AN ANALYSIS OF THE TEACHING OF MATHEMATICS

IN KADUNA STATE

BY

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ABSTRACT

The political e ercises which created states in Nigeria in 1968 and 1976 brought about increases in the number of Ministries of education in the country. The number in the Northern Region jumped from one to ten., As a consequence, the number of schools and pupil - population increased correspondingly.

This expansion in pupil-population and the improvement and broadening of the curriculum especially in Mathematics (a subject which, though upopular, is a compulsory offering in all post-primary schools in Kaduna State) demanded corresponding increase in the number of qualified teachers available to operate the new programmes. Those recruited to teach mathematics, at high cost to the Government, are largely Expatriates*,

The problem, thus, seeks to ascertain the extent to which these mathematics teachers are meeting the need of the State in particular, and the country in general.

The study is likewise concerned with the analysis of the teaching of mathematics in the lower forms of post-primary schools in Kaduna State. The investigation tested six null hypotheses which seek to find out the significance (or otherwise) of teacher factors such as age, experience, educational and professional qualification, sex, nationality, and attitude towards mathematics, to the effective teaching of mathematics.

The researcher hopes that the findings of the study maybe able to:

(i) help school administrators and recruitment agencies to examine more closely their teacher recruitment policies,

(ii) Make mathematics curriculum designers and teachers to reexamine closely their programmes of instructions, and

(iii) form basis for innovation and the strengthening of instructional practices of mathematics teachers in the country.

The study sample consists of 47 teachers (29 Expatriates and 18 Nigerians) found in 10 schools randomly chosen from a stratified population of 59 post-primary schools in Kaduna State where the

researcher works as an inspector of mathematics„ Relevant information about each teacher in the study have been collected from Staff Inventory Sheets of the Ministry of Education; his (teacher) attitude scale score obtained using an adaptation of the Attitude Scale Test developed by Lassa (1975), and his (teacher) classroom performance assessed on the ten-point score of the Student Teaching Practice Evaluation Form of the Department of Education, Ahmadu Bello University, Zaria. The data obtained from these sources are then compared and analysed.

The study results show that age, experience, educational and professional qualifications, sex, and nationality, are not factors which significantly contribute to the effectiveness with which a teacher teaches mathematicso However, a teacher's attitude towards mathematics is shown as a significant factor contributing towards his mathematics teaching effectiveness.

APPROVAL SHEET

In partial fulfilment of the requirements for the degree of Master of Education (Curriculum and Instruction-Mathematics), this thesis entitled AN ANALYSIS OF THE TEACHING OF MATHEMATICS IN KADUNA STATE, has been prepared and submitted by Mr. Jacob O. Ojo, who is hereby recommended for oral examination.

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DATE: _____

Dedicated to the memory of

My Father

Samuel Odediran Omisina Ojo

and

My Mother

Deborah Egberongbe Dada Ojo

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Olayide Ojo

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CHAPTER 1

THE PROBLEM

1.1 Introduction

Perhaps one of the significant phenomena to come up in the educational scene in Nigeria today is the initiation and induction of curriculum reforms. It began with Mathematics and the Physical Sciences, and it continued to cover almost all the disciplines in the educational system of the country.

The widespread effort in recent years to improve education and learning programmes has greatly contributed to the modification, restructuring, and reorganization of the Mathematics curriculum. With the improvement and broadening of the mathematics programme, the problem of getting qualified teachers to operate and teach the new programme became a pressing problem to the authorities. As a consequence, the government, with special reference to Kaduna State, has to launch a fullscale recruitment programme for more qualified mathematics teachers. In-as-much-as not enough Nigerian mathematics teachers are available in the

country, the Ministry of Education of Kaduna State, has to invest huge amount of money to recruit and employ mathematics teachers from outside Nigeria.

The employment of Expatriate teachers is admittedly essential, at this point of development of the country's educational programmes. But, if we agree with Elwell (1965) that Mathematics is one of the most effective tools in improving and accelerating education, the authorities should exercise more control and prudence in recruitment and employment of mathematics teachers. The researcher believes that the employment of Expatriate teachers could be made more worthwhile, and the huge amount invested in them be justifiable if and when these teachers become effective in their work.

Thus, the present study was undertaken to ascertain the quality of Expatriate mathematics teachers that are employed by the authorities in Kaduna State.

1.2 Statement of the Problem

The study attempts to investigate and analyse the teaching of Mathematics in the first three years of post-primary schools in Kaduna State, and at the same time determine the role played by expatriate Mathematics teachers in teaching the subject. Specifically the study seeks to answer the following questions:

1. To what extent do teacher factors such as: educational qualification, teaching experience, age, and sex contribute significantly to the effective teaching of mathematics to post-primary students?
2. How do expatriate teachers compare with Nigerian teachers in teaching mathematics?
3. Is there a relationship between teaching effectiveness in mathematics and teacher's attitude towards mathematics?

1.3 Hypotheses

The following hypotheses stated in the null form are tested to determine the relationship and/or effectiveness of the variables in the study:

1. There is no significant relationship between mathematics teaching effectiveness and educational qualifications of teacher.

2. There is no significant relationship between mathematics teaching effectiveness and teachers' teaching experience.

3. There is no significant relationship between mathematics teaching effectiveness and age of teacher.

4. There is no significant relationship between mathematics teaching effectiveness and sex of teacher.

5. There is no significant difference between expatriate teachers and Nigerian teachers on teaching effectiveness.

6. There is no significant relationship between the attitude of teachers towards mathematics and their teaching effectiveness.

1.4 Assumptions

In this study, the following are assumed:

1. That the respondents (teachers and students) work under similar conditions, in the different post-primary schools selected for the study.

2. That the entering behaviour of students is more or less similarly diversified in all the schools selected for the study.

3. That the age-range of the groups of student respondents is between 13 and 20 years, and that all of them possess the characteristics of adolescence.

4. That for every group of students in the sample, learning characteristics and cultural characteristics are basically the same.

5. That culture influences learning and teaching; that Mathematics is taught more effectively and becomes more meaningful to the child when set in his familiar culture.

1.5 Significance of the Study

Considering the amount of money invested by the Nigerian Government for its educational programmes, one wonders whether adequate learning experiences that could help develop the potentials of our youths are provided. It is therefore the purpose of this study to find out the extent to which educational programmes are helping towards the achievement of the goal of education in the country. The study limits itself only to the examination of the Mathematics programme.

It is hoped that the findings of this study will help curriculum designers, teachers and school administrators to examine closely their programme of instruction in order to determine its adequacy in achieving the goals of Nigerian education. Specifically, Mathematics teachers may profit from the

utcome of the study. It may help them to realize the need to improve their classroom behaviour so as to enable their students to benefit from their teaching.

The researcher hopes to come out with important findings and information that could serve as vital basis for the establishment of in-service training programmes designed to increase the number of indigenous Mathematics teachers that would be available for service in the post-primary institutions in the country. Based on the data collected in the study, it might become necessary for the researcher, being inspector of Mathematics in the Ministry of Education, to recommend to the higher authorities to revise or modify the present Mathematics curriculum.

As a whole, the researcher undertook this study with a view that the findings could serve as stepping stones to innovations and further strengthening of instructional practices of Mathematics teachers throughout the federation. Most importantly, the study hopes to provide a feedback to the government about its overseas recruitment policies.

Scope and Delimitation of the Problem

This study seeks to analyse the relationship between teaching effectiveness on one hand, and educational qualification, teaching experience, age, and sex of the teachers on the other hand. It will also explore and examine the differences in teaching effectiveness between Nigerian and Expatriate mathematics teachers. The study will further attempt to discover the relationship between teachers' attitude towards Mathematics and their classroom behaviour or effectiveness in teaching the subject.

The study is concerned mainly with Mathematics teaching in the first-three years of post-primary schools in Kaduna State. It uses a sample of 10 institutions randomly selected from among a stratified population of 44 secondary schools, including Technical and Commercial Schools, and 15 Teachers' Colleges.

1.7 Definition of Terms

For the purpose of the study, the following definitions are adapted:

Curriculum. All the experiences of a child under the control and guidance of the School.

Entering Behaviour. Describes the behaviours the student must have acquired before he can acquire particular new terminal behaviours. More simply, entering behaviour describes the present status of the students' knowledge and skill in reference to a future status, the teacher wants him to attain DeCecco (1968:59).

Expatriate Teachers. Non-Nigerians employed to teach in post-primary schools.

Modern Mathematics, is mathematics written, discussed and taught using the language and methods which have been introduced and developed in recent years.

Readiness is a product of both training or learning and maturation.

Traditional Mathematics. The term used for mathematics taught in all schools in Nigeria before 1960. It consists mainly of Arithmetic, Algebra, Geometry, Trigonometry, Calculus and Coordinate Geometry.

