a sequence is given by 3.2^{n-2}. Write down the first three terms of the sequence.

    a) 3/2, 0,6

    b) 3/2, 3,6

    c) 2/3, 3, 8/3

    d) 3/2, 3/4, 6

    e) 3/2, 3, 1/3

28. Simplify $(16/81)^{1/4}$

    a) 8/27

    b) 1/3

    c) 4/9

    d) 2/3

    e) 4/3

29. Factorize the expression $2y^2 + xy - 3x^2$.

    a) $2y(y + x) - 3x^2$

    b) $(2y-x)(2y+x)$

    c) $(3x - 2y)(x-y)$

    d) $(2y + 3x)(y-x)$

    e) $(x-y)(2y + 3x)$

30. Solve the equation $\frac{m}{3} + \frac{1}{2} = \frac{3}{4} + \frac{m}{4}$

a) -3

b) -2

c) 2

d) 3

e) 4

31. The curved surface area of a cylindrical tin is $704cm^2$. Calculate the height when the radius is 8cm (Take $\pi = 22/7$

a) 3.5cm

b) 7cm

c) 14cm

d) 28cm

e) 32cm

32. A Ladder lean against a vertical wall at an angle 60^0 to the wall. If the foot of the ladder is 5 metres away from the wall, calculate the length of the ladder.

a) $\frac{5\sqrt{3}}{3}$ m

b) 5m

c) $\frac{10\sqrt{3}}{3}$ m

d) $5\sqrt{3}$ m

e) 10m

33. The table below shows the Scores of students in a Physics test. Use the information to answer question 33 and 34.

Marks	1	2	3	4	5	6	7	8	9	10
No of Students	1	3	2	0	1	6	1	0	1	0

33. How many students scored at least 5 marks?

a) 1

b) 6

c) 8

d) 9

e) 14

34. How many students took the test?

a) 6

b) 10

c) 15

d) 55

e) 45

35. A number is chosen at random from the set (1,2,3...9,10). What is the probability that the number is greater than or equal to 7.