1.8 *Background of the Study*

Location of the State, Size and Population

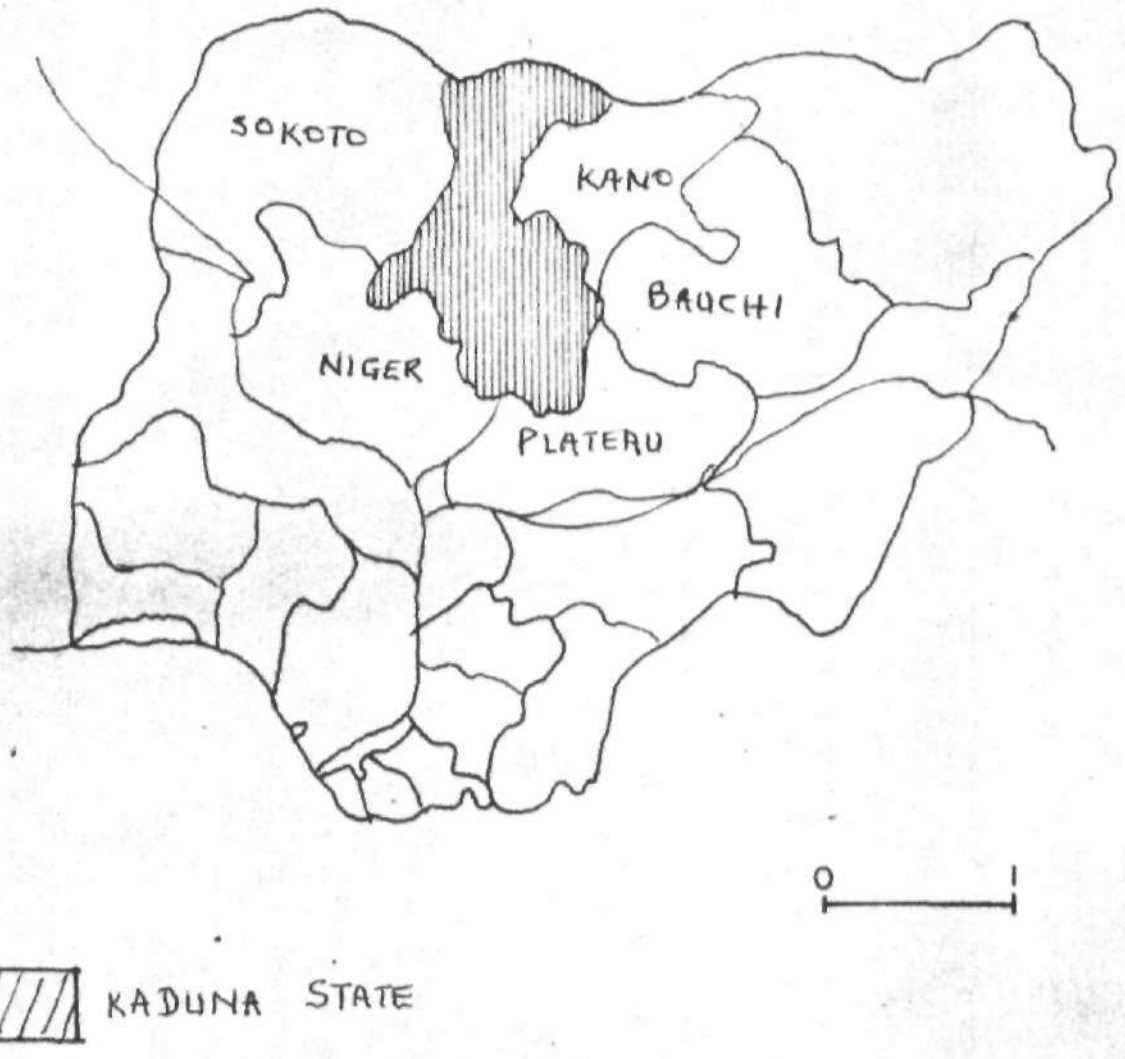
Kaduna State (Figure 1, Inset) lies approximately in the middle of Northern Nigeria. It stretches southwards from a northern boundary which it shares with the Niger Republic, for a distance of 451 kilometres. Its width from East to West is 296 kilometres. It shares a common boundary in the East, with Kano and Bauchi States, in the West with Sokoto and Niger State and in the South with Plateau State.

Lying north of the Niger-Benue trough Kaduna State occupies a sizeable part of the Northern Plateau. The land, rising abruptly in the south slopes gently north-eastwards towards the Chad Basin and in some part, north westwards towards the Rima River Valley. Out-shoots of granite hills and ridges are seen here and there.

An exact latest population figure is not available but the 1977 estimate puts it at 4,993,435. Of this number a greater proportion are Hausas and Muslims while a strong minority whose homes are to the

KADUNA STATE: THE SETTING OF THE STUDY

FIG. 1



south of the state speak a number of other languages, and are chfistians.

Some Government Policies Relevant to the Study

As policy of the government of Kaduna State, students in any post-primary institution do not necessarily belong to the locality in which the school is located. For any particular class the students population is a mixture, in an agreed proportion, of children in the 14 administrative areas into which the State is divided. It is the hope of the Government that by doing this it could bring students, from varying languistic and cultural back-ground together so that they could learn to live together in harmony, understanding and respecting the cultural differences that exist among them. It is also hoped that this will result, in the long run to a strong State and a strong nation.

Selection of pupils into post-primary institutions is done annually by the Ministry of Education which uses the results of the National Common Entrance Examination organised and administered by the West

African Examination Council, Lagos. In order to ensure that every primary school in the State which presents candidates for the selection examination is offered a chance in the exercise, standards for selection are delibrately varied. For instance, in the 1977 selection exercises only candidates who scored 220 marks or more out of 400 were invited for interview in one area whereas in another area candidates who scored 180 marks or more were equally invited. The intention is to distribute post-primary places in agreed ratio between all the qualified primary schools in the 14 administrative areas in the State.

Pupils who qualify for the selection examination must have had six years of primary education. One would expect that pupils so selected for post-primary education are the best among the pupils in a particular primary school. This is not always so, because of the need to meet the requirement of the policy of Government already stated. This is one reason why, for any class in a school in Kaduna State, students experiential background and learning set are varied and diversified.

It is a policy of the Ministry of Education in Kaduna State that all students in post-primary schools must be taught mathematics even if they do not offer it for certificate examination at the end of their courses. It is, therefore, the practice for every school to include mathematics in its curriculum. The belief is that mathematics is a core subject in education. A knowledge of it is essential to having a meaningful life in a scientific age. It has, in recent times, become a requirement of most disciplines in post-secondary institutions.

The recruitment and employment of personnel to teach in post-primary schools in Kaduna State is the concern of the State Public Service Commission. All post-primary schools in this State belong to the Government; as a result, all personnel employed to teach in these schools are governed by the Civil Service Rules. The administration and control of quality in education belong to the Ministry of Education.

Mathematics In Kaduna State Schools

Before September, 1976, the Arithmetic Syllabus designed in 1956 by the former Northern Regional Ministry of Education, was being used in teaching Arithmetic in most primary schools in the State. A preliminary survey of the position made by the researcher in 1972 showed that only two percent of the 54 schools randomly sampled were using the 1968 Mathematics Syllabus. Only one school (in Kaduna town) had the subject named "Mathematics" on its time-table. The rest of the schools used the term "Arithmetic".

CHAPTER 2

RESEARCH PROCEDURE

2.1 Introduction

The first part of this chapter describes the procedure employed in obtaining a stratified random sample of 10 schools from a population of 59 post-primary institutions. This is followed by a list, and the descriptions of the measures and instruments used for collecting information and data on the personal profiles of the teachers in the study, on their mathematics teaching attitudes, and their classroom performances. The chapter ends with a mention of other resource-centres found useful for the study.

2.2 Sampling Procedure Used

From a population of 59 post-primary schools in the State, sampling by stratification was adopted in selecting the 10 institutions for the study. The schools were grouped into two categoriese namely:

(i) Secondary Schools

(ii) Teachers Colleges

There were 44 post-primary schools in the first group. These include three Technical Schools, one Commercial School, and 40 Secondary Grammar Schools. The Technical Schools and 26 of the Secondary Grammar Schools are boys' boarding institutions, nine of the secondary boarding schools are for girls; the remaining five this stratum five schools (four for boys and one for girls) were randomly selected.

Fifteen Teachers Colleges formed the second grouping. There are 10 Boy's and five Girls' institutions in this category. Out of this, two Boy's and three Girls' Colleges were randomly chosen.

On the whole, 10 post-primary schools formed the samples for the study. Six of these are Boys'. The locations and distribution of the final sample schools form an interesting pattern. Four of the samples are located in urban centres while the remaining six are situated in rural settlements.

Forty-seven mathematics teachers teaching mathematics in Form I or II or III or in any combination of these classes were available in the schools selected. The largest number (11) was obtained from Government College, Kaduna, with a student population of 1,284 (1977). The smallest number (2) came from Teachers' College, Daura with a student population of 845 (1977).

All the teachers in this study formed the samples for the test on attitudes towards the teaching of mathematics and test on teaching effectiveness.

2.3 Methods of Collecting Data

The data and information required for this study were obtained from the following sources:

(i) Ministry of Education, Staff Inventories

(ii) Students Teaching Practice Evaluation Form, Department of Education, Ahmadu Bello University, Zaria

(iii) Teachers' Lesson Notes

(iv) Teaching Observations

(v) Personal Files of Respondents (teachers) Kept at the Ministry of Education, Headquarters, Kaduna.

(vi) Structured Interviews with respondents

(vii) Opinionnaires on attitudes towards mathematics

(viii) Library resources

The Inspectorate Division of the Ministry of Education's Staff Inventories (see Appendix A) have been very invaluable sources of reliable informations about the teachers observed. At the beginning of every school term, the Mathematics Department of the Inspectorate Division sends out to post-primary schools in the State individual Staff Inventory proforma to be completed and returned to the Ministry by mathematics teachers. The form seeks four main information about a teacher.

The first part seeks to know the teachers name, sex age, nationality, and academic qualifications. The second part seeks information about teaching experience in other schools, the type of school in which

the experience was obtained, the age/group of the subjects taught in the school and the total number of years spent in the school. The third part of the Inventory sheet seeks informations about the teachers teaching load at the school in which he is presently connected. The teachers is also required to furnish information about the classes, the subjects, and the number of periods per subject, per class, per week which he covers. The last section of the form seeks informations regarding the teacher's other activities in the school. He is to state whether he is a House-master, or a Form-master, or a Gamesmaster or a patron of one of the clubs and societies in the school.

The Staff Inventory sheets contain very useful information which have been used together with other data collected in assessing the teaching effectiveness of the teachers observed in this study.

Teachers' classroom performances were measured on the ten-pont scale of the Student Teaching Evaluation Form of the Department of Education, A.B.U. Zaria.

In this form, (Appendix B) the maximum points scorable is 100. A score of 70 and above is graded A (excellent); between 50 and 69 graded B (good); between 35 and 49, C (satisfactory); and between 0 and 34, D (poor).

A contributory source of the assessment of the teacher's classroom performance was his preparation of the lesson. This was examinable from the teacher's lesson notebook, and it was useful in indicating what amount of thought and preparations had been considered before the delivery of the lesson. The lesson notes showed projections of the teacher's classroom intentions. They clearly indicated his instructional objectives; his proposed instructional procedures, including the intended strategies; the class entering behaviour; and the evaluation procedures to be used.

Each respondent was observed by the researcher twice teaching Mathematics. The duration of a lesson period was 40 minutes. One of the lessons observed, in the case of any teacher, fell within the morning periods (that is, between 7:30 a.m. and 12:00noon) when both the teacher and his class were most likely

to be better set for mathematics teaching and learning. Whichever of his teaching score was better was chosen for this study.

A session of dialogue between the teacher and the researcher, who was the observer, followed every observation of the teacher's classroom performance. The interview sought and obtained valuable information about respondents view on the objective of mathematics teaching in Nigeria. These include his view about his student's preparedness for mathematics learning; his overal assessment of his class's understanding of the topics he has been observed teaching; a description of what instructional strategies he had adopted in the lessons; and the amount of preparation he had made before presenting the lesson to the class. Respondents were encouraged to illustrate their statements where necessary. The researcher, who is an Inspector of Mathematics Education for Kaduna State, was aware of the constraint of his superintendent possition over the respondents.

The instrument for testing mathematics attitude developed by Dr. P. Iassa, (see Apendix C) was used to measure the teachers' attitudes towards teaching mathematics. The opinionnaire contains 22 statements about mathematics. Each of the statements expresses a positive or nagative feeling or attitude towards mathematics teaching. Teachers were requested to indicate on a five-point scale the extent of their agreement or disagreement with the attitudes or feelings expressed, by making circles around the word or words which give the best indication of their feeling. The words are: Strongly Disagree (SD): Disagree (D): Undercided (U); Agree (A); Strongly Agree (SA).

In addition to the information obtained from the sources already enumerated, useful materials and information were obtained from the researcher's own library, the Ministry of Education library, and Kashim Ibrahim Library, Ahmadu Bello University, Zaria. The researcher was able to use his personal experience and position to advantage in introducing information from

the personal files of the teachers under study, and from sources that might be regarded as "classified". The data were gathered between September, 1977 and March, 1978.

2.4 Limitations

In finding out what mathematics is taught, what preparations are made before instructions are given, and the extent of the success attained by individual teachers, it was necessary to rate the teachers' classroom performances. There is always some element of subjectivity in rating and judging teachers' classroom behaviour. This is therefore considered as a limiting factor.

The time of the day when a mathematics lesson is being taught, the physical well-being of the teacher and the students, their emotional alertness, including that of the observer may affect the rating of a particular teaching performance. There is also the limitation that may be imposed by the subject-matter of instruction. Some topics, especially in Geometry lend

readily to activities which generate both the students' and their teachers' interest. Whereas some subject-matter, particularly in Algebra, require that the teacher exert greater energy and resourcefulness in order to generate pupil's interest in what is being taught.

Other limiting factors include, the locations of the sample schools, the age-range of the students, the differences in their experiential background, and the availability of resource material for teaching mathematics in the school. All these variables have been taken into account in this investigation before the assessments of the teachers were made and conclusions drawn.

CHAPTER 3

REVIEW OF RELATED LITERATURE AND THEORETICAL FRAMEWORK

3.1 Introduction

This chapter contains reviews of some literatures related to the study. These include. a recapitulation of the main ideas in Smith's (1968) report on the Trinidad Conference of Commonwealth Mathematics Educators wherein Polya (1969) outlined the broad and narrow objective of mathematics education, Sawyer (1969) identified the main problem of mathematics learning and teaching as those embedded in the attitudes of the learner and those of the adults around him towards mathematics; wrigley (1969) described the nature and forms of educational assessment and avaluation; and Blakers (1969) discussed at length resource materials for mathematics teaching and identified teachers as the most important resource materials.

The chapter also includes: a brief review of Taiwo (1974) Mathematics Teaching In Schools where in the authors' main contribution was the stress he made of the importance and relevance of culture to mathematics learning and teaching; an over-view of UNESCO (1970) New Trends In Mathematics Teaching wherein Davis (1970) gave guidelines for choosing syllabus content for mathematics learning and teaching; and a section on mathematics and the Nigerian culture.

Using Glaser's (1962) model, DeCecco (1968) distinguished four parts of a teaching model. These have been reviewed at some greater detail. The chapter ends with a review of Coker's (1972) study of the academic and professional qualifications of mathematics teachers, and a summary of the theoretical framework of the study.

3.2 Mathematics in the Commonwealth Schools

In 1966, the Commonwealth Education Liaison Committee, having taken into account a number of suggestions made to it by some government of member countries of the association and by the Commonwealth Education Conferences held in the previous years emerged with a consensus that there should be a general meeting of selected and invited mathematicians to consider the question of the teaching of mathematics in primary and post-primary schools. In his letter of invitation to member countries the Secretary of the Commonwealth Secretariate Mr. Smith (1968) spelt out the aims of the conference thus:

(i) To survey current practice in school mathematical education at primary and secondary level, both in teaching methods and procedures and in content;

(ii) To consider the principles on which temporary courses should be planned and executed for the different levels of children development and abilities;

(iii) To examine the problems which must be met if courses are to be appropriate to the differing cultural scientific, and economic needs of the countries concerned.

The conference was held at the University of the West Indies, St. Augustine, Trinidad, in September, 1978. It lasted for two weeks, during which period, 94 delegates from 29 countries and territories of the Commonwealth attended. Eminent scholars and governments were invited to present papers related to the teaching of mathematics. These were presented at Plenary Sessions; the themes were considered in greater details at Groups working Sessions. The report of their delibrations is what constitute the literature now being reviewed. Chapters III, V, VII and VIII of the report are of particular relevance to this study.

In chapter III, Professor G. Polya, of Stanford University, California, U.S.A. gave the lead paper on Fundamental Ideas and Objectives of Mathematics Education. He identified two basic groups of objectives of mathematics education. In the first group are those which stress the usefulness of mathematics and in the second category are those which seek to enhance the personality of the learner.

In the report, Professor Polya summarised the first group of objectives for mathematics education at the Secondary School as for (i) Professional preparation and (ii) for prospective technical personnels (technicians, enginners, scientists, managers). He went on further to explain that the objectives are narrow and they have been derived from the economic needs of the society. Professor Polya recommended that the school should try to attain these objectives in addition to attaining the wider and higher objectives for teaching mathematics particularly in the post-primary school.

The author (Polya) listed the higher objectives as:

(i) Serve the individual and the community.

(ii) Develop all the inner rescources of the child.

(iii) ...General Culture

(iv) Discipline of the mind

(v) Mental and emotional maturity

(vi) Desirable hibit of thinking

(vii) A well balanced personality.

Professor Polya warned that although the aims suggested contain high ideals worth striving for they become worthless if pretentious and incompetent mathematics teachers use them as cheap and empty slogans. He admonished that "Each of those ideals is worthwhile provided that you honestly believe in it and it is really valuable if you earnestly try to live up to it, if you translate it into everyday practice of the school."

Two rules for the learning process have been suggested namely:

(i) Learning should be active

(ii) Learning should be in consecutive phases.

These "principles of learning" should never be disregarded by a teacher particularly of mathematics. Professor Polya admits that the idea contained in these principles are basic and very old. They had been said many times over by past and present educators, and philosophers, from Socrates to Comenius and Montessori. Restating these principles Polya (1969:31) pointed out:

> ...learning begins with action and perception, proceeds from thence to words and concepts, and should end in desirable mental habits.

Winding up the discussion on Fundamental Ideas and Objectives of Mathematical Education, Professor Polya dealt with problems, and the tactics of problem solving. He asserted that problem solving "appears to be the most cardinal mathematical activity", and that solving problems is a specific achievement of intelligence which is, in turn, the specific gift of mankind. Students should be guided to do mathematical problems from which a number of desirable mental habit namely - precision, orderliness, ability to concentrate, ability to handle abstract objects - will result.

Mathematical problems drawn from students familiar experiences should be devised and used to implant in them such attitudes and procedures as are generally useful for solving any kind of problem. The teaching of mathematics in post-primary schools should emphasize this technique of problem - solving. He concluded:

> ...There is no scientifically guaranteed best way of teching. There are as many good ways of teaching as there are good teachers. Yet there is one specific point about which there is little dissension. All experts agree that mere possession of information is of little value in mathematics. To know mathematics means to be able to do mathematics. To use mathematical language, to find the unknown, to check a proof, and so on. Therefore to teach mathematics we must give opportunity to students to do mathematics.

Chapter V of the report is on "Mathematics in Secondary Schools" a lead paper resented by Professor W.W. Sawyer of the Department of Mathematics and College of Education, University of Toronto, Canada. Basically the submissions made here are echoes of the principles and the analyses given by Professor Polya in Chapter III. The main additional points made which

are considered relevant to this research are embodied in the statements made by Professor Sawyer (1969:17)

> ...The main difficulty in mathematics lies neither in the nature of the subject nor in the limitations of the learner, but rather in the attitudes of the adults around him... Mathematics is an activity and depends greatly on the attitude of the learner. Attitudes are formed young. The greatest influence on the future teachers is the elementary school; the next greatest, the secondary school.

This is why some authorities suggest that post-primary school teachers should likewise concern themselves with what goes on in the primary schools. For the proper and effective teaching of mathematics both levels of education should co-operate.