a) 1/10

b) 3/10

c) 2/5

d) 3/5

e) 7/10

36. A dealer buys a car for N1,500 and sells it for N1,800. Find his percentage gain.

a) 15%

b) 20%

c) 25%

d) 30%

e) 35%

37. Simplify $2-(1/3 \times 1\frac{1}{2}) + (3 \div 3/5)$

a) $6\frac{1}{2}$

b) $5\frac{1}{2}$

c) $4\frac{1}{2}$

d) $3\frac{1}{2}$

e) $2\frac{1}{2}$

38. Express 0.007023 in standard form.

a) 7.023×10^{-2}

b) 7.023×10^{-3}

c) 7.23×10^{-3}

d) 7.023×10^{-4}

e) 7.23×10^{-4}

39. A carpenter measured the width of a room as 3.27m. This measurement is correct to the nearest

a) Metre

b) ten centimetre

c) millimetre

d) centimetre

e) tenth of a metre

40. The first two terms of a geometric progression are 3 and 12. What is the 4th term?

a) 192

b) 108

c) 48

d) 36

e) 30

41. If (x-7) and (x+3) are factors of $x^2 + kx - 21$, what is the value of k.

a) +4

b) +3

c) -3

d) -4

e) -7

42. If 24.23 -x + 17.03 = 31.62, what number does x represent?

a) 7.20

b) 9.64

c) 38.82

d) 41.26

e) 72.88

43. Solve the equation $\text{Log}_5\ 2x = 3$

a) 7.5

b) 30

c) 62.5

d) 125

e) 250

44. Which of the following equation has the root 3 and -6?

a) $x^2 - 3x - 18 = 0$

b) $x^2 + 3x - 18 = 0$

c) $x^2 - 9x + 18 = 0$

d) $x^2 - 6x - 18 = 0$

e) $x^2 + 6x - 18 = 0$

45. Which of the following is a root of the equation $x^2 + 4x - 45 = 0$?

a) 9

b) 3

c) -3

d) -5

e) -9

46. The sum of the interior angles of a polygon of n sides is 900^0. Find the value of n

a) 6

b) 7

c) 8

d) 9

e) 10

47. Which of the following is not a property of a rectangle

a) All the four angles are right angles

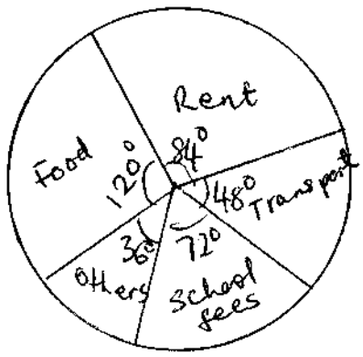
b) The opposite sides are equal

c) The opposite sides are parallel

d) The diagonals bisect each other

e) Right angles are formed where the diagonals cross each other.

The pie chat below shows the monthly expenditure of a family. The family spends N200 on transportation. Use the information below to answer 48 and 49.



48. How much does the family spend on rent?

a) N250.00

b) N270.00

c) N300.00

d) N320.00

e) N350.00

49. Find the total expenditure of the family for the month.

a) N1,200.00

b) N1,260.00

c) N1,350.00

d) N1,440.00

e) N1,500.00

50. Calculate the value of d in the diagram below.



a) 50

b) 60

c) 100

d) 120

e) 150

APPENDIX IIb

Solution to the Mathematics achievement test in Random Arrangement.

1. d	21. d	41. d
2. a	22. c	42. b
3. d	23. c	43. c
4. c	24. d	44. b
5. d	25. b	45. e
6. b	26. a	46. b
7. c	27. b	47. e
8. c	28. d	48. e
9. c	29. d	49. e
10. e	30. d	50. a
11. e	31. c	
12. d	32. c	
13. d	33. d	
14. d	34. c	
15. b	35. c	
16. e	36. b	
17. d	37. a	
18. d	38. b	
19. e	39. d	
20. c	40. a	

APPENDIX IIIa

MATHEMATICS ACHIEVEMENT TEST IN EASY TO DIFFICULT MANAGEMENT

NAME: .....

INSTRUCTION: DO NOT START UNTIL YOU ARE TOLD TO.

While you are waiting, read the instruction very carefully.

1. Write your name in the space provided.
2. Answer all 50 questions.
3. Read each question carefully. There are five options - A to E. Circle the one you think is the correct answer to the question.

NOTE: Do not choose more than one option for a question.

1. A Carpenter measured the width of a room as 3.27m. This measurement is correct to the nearest.
   a) Metre
   b) Ten centimetre
   c) Millimetre
   d) Centimetre
   e) Tenth of a metre
2. If 24.23 - X + 17.03 = 31.62, what number does X represent?
   a) 7.20
   b) 9.64
   c) 38.82

d) 41.26

e) 72.88

The Table below shows the scores of students in a physics test, use the information to answer questions 3 and 4.

Marks	1	2	3	4	5	6	7	8	9	10
Number of Students	1	3	2	0	1	6	1	0	1	0

3. How many students scored at least 5

a) 1

b) 6

c) 8

d) 9

e) 14

4. How many students took the test

a) 6

b) 10

c) 15

d) 55

e) 45

5. If a = 4, b = -5 and c = -2

Evaluate $\dfrac{a + bc}{b + c}$

a) -8

b) -7

c) -5

d) -2

e) 10

Use the following for questions 6 to 8

Score	0	1	2	3	4	5
Frequency	2	3	4	2	7	2

6. Find the mode

a) 2

b) 3

c) 4

d) 5

e) 7

7. Find the mean score

a) 1.75

b) 2

c) 2.5

d) 2.75

e) 3

8. The median score is

a) 0

b) 2.5

c) 3

d) 5

e) 7

9. A dealer buys a car for N1,500 and sells it for N1,800. Find his percentage gain.

   a) 15%

   b) 20%

   c) 25%

   d) 30%

   e) 35%

10. Which of the following is not a property of a rectangle.

   a) All the four angles are right angles

   b) The opposite sides are equal

   c) The opposite sides are parallel

   d) The diagonals bisect each other

   e) Right angles are formed where the diagonals cross each other.

11. Correct 5.065777 to three significant figures.

   a) 5.10

   b) 5.07

   c) 5.06

   d) 5.066

   e) 5.065

12. Find the range of the following observations,

   8,9,2,2,7,5,18,4,6,12

   a) 24
   b) 20
   c) 18
   d) 16
   e) 2

13. Express 0.007023 in standard form.

    a) 7.023×10^{-2}

    b) 7.023×10^{-3}

    c) 7.23×10^{-3}

    d) 7.023×10^{-4}

    e) 7.23×10^{-4}

14. Convert 77 in base 10 to base two

    a) 1001101

    b) 111001

    c) 100110

    d) 10101

    e) 10011

15. A sales girl gave a change of N1.15k to a customer instead of N1.25k. Calculate here percentage error.

    a) 10%

    b) 8.7%

    c) 8.0%

    d) 2.4%

    e) 0.10%

16. Simplify $2 - (1/3 \times 1\frac{1}{2}) + (3 \div 3/5)$

    a) $6\frac{1}{2}$

    b) $5\frac{1}{2}$

    c) $4\frac{1}{2}$

    d) $3\frac{1}{2}$

    e) $2\frac{1}{2}$

17. Let the Universal set ϵ = (all positive integers less than 11).

If P = (1,2,4,5,7)

Q = (3,4,5,7,8,9)

Find P' $\cap$ Q'

a) (1,2,3,6,8,9,10)

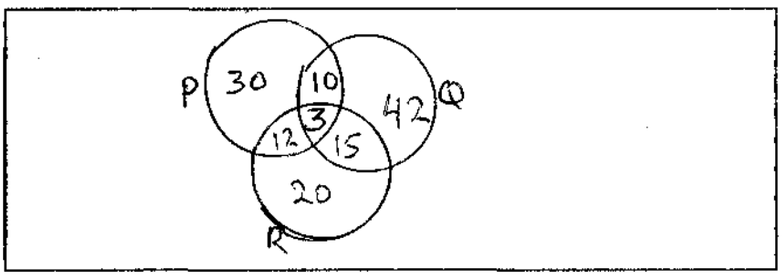
b) (1,2,6,10)

c) (6,10)

d) (3,6,8,9,10)

e) (8,9)

Use the venn diagram below, answer question 18 and 19



18. The set P is

a) (30)

b) (10,12,3)

c) (30,10)

d) (30,10,12,3)

e) (30,12,3)

19. P ∩ Q ∩ R is

a) (10,3,12,15)

b) (30,42,20)

c) (3)

d) (10)

e) (10,12,15)

20. If (X-7) and (X+3) are factors of X^2 + kx-21. What is the value of k?

a) **+4**

b) **+3**

c) **-3**

d) **-4**

e) **-7**

21. The nth term of a sequence is given by 3.2^{n-2} write down the first three terms of the sequence.

a) 3/2, 0,6

b) 3/2, 3,6

c) 3/2, 3, 8/3

d) 3/2, 3/4, 6.

e) 3/2, 3, 1/3

22. Simplify $\left(\frac{16}{81}\right)^{\frac{1}{4}}$

a) 8/27

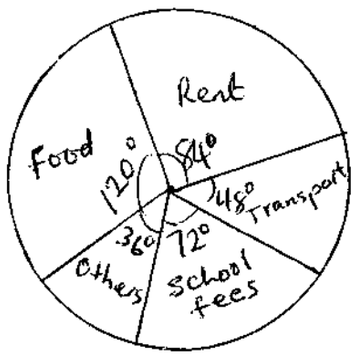
b) 1/3

c) 4/9

d) 2/3

e) 4/3

The Pie Chat below shows the monthly expenditure of a family. The family spends N200 on transportation. Use the information below to answer question 23 and 24.