The lead paper on Assessment and Evaluation in Chapter VI was presented by Professor J. Wrigley (1969) of the University of Reading, England. In it, he emphasised the need for assessment of new programmes with regards to individual students' progress as well as to find out whether such programmes are achieving their stated specific

objectives. Two principles for assessment were suggested. Firstly, in testing, the welfare of students must be considered. Its effect should be beneficial to the student causing no hindrance to their mathematical or personnal development. Secondly, the teacher must take an active part in teaching and assessing. His overall accummulated records of students work should account for a sizeable part of the test.

Professor Wrigley described, in some detail, a number of forms of assessments which are available. The selection of any one form of test will depend on the purposes of the assessment.

The recruitment and training of mathematics teachers was discussed in Chapter VII of the report. Records show that serious shortage of competent teachers of mathematics exist all over the world. In many cases the difficency is both in quantity and quality particularly at the primary levels. Some suggestions have been made regarding the improvement of the situation. For instance, teachers should be given

inservice training and be encouraged to take courses in new trends in mathematical education. Governments should likewise invest more in training mathematics teachers and request universities to mount sandwich courses to improve the number of qualified personnel particularly in the primary and post-primary schools.

Some of the suggestions will be taken up, in more detailed considerations later in this submission.

Professor A.L. Blakers, (1969) of the Department of Mathematics, University of Western Australia gave the lead paper on Resources For Learning Mathematics, Chapter VIII. He identified the teacher as "the main channel for the communication of mathematical ideas to the student". He (the teacher) is therefore the most important resource material. Textbocks were also highly rated as resource materials for the teacher and the students. It is therefore important that institutions of learning should possess a good accessiable collection of mathematics books. Other materials such as photographs, films, radios, televisions, projectors and the like have only limited uses and are costly. Teachers and students

should endeavour to use more frequently locally produced or home-made materials which could be made more readily available.

It has been necessary to review in greater details this report of the specialist meeting of Commonwealth mathematicians and educators. The records of the proceedings supply, to a large extent, the theoretical framework of this research. It has dealt with the whole procedure of mathematics teaching in schools - Fundamental Ideas and objectives of mathematics education; methods of teaching mathematics and the learning principles; assessments of students progress and evaluation of programmes; recruitment, training and re-training of teachers; and resource materials for learning mathematics.

3.3 Mathematics Teaching In Schools

After the 1968 Commonwealth Education Conference at the University of the West Indies, Trinidad, Professor C.O. Taiwo (1974) of the University of Lagos, Nigeria was commissioned to adapt the materials produced by various groups at the seminar and use them

for a simplified book on "Mathematics Teaching In Schools." The book was eventually circulated in 1974 under the auspicis of the Commonwealth Secretariate, London.

The content of the book is essentially similar to the analysis contained in Mathematics Teaching In Commonwealth Schools - already reviewed. Writing as a Nigerian, however, Professor Taiwo (1974:22) made some suggestions which are more suitable and relevant to our situation. He said that "it is desirable that, teachers should have considerable freedom in deciding syllabus content..."

In teaching mathematics, proofs and or justifications should be given for formula theorems and algorithms, students should be directed to do mathematics of the type that is drawn from their experiential background and relevant to their educational need. The author stressed the importance and relevance of culture to mathematical learning and teaching, Taiwo (1974:46) concludes:

> ...the teacher should understand the culture in which he is working, and how this affects not only the suitability of what is taught (the curriculum) but also the choice of a teaching strategy (including the use of learning resources) which is likely to prove effective.

3.4 Mathematics and the Nigerian Culture

Education is a cultural process. Each new member of a society or a group must learn to act appropriately as a member and contribute to its maintenance and, occasionally to its improvement. Mathematics studied in a cultural setting is an instrument for adaptation and change. To have a better grasp of the principles involved in mathematics, it must be studied as it is embedded in the culture of which it is an integral part and which it serves.

Educators are agreed that children are decidedly influenced by the culture of the society in which they live. In the light of this, teachers must identify the main features of this culture and understand how these molded the child's mathematical thinking and influence his response to learning. Them, they can devise effective strategies of instruction in the subject. If the child is to

assimilate fully the mathematics that we teach him, it should be related to his familiar culture.

One might asked - Is there Nigerian culture? Or what really constitute Nigerian culture? Answers to these questions depend on a number of considerations. In the first place, what is culture? One definition says, culture is, "the way of life of a society". It further explains, "culture has distinguished human societies from animal groups since the beginning of mankind. The customs, ideas and attitudes shared by a group, which make up its culture are transmitted from generation to generation by learning processes rather than biological inheritance" (Smith, et.al; 1968). In the case of Nigeria there has been acculturation going on through our age-long historical contact and a distant common origin evident in our distinctive customs, identical ideas, and a common generally accepted attitude to life. There is much in our language, customs, way of life, beliefs, religion, recreation, work, and festivities which could add a lot of meanings to mathematics teaching in this country. Everyone admits that mathematics is an important

subject and that any education curriculum which omits it is not complete. But very few people even today, think of mathematics as alive, exciting, and interesting. Most adults after leaving school never take up a book on mathematics to read for 'pleasure' and fun. On the contrary, they are too happy to say "good bye" to mathematics learning.

Admittedly, mathematics is, to as large extent, abstract. "It is the subject in which we do not know what we are talking about or whether what we say is true." (Russell, in Stone, 1961:4). That is to say it deals primarily with ideas, thoughts, and concepts which are obtained from the material world around us. The emphasis is not upon the physical objects themselves but upon relationships between sets of objects. These ideas and concepts are used to form other richer thoughts which may then be projected back into the physical situation to solve problems of daily life. This abstraction which is called mathematics, as Russell (1961) further pointed out "possesses not only truth, but supreme beauty, a beauty cold and austere, like that

of sculpture, without appeal to any part of our weaker nature, sublimely pure, and capable of a stern perfection such as only the greatest art can show." The teacher of Mathematics therefore, tries to lead his students to discover this 'truth' and 'beauty' through patient analysis of the problems involved, and by carefully devising teaching approaches whereby the mathematics of situations was revealed clearly rather than hidden under symbols on papers or among irrelevant impression coming to the eyes and feelings from all physical experiences.

The technique is to get students to understand why things work the way they do to a much greater extent than has been customary. Students are led through active participation in relevant and meaningful activities to discover relations, patterns and the basic principles in mathematics. It is not enough always to shouw the student how to work a problem and to ask him to memorise this. There are many possible ways of arriving at the answer, and the students own way might even be better.

Mathematics itself has changed. Older content

have been expanded and re-aranged in new patterns. Newer topics such as sets and modula arithmetics have been added. Mathematics has to be related to human needs and concerns and as both needs and concerns have changed with the advance of civilisation and progress in technology, mathematics has spread out in these new directions in order to meet the new challenges.

The new approach therefore, hopes to given the student confidence in using his own mind to be able to decide whether he is wrong or not. It hopes to prepare him to be able to meet new situations in a changing world with courage and determination to succed. These are sound educational goals, worthy of striving for. However, one may wish to know the extent to which this country is moving towards the achievement of these objectives in the context of its culture.

Nigeria is a multilingual society, where most people in institution of learning are bilingual, speaking usually some English and the language of the ethnic group to which they belong. Often they prefer to identify themselves by their particular language, In a country with no less than 200 ethnic identities, it is not suprising therefore, that English (a colonial

heritage) has remained the lingua franca of the nation even after gaining its independence in 1960. It has remained the language of the school, from the upper primary classes up to university level. In a few instances where the children came from urban consmopolitan settlements in this State, English is the medium of instruction throughout the primary school. However, in other places, the common practice in the schools is to use Hausa as the medium of instruction, in the first two or three years in school and then propgressively graduate to the use of English.

One very obvious effect of this seemingly formidable language obstacle to mathematics teaching is that the child is unable to use words or structure precisely. Nor is the teacher able to establish, with the necessary amount of certainty, some communication with the child. Most of mathematics is abstract; and abstract ideas are hard to define. There is a consolation, however, in that mathematics has a language of its own which cuts through international linguistic boundaries.

It is here that the teacher's ability to adapt is required. For the child to be able to understand mathematics there are some basic linguistic agreements that must be reached between the teacher and his pupils so as to be able to engage in proper and productive communication.

The expression ¼ has two possible mathematical interpretations:-

(i) as a name for rational number it is pronounced "one-forth" or "one-quarter";

(ii) as an operation, where the vinculum is regarded as a division sign, it means "one out of four".

whereas students in this country would not hesitate to see ¼ or ¾ as 'one-quarter' or "three-quarters" respectively, they are more likely to read $\frac{5}{4}$ as "five over four" and not "five-quarters". Students' experiential background in the main, in this country, does not include using such fractional numbers as numerals. They are more familiar with the operational meanings of fractions because, quite often they must have had occasions, at home, to share out things into equal parts.

It is more logical therefore for teachers to use the second meaning in teaching rational numbers especially when these are being introduced to students for the first time.

A second area of difficulty relates to teaching concepts which are outside the childs own experiences and which di.bolically nagate his practical experiences. One such example occurs in teaching Sets. A Set is usually defined as a collection of things' or ideas. But this definition soon leads to ambiquity. Difficulties arise when terms like the empty set, the set with one element is being explained to the child. He argues, "you cannot define a set as a collection of things and at the same time claim that there exists a Collection of things that is empty, nor can you have a collection where there is only one element. As far as the child is concerned, a collection always imply many elements.

Respect for authority and elders is an aspect of the Nigerian culture. This singular attitude to life is often misunderstood, usually by outside observers.