23. How much does the family spend on rent?

a) N250.00

b) N270.00

c) N300.00

d) N320.00

e) N350.00

24. Find the total expenditure of the family for the month.

a) N1,200.00

b) N1,260.00

c) N1,350.00

d) N1,440.00

e) N1,500.00

25. The first two terms in a geometric progression are 3 and 12. What is the 4th term?

    a) 192

    b) 108

    c) 48

    d) 36

    e) 30

26. Express the product of 0.06 and 0.09 in standard form.

    a) 5.4×10^{-3}

    b) 5.4×10^{-2}

    c) 5.4×10^{-1}

    d) 5.4×10^{2}

    e) 5.4×10^{3}

27. Factorize $5y^2 + 2ay - 3a^2$

    a) $(5y - a)(y + 3a)$

    b) $(5y + a)(y - 3a)$

    c) $5y^2 + a\ (2y-3a)$

    d) $(y - a)(5y + 3a)$

    e) $(y + a)(5y - 3a)$

28. The sum of the interior angles of a polygon of n sides is 900^0. Find the value of n.

    a) 6

    b) 7

c) 8

d) 9

e) 10

29. Factorize the expression $2y^2 + xy - 3x^2$.

a) $2y\ (y + x) - 3x^2$

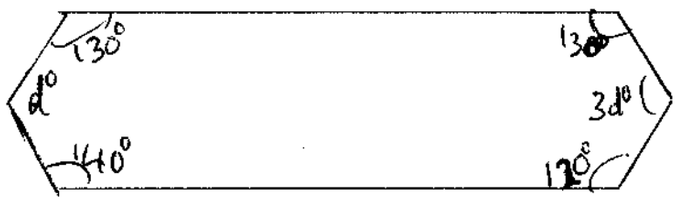
b) $(2y - x)(2y + x)$

c) $(3x - 2y)(x - y)$

d) $(2y + 3x)(y - x)$

e) $(x - y)\ (2y + 3x)$

30. Calculate the value of d in the diagram below.



a) 50

b) 60

c) 100

d) 120

e) 150

31. A student measured the length of a room and obtained the measurement of 3.99m. If the percentage error of his measurement was 5% and his measurement was smaller than the length, what is the length of the room?

a) 3.78m

b) 3.80m

c) 4.18m

d) 4.20m

e) 4.788m

32. If Q = (all perfect squares less than 30) and P = (all odd numbers from 1 to 10). Find Q n P.

a) (1, 4, 9, 16, 25)

b) (1, 3, 4, 5, 7, 9, 16, 25)

c) (1, 3, 5, 7, 9)

d) (1, 9)

e) (ø)

33. Which of the following is a root of the equation $X^2 + 4x - 45 = 0$

a) 9

b) 3

c) -3

d) -5

e) -9

34. Which of the following equation has the root 3 and -6

a) $X^2 - 3x - 18 = 0$

b) $X^2 + 3x - 18 = 0$

c) $X^2 - 9x + 18 = 0$

d) $X^2 - 6x - 18 = 0$

e) $X^2 + 6x - 18 = 0$

35. Evaluate $(101.5)^2 - (100.5)^2$

a) 1

b) 2.02

c) 20.02

d) 202

e) 2020

36. Simplify $(27^{1/3})^2$

a) $4\frac{1}{2}$

b) 6

c) 9

d) 18

e) 81

37. In a factory 2kg bags of flour are weighed. The machine rejects filled bags which have an error of more than 2%. Find the difference in weight between the lowest and highest acceptable weights.

a) 800g

b) 400g

c) 80g

d) 40g

e) 8g

38. If the bearing of X from Y is 247, Find the bearing of Y from X.

a) 023^0

b) 067^0

c) 113^0

d) 157^0

e) 203^0

39. A number is chosen at random from set (1,2,3, ... 10) What is the probability that the number is greater than or equal to 7.

a) 1/10

b) 3/10

c) 2/5

d) 3/5

e) 7/10

40. Simplify $36^{\frac{1}{2}} \times 64^{-1/3} \times 5^0$

a) 0

b) 1/24

c) 2/3

d) $1\frac{1}{2}$

e) $7\frac{1}{2}$

41. If $\text{Log}_{10}\ a = 4$, what is a

a) 0.4

b) 40

c) 400

d) 1000

e) 10,000

42. Evaluate $\log_4 256$

a) 64

b) 32

c) 16

d) 8

e) 4

43. If $3^{Y} = 81^{1/3}$, find Y

a) -27

b) -4/3

c) $-\frac{1}{2}$

d) 3/4

e) 4/3

44. Solve the equation $\log_5 2x = 3$

a) 7.5

b) 30

c) 62.5

d) 125

e) 250

45. Solve the equation $m/3 + \frac{1}{2} = 3/4 + m/4$

a) -3

b) -2

c) 2

d) 3

e) 4

46. Points P and Q are respectively 24m North and 7m East of Point R. calculate /PQ/ in metres.

a) 20

b) 24

c) 25

d) 31

e) 84

47. A cone is made from a sector of a circle of radius 14cm and angle of 90^0 what is the area of the curved surface of the cone (Take $\pi = 22/7$)

a) $22cm^2$

b) $38.5cm^2$

c) $77cm^2$

d) $154cm^2$

e) $308cm^2$

48. The curved surface area of a cylindrical tin is $704cm^2$ Calculate the height when the radius is 8cm. (Take $\pi = 22/7$)

a) 3.5cm

b) 7cm

c) 14cm

d) 28cm

e) 32cm

49. A ladder lean against a vertical wall at an angle 60^0 to the wall. If the root of the ladder is 5 metres away from the wall. Calculate the length of the ladder.

a) $\frac{5\sqrt{3}}{3}$ m

b) 5m

c) $\frac{10\sqrt{3}}{3}$ m

d) $5\sqrt{3}$ m

e) 10m

50. Find the value of P if 1/P = 1/4.5 + 1/5.5

a) 40/99

b) 1/5

c) 4/99

d) $2\frac{19}{40}$

e) $4\frac{9}{20}$

APPENDIX IIIb

Solution to the Mathematics Arrangement Test in Easy to Difficult Arrangement.

1. d	21. b	41. e
2. b	22. d	42. e
3. d	23. e	43. e
4. c	24. e	44. c
5. d	25. a	45. d
6. c	26. a	46. c
7. d	27. e	47. d
8. b	28. b	48. c
9. b	29. d	49. c
10. e	30. a	50. d
11. b	31. d	
12. d	32. d	
13. b	33. e	
14. a	34. b	
15. c	35. d	
16. a	36. c	
17. c	37. c	
18. d	38. b	
19. c	39. c	
20. d	40. d	

APPENDIX H

Table A-14. Critical Values for the Dunn Method of Planned Comparisons for $\alpha = .05$ and $\alpha = .01$