Some observers complain that it leads the student to accept whatever he is taught without question. Some people say it reduces him to more receptacle always at the receiving end of information. Others say, that he would as a result grow up into a complacent adult without any urge to face the challenge of civilisation. It is even suggested that "rote learning would be the common procedure in our schools. These inferences are far-fetched. Nigerians have evolved, over a period of centuries, societies where old age is synonymous to experience and, to some extent, sagasity. Elders in the society had established a reputation for sincerity, honesty and obedience to traditional laws. They had made the young ones to believe that they, as elders, would not exaggerate or mis-represent issues. This norm had been passed on from one generation to another and have become a credo passed from father to son. It has worked in the society so well that the resultant respect for authority and old age sprang from an acceptance on the part of the child of the honesty and sincerity of his elders.

Quite unlike the 'advanced societies' where television, newspapers, radios, and other instruments of mass-media have sometimes become agents of exaggration, inaccuracies, distortions and occasional dishonesty. It is no surprise that some youths of 'advanced societies' no longer trust their elders.

By and large, when a Nigerian child comes to school he expects his teacher to be knowledgeable, honest, sincere and truthful; so he respects him. The gravest mistake the teacher can make then, in the author's view is for him to let the child down either by being inaccurate, or dishonest, or insincere. Unfortunately, not much of the norms of the "old society" remain. Many of our teachers in the "new society" are being taught by teachers whose cultures are foreign to our own. Our progress in 'Civilisation' has brought us into contact with a number of things which are alien to our culture. All these are affecting our attitude to work, life and some of our cherished values.

A number of mathematics textbooks in circulation in schools in this country have been written by foreign authors. They draw examples from their own backgrounds which are very unfamiliar to the students who use the books. Questions such as the ones below are given:

(i) Two trains approach each other from opposite directions. The first train which is 150m. long approaches at 100 k.p.h. while the second train, 25Cm. long, approaches at 80 k.p.h. Find the time they take to pass each other.

(ii) Find the volume of water in a bath whose dimensions are 6m by 2m, by 1½m.

The absurdity in the first example is that, Nigeria has a single-tract railroad. The situation when two trains would approach each other from opposite directions at such speeds could not arise. If it did, it would be a tragedy. In the second example, baths are not as common a feature of most Nigerian homes as they are of most European homes. In teaching Relative Velocity, examples could be drawn from situational settings familiar to students. If the teacher is less familiar with what is local in the place where his school is, he could draw from the wealth of knowledge of his pupils on such matter.

3.5. New Trends In Mathematics Teaching

In 1970, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) has, as one of its programmes, the promotion of the exchange of informations related to the content and the teaching of the sciences at all levels. It publishes fairly regularly collection of articles titled, the Teaching of Basic Sciences. It has adapted articles and papers from leading Science-teaching journals relevant to the content, curricula approaches, and new techniques in the teaching of the basic Sciences which include Mathematics. The book, "New Trends In Mathematics Teaching, Volume II" is a direct product of this. It was prepared with the collaboration of the International Commission on Mathematics Instruction of the International Mathematics Union.

Chapters II, III, and IV contain articles relevant to this research. Here again, as in the other literatures already reviewed the main emphasis has been that mathematics teaching should be practical, creative and should be unfolded from the spontaneous movements of thinking. The teacher's essential role is that of a guide whose knowledge of the subject and the understanding of how children learn help him to direct his students' intuition and intention to higher levels of achievements.

Davis R.B. (1970) writing a report in the (UNESCO) publication on "The Madison Projects Approach To A Theory of Instruction," made an analysis of what factors he considers should help a teacher to determine the content of what mathematics should be taught. In choosing appropriate mathematical experiences he suggested that the following factors should be taken into account:

(i) Adequate previous "Readiness"

(ii) Relation to Fundamental ideas

(iii) The student must have an active role

(iv) Concepts must be learned in familiar and relevant context

(v) Interesting pattern must lurk under the surface of every task

(vi) The experiences should be appropriate to the age of the learner

(vii) The sequence of Informal Exploratory Experiences must seem to add up to something worthwhile.

3.6. The Psychology of Learning and Instruction

This section will review the teories of DeCecco (1968) on psychology of learning and instruction as he presents them in his book titled "Educational Phychology."

3.6.1 Theory of Teaching. Although it is recognized that there is need to have a general concept of teaching, yet up to now there seem to be no single concept of teaching. Experience and traditions have remained for all times, the main source of knowledge. Agreeing with Gage's analysis of theories of teaching, DeCecco (1968:7) said:

> A theory of teaching should answer three questions: how teachers behave, why they behave as they do, and with what effect. It should be a general concept which applies to all teachers, to all students, to all subjects matter and to all situations, both in and out of school in which teaching may occur. It should consider the behaviour of teachers, the cause and the learning of students, the effect. And it should explain, predict, and control the way in which the behaviour of the teacher affects the learning of the students.

Gage (1964) pointed out that teaching covers different processes, behaviour, and activity, to be the proper subject of a single theory. He advised that, "we must not be misled by one word 'teaching', in searching for one theory to explain it." To differentiate theory of learning from theory of teaching, DeCecco explained that the former describes and explains the condition under which learning does or does not take place; the latter must be based on theories of learning which are usually broad and basic. Theories and practice of teaching are influenced by philosophy of education.

3.6.2 Teaching Models. According to DeCecco, the best subsitute for a theory of teaching would be a teaching model of the kind designed by Glaser (1962) as shown in figure 2.

The four parts of the model correspond to the main parts of the teaching behaviour which this investigation sought for in the teaching of each of the respondents observed.

Box A, in Figure 2 contains Instructional Objectives. The author (DeCecco) described Instructional Objectives as "those that the students should attain upon completion of a segment of instruction." These vary in scope and character. In stating their instructional objectives, teachers must set them out explicitly, clearly and precisely in terms of the expected students' terminal behaviour.

Entering Behaviour, (Box B) is described by DeCecco as "the behaviour the student must have acquired before he can acquire particular new terminal behaviour." It has also been described as learning sets, learning abilities, and learning styles. The basic theme that permiates the discussion on entering behaviour is the need for the teacher to endeavour at all times to make accurate determination and assessment of his students entering behaviour when he is drawing up his plans for instruction and during actual delivery.

The third component (Box C) of the basic teaching model - Instructional Procedure deals with skills, concepts, principles and problem-solving.

DeCecco warned that several factors, including instructional objectives and entering behaviour, determine the proper selection of instructional procedures. He further said that: (DeCecco 1968:238)

> ...before a teacher can decide how to teach he must determine what to teach - the Instructional Objectives. Generally, these objectives should have priority over the procedures except in those unusual cases in which we can find no adequate instruction to meet particular objectives.

Teachers should ensure that they descriminate objectively in their choice of instructional procedures. They should not make their preference for particular procedures the deciding factor for selecting instructional objectives. It is necessary to determine whom to teach first (entering behaviour of the students) before choosing the appropriate instructional procedures. Other factors which could guide teachers in their designs of instructional procefures include, conditions of learning, - external or internal conditions. The teacher must decide to choose the appropriate conditions

of learning that would most likely yield the best result. As the level of learning increases in complexity, conditions for learning change correspondingly. Following the classification of learning of Gagne, DeCecco (1968:239) identified the following learning types:

(i) Classical and operant conditioning

(ii) Skill learning

(iii) Language learning

(iv) Concept learning

(v) Principle learning, and

(vi) Problem solving.

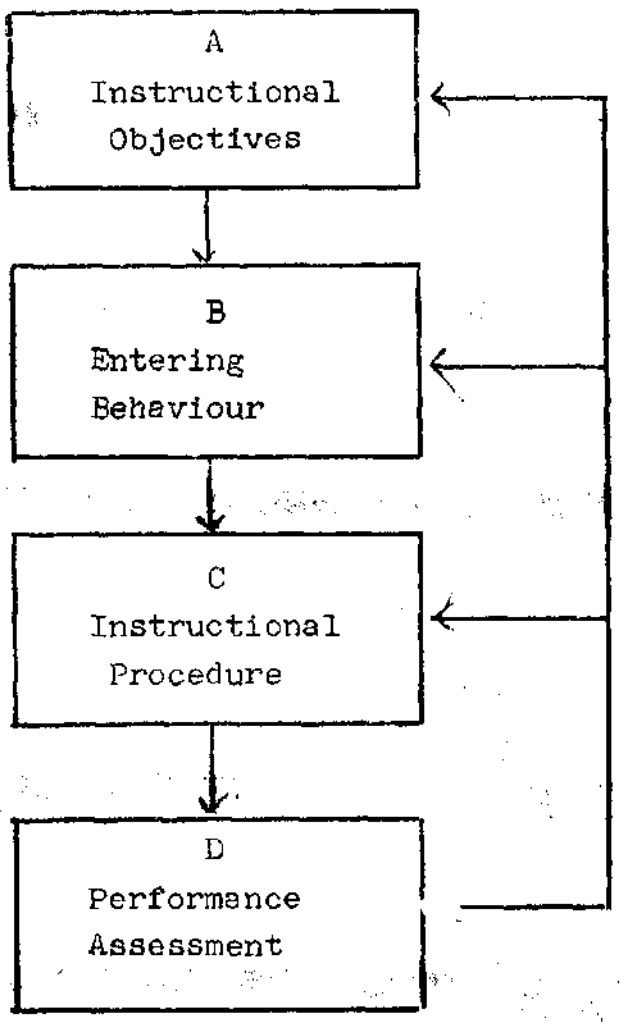
A teacher's task includes the inference and the choice of the specific procedures and materials for use from the learning types involved, and the conditions associated with them.

Performance Assessment, Box D, is concerned with the use of the classroom and standardised test procedures to measure the terminal performances of students. It is directly related to all the other three teaching

components already discussed. It is strongly related to the first component, because performance assessment is based on instructional objectives. A teacher's intention in assessment of performance of his students is to determine the extent to which his students have learned the subject matter stated in his instructional objectives. Performance assessment is also an important source of feedback on the adequacy with which a teacher has assessed his students entering behaviour and on the suitability or appropriateness of his instructional procedures. The relatedness of all the components could be seen in figure 3.

FIGURE 3

FEEBACK LOOPS FOR PERFORMANCE ASSESSMENTS



3.7 Academic and Professional Qualifications of Mathematics Teachers

Coker, K.I. (1972) made a survey of the academic and professional qualifications of post-primary schools mathematics teachers in North Central State (Kaduna State). The researcher sought answers to the following questions:

(a) How many of our qualified mathematics teachers are Nigerians?

(b) How many of these Nigerians are indigenous to the State?

(c) Are these teachers satisfied with their conditions of service?

(d) If the expatriates are satisfied are the Nigerians satisfied?

(e) Have we enough mathematics teachers in the State?

The study was merely a fact-finding one. Questionnaires were sent to teachers of mathematics in all the State post-primary schools. Of the 165 questionnaires sent out only 50 were returned and these came from 21 of the 33 schools in the population. The investigation showed that the total number of mathematics teachers, 50 was extremely low, and that of this number a preponderence who were mostly Nigerians were non-graduate

teachers. Forty-eight percent of mathematics teachers in the schools were expatriates from India and Pakistan. Only six mathematics teachers were indigenous to the State.

The researcher suggested that the reason for this abbysmally low number of indigenous mathematics teachers in the schools was because the condition of service was poor and that many schools were located in areas which lacked social amenities. He suggested tha: (Coker 1:1972:23).

> It is therefore advisable that the State Government should do everything to improve the conditions of service for the graduate teachers. The State Scholarship Board should give special preference to the students who like to become mathematics graduate teachers in the award of scholarship.

A few more suggestions were put forth with the view that these, when implemented would help to bring more people into the fold of mathematics teaching. It was recommended that experienced teachers could be sent to attend summer courses at the Universities to up-date their teaching effectiveness. It was also

suggested that the number of lessons per week, which a mathematics teacher should teach could be reduced to 22 so as to allow him time for preparations. In concluding, the researcher (Coker) said, that "lack of good mathematics teachers in our post-primary schools results in poorly prepared mathematics students."

The study did not show nor find out what constitute "good" mathematics teaching. It did not find out whether there were "good mathematics teachers" in these schools or not. While it may be correct to suggest that the number of indigenous mathematics teachers in the schools was low it could not be asserted with equal definitness that this low figures was due to poor conditions of service and the locations of the schools in which the teachers teach, without first defining clearly what "conditions of service" and "social amenities" are.

Although the investigator did not test whether or not there exists any repationship between effective teaching of mathematics and such factors as age, sex, nationality, experience, preparation, attitudes and qualifications, he has, however, given useful informations about the quantity, nationalities, age range of the teachers, and their general attitudes towards mathematics. The present study seeks to take off from this basis.

An analysis of the aforementioned studies indicate that several variables affect, to a large extent, the acceleration of learning and the effectiveness of teaching mathematics. These variables as identified by the studies reviewed include teacher's academic preparation and professional background, teaching experience, attitudes towards the subjects by both teachers and students, mastery of the subject matter, personality, and methods of teaching, and an understanding and use of the culture under which the teacher is working. The studies reviewed showed that teaching and learning go hand in hand. One cannot talk about teaching, or assess the effectiveness of teaching, without necessarily talking about learning or assessing the extent to which learning has taken place in a given situation. Therefore students' factors such as entering behaviour, attitudes towards the subject, learning styles, capabilities, special interest, motivation, experiential background, and age are variables which play important roles in any teaching/learning situation.

3.8 Theoretical Framework of the Study

This study is based on a number of theories. The study assumes that for a good and effective teaching to take place a number of criteria must be met. Firstly, the teacher must be matured in age. He must have attained some chronclogical maturity which places him in a respectable position above his students. His emotions, comportment and composure should have attained some heights which enable him to conduct himself before his class with understanding and tolerance. Secondly a mathematics teacher must be academically qualified. He should have mastery of the subject matter he has to teach. Mathematics is a very wide subject. It is not, therefore, always possible for the mathematics teacher to know all the branches of the subject. Nevertheless, a well-qualified

teacher should be able to avail himself of appropriate literatures that would supply the information he needs to supplement his knowledge.

Thirdly, experience in teaching mathematics is an advantage to good mathematics teaching. In dealing with new concepts the teacher must decide what content will attain the objective of the study, and then he must select the strategy that would produce the best result. This is not always easy. However with experience he would be in a position to select which instructional strategies had produced good results in similiar situations.

Fourthly, a good and effective teacher of mathematics should have mastery of the language of instruction. In our case, in the post-primary schools, English is the medium of instruction. It is therefore important that he should have a good command of English. It is realised that mathematics has a language of its own; nevertheless, the mathematics teacher should be able to effectively communicate with his students. He should be able to apply the process of communication

effectively. As the communicator the teacher must ensure that he encodes ideas and concepts correctly using all available media and materials for the purpose so that the interpreters (the students) decodes and react appropriately. Messages seldom get communicated unchanged. It is a major task of the classroom teacher to ensure that worthwhile messages are received by students correctly and effectively.

Fifthly, to be an effective mathematics teacher, the culture in which the students are learning should be understood and used. Examples should be drawn from the students' familiar culture, Topics should be relevant. The relevancy of culture to sound mathematical understanding is further amplified in a subsection in this chapter.

3.9 Systematized Instruction

Mathematics is a science. It should be taught following upon planned strategies. The framework for this investigation is the Systematised Instruction.

The child remains the focus of attention in systematised instruction. The teacher begins by asking four questions:-

(i) What are the goals to be accomplised by the lesson?

(ii) Under what conditions will the child seek to achieve these?

(iii) what teaching aids would be used to organise the teaching-learning situation for attaining the goals?

(iv) How well were the goals achieved?

These four "corner-stone" of instruction correspond to the four components of the teaching models in Figure 2. The teacher must state clearly and explicitly his instructional objectives; he must know and base his instruction strategies on the entering behaviour of his students; he must select the strategies that would yield the best result; and he must use appropriate performance assessment methods to determine the extent to which learning has taken place in order to measure the success or failure of his teaching.

A good preparation is essential to an effective teaching. In his preparation the teacher must define clearly his instructional objectives in measurable behavioural terms and select the content appropriate to these objectives. He then select adequate learning

experiences and attempts to individualise instructions learning in mind the individual needs of his students. He must select one or more learning-teaching format for attaining the objectives. He chooses carefully the physical facilities to carry out the learning exercises adopting and adapting materials and equipments appropriate for the learning-teaching experiences. All of these must be considered carefully and written down in note form in the teacher's note-book. The test materials must be carefully selected and graded so that they measure the terminal behaviour of the students accurately.

The first stage in a teaching-learning situation is, lesson planning. A well-prepared lesson is very important. The rest of the work comes spontaneously with a good plan. The next stage is that in which the teacher delivers the content of his lesson.

In actual delivery, the teacher must introduce the topic in a way to arouse and maintain the class interest in the subject. He should bring into play all the experiences and knowledge of learning-teaching he has to motivate his students towards the correct

direction. His presentation of the topic must lead from known to unknown, from the familiar to the less familiar, from the concrete to the abstract. He must use effective communication media. He should invite students participation so that they do not remain passive listeners. His mode of questioning should be such that would lead his pupils to discover answers. He should always bear in mind that, as Fuller (1968:9) said:

> It is possible to design environments within which the child will be neither frustrated nor hurt, yet free to develop spontanously and learned to undertake reform of the environment and not to try to reform Man. If we design environment properly it will permit the child and Man to develop safely and to behave logically.

The assessment of teaching performance recorded and analysed in this research has been based largely on the theoretical framework discussed in the preceding passages. In doing this, the researcher was not unmindful of some constraints and limiting factors.

CHAPTER 4

PRESENTATION AND INTERPRETATION OF DATA

4.1 Introduction

This chapter is in two parts. The first part presents the profile of the mathematics teachers under study. It gives the total number in the sample and describes their nationality, sex, education and professional qualifications, age, and years of teaching experience. The second part describes and analyses the effect of the variables (discussed in the first part), on the teachers' classroom performances. The chapter ends with an examination of the role of their attitudes towards mathematics teaching and the effectiveness of their teaching.

4.2. Profile of Mathematics Teachers

A total of 47 teachers drawn from 10 different post-primary schools in Kaduna State constituted the final sampling for this study. These teachers were teaching mathematics in these school. Of this number, 74 percent are males and 26 percent females. The number of expatriate teachers in the sample is 29

while Nigerians are 18.

The Expatriate teachers surveyed come from different countries. For ease in tabulating date, the teachers were grouped into four. Thus, Indians (16), Sri Lankans (4), and Pakistanis (3) are grouped under "Indian Sub-Continent". For the "Far-East Countries", the three respondents come from the Philippines. The Canadian (1) and the British (1) respondents are grouped under one nomenclature "European"; and the teacher identified under "Middle East" is an Egyptian.

4.2.1 Nationality and Sex. Table 4.2.1. shows the Nationality and Sex distribution of the teachers in percentage. Nigerians who formed 38 percent of the total number of teachers under study, are outnumbered by their expatriate counterparts who formed 62 percent. The nationality-sex pattern further shows that: in the Nigerian group there are 17 or 36 percent males and only one (or two percent) female. In the expatriate group however, 18 or 38 percent are males while 11 or 24 percent are females. The region from which the greatest number, 23 or 49 percent of teachers in the

sample of study was employed, is the Indian sub-Continent.

TABLE 4.2.1.