Number of Comparisons (c)	α	Error df 5	7	10	12	15	20	24	30	40	60	120	∞
2	.05	3.17	2.84	2.64	2.56	2.49	2.42	2.39	2.36	2.33	2.30	2.27	2.24
	.01	4.78	4.03	3.58	3.43	3.29	3.16	3.09	3.03	2.97	2.92	2.86	2.81
3	.05	3.54	3.13	2.87	2.78	2.69	2.61	2.58	2.54	2.50	2.47	2.43	2.39
	.01	5.25	4.36	3.83	3.65	3.48	3.33	3.26	3.19	3.12	3.06	2.99	2.94
4	.05	3.81	3.34	3.04	2.94	2.84	2.75	2.70	2.66	2.62	2.58	2.54	2.50
	.01	5.60	4.59	4.01	3.80	3.62	3.46	3.38	3.30	3.23	3.16	3.09	3.02
5	.05	4.04	3.50	3.17	3.06	2.95	2.85	2.80	2.75	2.71	2.66	2.62	2.58
	.01	5.89	4.78	4.15	3.93	3.74	3.55	3.47	3.39	3.31	3.24	3.16	3.09
6	.05	4.22	3.64	3.28	3.15	3.04	2.93	2.88	2.83	2.78	2.73	2.68	2.64
	.01	6.15	4.95	4.27	4.04	3.82	3.63	3.54	3.46	3.38	3.30	3.22	3.15
7	.05	4.38	3.76	3.37	3.24	3.11	3.00	2.94	2.89	2.84	2.79	2.74	2.69
	.01	6.36	5.09	4.37	4.13	3.90	3.70	3.61	3.52	3.43	3.34	3.27	3.19
8	.05	4.53	3.86	3.45	3.31	3.18	3.06	3.00	2.94	2.89	2.84	2.79	2.74
	.01	6.56	5.21	4.45	4.20	3.97	3.76	3.66	3.57	3.48	3.39	3.31	3.23
9	.05	4.66	3.95	3.52	3.37	3.24	3.11	3.05	2.99	2.93	2.88	2.83	2.77
	.01	6.70	5.31	4.53	4.26	4.02	3.80	3.70	3.61	3.51	3.42	3.34	3.26
10	.05	4.78	4.03	3.58	3.43	3.29	3.16	3.09	3.03	2.97	2.92	2.86	2.81
	.01	6.86	5.40	4.59	4.32	4.07	3.85	3.74	3.65	3.55	3.46	3.37	3.29
15	.05	5.25	4.36	3.83	3.65	3.48	3.33	3.26	3.19	3.12	3.06	2.99	2.94
	.01	7.51	5.79	4.86	4.56	4.29	4.03	3.91	3.80	3.70	3.59	3.50	3.40
20	.05	5.60	4.59	4.01	3.80	3.62	3.46	3.38	3.30	3.23	3.16	3.09	3.02
	.01	8.00	6.08	5.06	4.73	4.42	4.15	4.01	3.90	3.79	3.69	3.58	3.48
25	.05	5.89	4.78	4.15	3.93	3.74	3.55	3.47	3.39	3.31	3.24	3.16	3.09
	.01	8.37	6.30	5.20	4.86	4.53	4.25	4.1*	3.93	3.83	3.76	3.64	3.54
30	.05	6.15	4.95	4.27	4.04	3.82	3.63	3.54	3.46	3.38	3.30	3.22	3.15
	.01	8.68	6.49	5.33	4.95	4.61	4.33	4.2*	4.13	3.93	3.81	3.69	3.59
35	.05	6.36	5.09	4.37	4.13	3.90	3.70	3.61	3.52	3.43	3.34	3.27	3.19
	.01	8.95	6.67	5.44	5.04	4.71	4.39	4.3*	4.26	3.97	3.84	3.73	3.63
40	.05	6.56	5.21	4.45	4.20	3.97	3.76	3.66	3.57	3.48	3.39	3.31	3.23
	.01	9.19	6.83	5.52	5.12	4.78	4.46	4.3*	4.1*	4.01	3.89	3.77	3.66
45	.05	6.70	5.31	4.53	4.26	4.02	3.80	3.70	3.61	3.51	3.42	3.34	3.26
	.01	9.41	6.93	5.60	5.20	4.84	4.52	4.3*	4.2*	4.1*	3.93	3.80	3.69
50	.05	6.86	5.40	4.59	4.32	4.07	3.85	3.74	3.65	3.55	3.46	3.37	3.29
	.01	9.68	7.06	5.70	5.27	4.90	4.56	4.4*	4.2*	4.1*	3.97	3.83	3.72
100	.05	8.00	6.08	5.06	4.73	4.42	4.15	4.01	3.90	3.79	3.69	3.58	3.48
	.01	11.04	7.80	6.20	5.70	5.20	4.80	4.7*	4.4*	4.5*		4.00	3.89
250	.05	9.68	7.06	5.70	5.27	4.90	4.56	4.4*	4.2*	4.1*	3.97	3.83	3.72
	.01	13.26	8.83	6.9*	6.3*	5.8*	5.2*	5.0*	4.9*	4.8*			4.11

*Obtained by graphical interpolation. Table reproduced from Multiple comparisons among means. *Journal of the American Statistical Association*, 1961, 56, 52–64, with permission of the author, O. J. Dunn, and the editor.