NATIONALITY AND SEX DISTRIBUTION OF MATHEMATICS TEACHERS IN PERCENTAGES

Nationalities	Number			Percentage		
	Male	Female	Total	Male	Female	Total
Nigerians	17	1	18	36	2	38
Expatriates						
Indian Sub-Continent	16	7	23	34	15	49
Far East Countries	0	3	3	0	7	7
Europeans	1	1	2	2	2	4
Middle East	1	0	1	2	0	2
Total	35	12	47	74	26	100

4.2.2 Age of Mathematics Teachers. The age-range of teachers (Nigerians and Expatriates) as shown in Table 4.2.2 vary widely. The youngest member (a Nigerian male) is 21 years old while the oldest (an expatriate) is 58 years old.

The nationality - age pattern indicates that most of the teachers in the 21 - 30 year age-range, 30 percent are Nigerians whereas Expatriates in this group constitute 23 percent. In the 31 - 40 year age-range, however, most of the teachers (27 percent) are Expatriates while Nigerians constitute six percent.

Of the total 10 percent in the age range 41 - 50 years, two percent are Nigerians while eight percent are Expatriates. The two teachers in age-range 51 - 60 years are Expatriates.

TABLE 4.2.2

AGE-GROUPS OF MATHEMATICS TEACHERS
IN PERCENTAGES

	Number					Percentage		
	Nigerians		Expatriate					
	Male	Female	Male	Female	Total	Nigerian	Expatr.	Total
21-30 years	13	1	7	4	25	30	23	53
31-40 years	3	0	5	7	15	6	27	33
41-50 years	1	0	4	0	5	2	8	10
51-60 years	0	0	2	0	2	0	4	4
Total	17	1	18	11	47	38	62	100

4.2.3 Educational and Professional Qualifications. The ranking adopted in this study as shown in Table 4.2.3 is that which is practised by Kaduna State Ministry of Education, for all teachers in its employment in post-primary school.

In general, those at the top rank (Category) are highly qualified teachers who possess Masters degrees (Science, Art,) and, in addition have teaching

TABLE 4.2.3

EDUCATIONAL AND PROFESSIONAL QUALIFICATIONS
OF MATHEMATICS TEACHERS

Ranks	Number					Percentage		
	Nigerian		Expatriates		Total	N	E	Total
	M	F	M	F				
Category I	0	0	0	0	0	0	0	0
Category II	3	0	3	0	6	6	6	12
Category III	1	0	15	11	27	2	56	58
Category IVB	7	0	0	0	7	15	0	15
Category IVB	3	1	0	0	4	9	0	9
Category V	3	0	0	0	3	6	0	6
Total	17	1	18	11	47	38	62	100

Legend:

Category I - MA/M.Sc with Dip.Ed/Cert.Ed

Category II - BA/B.Sc with Dip.Ed/Cert.Ed
BA/B.Sc (Ed.)

Category III - BA/B.Sc

Category IVA - NCE, HDME; D.M.E

Category IVB - Grade I and Grade II

Category V - H.S.C.

N= Nigerians M = Males
E= Expatriates F = Females

qualifications which may be Diploma or Certificate in Education. Holders of the Masters degree in Education fall into this group. In the second rank (Category II) are those teachers who hold Bachelor's degree (Science, Art) and, in addition Diploma or Certificate in Education. Teachers who have their first degree in Education fall into this second ranking. This group are often referred to as well-qualified teachers.

Those who possess the first degree only are classified under the third category. This group is referred to as academically-qualified. Holders of Bachelor's degree (Art or Science) without any teaching qualifications fall in this classification (Category III).

The fourth ranking (Category IV) consists of those who are regarded as professionally qualified. This group is further sub-divided into two rankings namely:

(i) Professionally well-qualified - this includes holders of the Nigerian Certificate in Education (N.C.E.); Higher Diploma in Mathematics Education (H.D.M.E.); and Diploma in Mathematics Education (D.M.E.).

(ii) professionally qualified - which includes Grade I Teachers and Grade II Teachers.

In the fifth group (Category V) are those classified as auxiliary teachers, who are regarded as non-qualified. They consist of holders of Higher School Certificates. Their tenure is usually temporary as they soon gain admission into Higher Colleges or the Universities for further studies. They are therefore, as a general rule, "seasonal birds".

Teachers who possess degrees from a university from the Indian Subcontinent other than those universities which are affiliates of the University of London are classified differently. A holder of a Masters degree (Science or Art) plus a teaching diploma or certificate obtained from such a University falls into the second ranking; while a holder of a Bachelor's degree (Science or Art) plus a teaching qualification (degree, diploma, or Certificate) also from such universities, is ranked with the third grouping. A first degree holder who possesses no teaching qualification is placed in category IV. As a rule, however, holders of the first degree (Science or Art)

only from any of the universities in the Indian Sub-Continent other than the exceptions already mentioned are not employed to teach in post-primary schools in Kaduna State. Graduates of recognised universities from Europe and the American continent are regarded, on equal grounds as graduates from Nigerian universities.

Table 4.2.3 shows the rank-distribution of the 47 teachers in the study. As can be seen in the table, nobody comes under Catetory I. This is understandable, since highly qualified teachers would rather serve institutions of higher learning such as Advanced Teachers' College, College of Technology or the University.

Category III contains the largest number of respondents. Of the 27 teachers available in this group, only one is a Nigerian. The seven (15 percent) respondents in Category IVA, the four (9 percent) respondents in Category IVB, and the three (6 percent) respondents in Category V are all Nigerians. For obvious reasons there are no Expatriates in any of these lower categories.

4.2.4 Teaching Experience. Table 4.2.4 contains the classification of teachers under study into three teaching - experience group: those with 0 - 3 years are in the first group; those whose accumulated teaching experience are from four years to six years are in the second group; and the third group consists of teachers with seven or more years of teaching experience. This stratification follows closely the pattern employed by Kaduna State Ministry of Education for determining promotion - year for teachers under its employment.

In normal circumstances, a teacher on first employment with the Ministry of Education will be on probation during his first three years of teaching. At the end of this period he would have earned a promotion credit which should elevate him to the next rank if he had been judged a successful employee. If he were an expatriate his contract would have been due for renewal. A teacher whose performance is assessed as below standard would not be promoted and may be re-premanded, cautioned or have his appointment terminated, or have his contract appointment not renewed.

After a second set of three years of successful work a teacher would be due for and may be promoted to the next rank. After six years of good work, a teacher would be due for consideration for appointment or elevation to a duty-post, such as Senior Master, Year-Group Master, Vice Principal, and Principal. Thereafter, the three-year duration promotion pattern may not be followed. A teacher's movements upwards may be accellerated or slowed down, depending on a number of factors and circumstances which have bearing on the exigency of the State teaching service.

A study of Table 4.2.4 shows that a preponderance of the teachers under study have seven or more years teaching experience. Sixty percent of the respondents are in this group. About six or 13 percent of the teachers have teaching experiences ranging between four and six years. Twnty seven percent of the teachers in the sample study are novices in their probation years.

The break-down of the nationalities indicate that only six or 13 percent of the Nigerians are in the well - experienced group whereas 22 or 47 percent

of the Expatriates have been identified in this class. Two Nigerians and four Expatriates have teaching experiences which range between four and six years. Of the 13 novices, 10 are Nigerians and only three are Expatriates.

Among the expatriate females in the study, only one is a novice. The only female Nigerian has had two years of teaching experience.

The number of years of teaching accumulated by individuals in the sample study vary widely. A teacher who is an expatriate male and the oldest member of the group has been on the job for 28 years. Three others (two Nigerians, and one Expatriate - all males) are virtually new in the teaching profession. Their experience in each case is less than one year when they were visited by the researcher.

TABLE 4.2.4

TEACHING EXPERIENCE OF MATHEMATICS TEACHERS

Teaching Experience in Years	Number					Percentage		
	Nigerians		Expatriates		Total	N	E	Total
	M	F	M	F				
0 - 6	9	1	2	1	13	21	6	27
4 - 6	2	0	2	2	6	4	9	13
7 and over	6	0	14	8	28	13	47	60
Total	17	1	18	11	47	38	62	100

Legend:

N = Nigerian

E = Expatriate

M = Male

F = Female

4.3 Analysis of Mathematics Teaching

All the 47 teachers in the group studied were observed teaching mathematics at least twice. As already mentioned in Chapter IV, their classroom

performances were measured on the ten-point scale of the Students Teaching Practice Evaluation Form designed by the Department of Education, Ahmadu Bello University. Each respondent received two ratings and the better of the two scores was taken as the final grade and used in this research. Below, is the break-down of the grades obtained by the teachers.

4.3.1 Teaching Assessment By Qualification/Ranks. The ranking system adopted for this research as been described earlier in this Chapter. Table 4.3.1 shows the six Categories into which the teachers have been classified and the four ratings used. No teacher, in the sample, qualified for classification into Category I. Of the six respondents in Category II - the group consisting of the highest qualified teachers academically and professionally, two each were assessed A or B, or C. More than half (14 teachers) of those in CATEGORY III was rated as "poor". Category III is composed of academically highly qualified teachers who have no teaching qualifications. The teachers in CATEGORY IVA and IVB have shown very satisfactory performance except two who were rated D.

TABLE 4.3.1

ASSESSMENT OF MATHEMATICS TEACHING

PERFORMANCE BY QUALIFICATIONS/RANKS

Ranks By Qualifications	Performance Assessments				
	A	B	C	D	Total
Category I	0	0	0	0	0
Category II	2	2	2	0	6
Category III	2	4	7	14	27
Category IVA	2	1	2	2	7
Category IVB	1	3	0	0	4
Category V	0	0	0	3	3
Total	7	10	11	19	47

Legend

A = 70% and above : Excellent

B = 50 - 69% : Good

C = 35 - 49% : Satisfactory

D = 0 - 34% : Poor

4.3.2 Assessment By Teaching Experience. The teachers sampled for this study have been divided into three groups based on the number of years of teaching experience accumulated by each member. As seen in Table 4.2.4 the first group consists of teachers whose teaching experience were in the range 0 - 3 years: the second groups, 4 - 6 years; and third group, 7 or more years.

Table 4.3.2 shows the breakdown of the gradings obtained by respondents under the three teaching experience groups. Of the 13 novices in the first group, two were rated A, and five were rated D. A total of six teachers were in the second group. Only one was rated B, the remaining five obtained D. There were 28 members in the well-experienced group. Of this number, five were rated A. In spite of their long years of teaching, nine of them were found to be doing poorly in their teaching, during the assessment.

TABLE 4.3.1

ASSESSMENT OF MATHEMATICS TEACHING

PERFORMANCE BY EXPERIENCE

Experience in years	Performance Assessment A	B	C	D	Total
0 - 3	2	1	5	5	13
4 - 6	0	1	0	5	6
7 and over	5	8	6	9	28
Total	7	10	11	19	47

Legend:

A = 70% and above : Excellent

B = 50 - 69% : Good

C = 35 - 49% : Satisfactory

D = 0 - 34% : Poor

4.3.3 Teaching Assessment By Age. Classification of respondents' classroom performance based on the age-factor follows the pattern used under Table 4.2.2. Four age-groups have been identified. In the first group are those who are between 21 and 30 years old.

In the second group are teachers whose ages lie between 31 and 40 years. The third group consists of members who are 41 years to 50 years. Those above 50 years old formed the fourth group.

Table 4.3.3, which contains the breakdown of the teachers' classroom performance gradings, shows that 25 teachers are in the first age-group. Three of them were rated A, five obtained B, another five members got C, and twelve (nearly half of the total number in the group) were rated D. In the second age-group, two obtained A, four scored B, three were graded C and six were rated D. Of the total five members of the third age-group, three obtained each either A or B or C. The remaining two got D.

Two teachers who are the oldest among the study sampled (fourth age-group) were rated either B or C each.

A further breakdown of the assessment gradings of the four age-groups, and comparison of their group performance under the two ratings satisfactory and poor, show a fairly consistent pattern as shown under

the classification of gradings by experience. The age-group pattern shows that 52 percent of the members of the first group (21 - 30 years) were considered satisfactory teachers. Sixty percent of the second and theird age-groups were rated satisfactory, and all the members of the fourth group were likewise graded satisfactory.

TABLE 4.3.3

ASSESSMENT OF MATHEMATICS TEACHING PERFORMANCE BY AGE

Age-Groups	Performance Assessments				Total
	A	B	C	D	
21 - 30	3	5	5	12	25
31 - 40	2	4	3	16	15
41 - 50	1	1	1	2	5
51 - 60	0	1	1	0	2
Total	6	11	10	20	47

Legend:

A = 70% and above : Excellent

B = 50 - 69% : Good

C = 35 - 49% : Satisfactory

D = 0 - 34% : Poor

4.3.4 Teaching Assessment By Sex. There are 35 male and 12 female respondents in the study. Table 4.3.4 shows the distribution of grades obtained by sex.

In the male samples, six members were rated A, another six were rated B, eight obtained C and 15 got D. Only one of the 12 females obtained A. Four of them got B, three got C and four were graded D.

A comparison of scores between the male and the female teachers shows that 17 percent of the male teachers were rated A, whereas only eight percent of the female teachers obtained A. On the other hand, while 17 percent of the males obtained B, over 33 percent of the females got B. A considerable proportion of both sexes, in each case, were rated very low. Fourty-three percent got D in the case of the male samples while 33 percent in the case of the female members got D.

TABLE 4.3.4

ASSESSMENT OF MATHEMATICS TEACHING

PERFORMANCE BY SEX

Grades Obtained	Respondents		Total
	Males	Females	
A	6	1	7
B	6	4	10
C	8	3	11
D	15	4	19
Total	35	12	47

Legend:

A = 70% and above : Excellent

B = 50 - 69% : Good

C = 35 - 49% : Satisfactory

D = 0 - 34% : Poor

4.3.5 Teaching Assessment By Nationality

The respondents were classified into two groups; Nigerians and Expatriates. The breakdown of the countries from which the Expatriate came is shown in Table 4.2.1.

A total of 18 Nigerians and 29 Expatriates formed the sample studied. Table 4.3.5 contains an analysis of the teaching scores obtained by respondents. The table shows that 22 percent of the Nigerians in the group obtained A (the highest rating) whereas only 10 percent of the Expatriate teachers were rated A; 28 percent of the Nigerians got B while 17 percent of the Expatriates were placed in this category. In the C rating, the Expatriates had a slight edge over their Nigerian colleagues - 24 percent of the Expatriates as against 22 percent of the Nigerians were rated C.

Nearly half (49 percent) of the Expatriates in the sample were rated D (an assessment showing unsatisfactory teaching). On the other hand, only 28 percent of the Nigerians got D. It would appear that Nigerian teachers in this study performed better than their Expatriate colleagues most of whom have been classified as professionally and academically

more qualified than the Nigerians.

TOTABLE 4.3.5

ASSESSMENT OF MATHEMATICS TEACHING
BY NATIONALITY

Teaching Assessment	Number		Percentage	
	N	E	N	E
A	4	3	22	10
B	5	5	28	17
C	4	7	22	24
D	5	14	28	49
Total	18	29	100	100

4.4 Attitude Towards Mathematics and Mathematics Teaching

Bank (1963) found out that an unhealthy attitude towards mathematics by students may result from a number of causes. He identified the teacher's own attitude towards mathematics as the most significant contributing factor. If, in teaching the subject, he (the teacher) feels insecure and unhappy; if he dreads and dislikes the subject and

regards mathematics as consisting largely of rote learning devoid of understanding, then he would transmit his feelings to the students. On the other hand, if he is a teacher who has mastery of the subject and is interested and enthusiastic about what he is doing he would transmit to his pupils love and understanding of mathematics. Husen (1967) confirmed this finding which Aiken and Dreger (1961) had earlier found out in their study on "The Effect of Attitudes on Performance in Mathematics". All the 47 teachers in the sample were tested for attitudes towards mathematics. The instrument used for this purpose, was the attitude Scale Test Developed by Lassa (1975). This was slightly modified by removing two items that were considered not relevant to this study. As already explained earlier, the test employ semantic differentials in determining respondent's attitude towards mathematics by showing the degree of likeness or dislike for mathematics and mathematics teaching. The scale measure used is the Likert method of summated ratings which is commonly used by attitude investigators. The subject is requested to indicate his agreement or disagreement with each of

the 22 statements in the test. The results were then scored on the 1 - 5 points weights assigned to the five options of responses against each statement. The maximum points scorable is 110 which indicates a very high likeness for mathematics. A score of 22 points, the lowest mark scorable is a strong indicator of a candidate's dislike for mathematics. A subject with 66 points, is considered as undecided.

Table 4.4.1 shows the distribution and classification of the scores of respondents on attitude rating. The lowest score in the group is 68 while four members of the sample scored 110 points each. The group's mean score is 98.9 which is an indicator that the teachers in the study, generally, have positive attitude towards mathematics. About 10.6 percent of the respondents, however, have less positive feelings towards mathematics. The remaining teachers in the sample, 89.4 percent show strong positive attitudes towards mathematics.

TABLE 4.4.1

ANALYSIS OF ATTITUDE SCORES

Score Range	Number	Percentage
0 - 22	0	0
23 - 44	0	0
45 - 66	0	0
67 - 88	5	10.6
89 - 110	42	89.4
Total	47	100

Group mean 98.9.

4.5 Results and Analyses of the Hypotheses Tested

The objective of this study, as stated in Chapter 1, is to investigate (the teaching of mathematics) and to evaluate the role played by Expatriate mathematics teachers in teaching the subject to Forms 1, 2, and 3 students of post-primary schools in Kaduna State. Six hypotheses were tested to shed light on the following specific questions:

1. To what extent do teacher factors such as: educational qualifications, experience, age and sex, contribute significantly to the effective teaching of mathematics to post-primary students?
2. How do Expatriate teachers compare with Nigerian teachers in teaching mathematics?
3. Is there a relationship between teaching effectiveness in mathematics and teachers' attitude towards mathematics?

The hypotheses sought the existence or otherwise of relationship between the stated factors. In order to determine the degree of closeness of the linear relationship that exists between the variables, a correlation coefficient was computed for each pair of factors being examined.

Pearson's formula, (See Appendix L) for computing correlation coefficient was used for Hypotheses 1, 2, 3, 4, and 6 while the t-Test (also in Appendix L) was used for Hypothesis 5.

Means and standard deviations were calculated by use of computer for each of the pair of variables of examination in each of the Hypotheses. In the tables which follow, means, and standard deviation have been included only as additional information. For each question, (except Hypothesis 5) the correlation coefficient was found and the coefficient of determination which explains the amount of variation was computed. The tabulated index of correlation at the appropriate degree of freedom and, the 0.05 significant level was found. The result was compared with the calculated coefficient and a decision obtained. Similarly, for Hypothesis 5, the index of comparison was computed and compared with the tabulated 't' at the appropriate degree of freedom and level of significance before a decision was made.

Tables 4.5.1, 4.5.1(a) and 4.5.1(b) show the results of the test for Hypothesis 1. For the purpose of analysis the test has been subdivided. The two variables examined are

educational and professional qualifications and teaching effectiveness. Table 4.3.1 (see page 86) shows a description of the categories of teachers in the study sample. In Tables 4.5.1, 4.5.1(a) and 4.5.1(b) the two variable have been designated X and Y respectively.

Table 4.5.1 shows the test results of the 47 teachers without regards to nationality. The calculated correlation coefficient, r = -0.036 and the tabulated correlation coefficient, r = 0.288 at 45 degree of freedom and 0.05 level of significance. (Steel;1960). Calculated r is thus less than tabulated r, therefore, Hypothesis 1 is not rejected. It does seem that among the group tested, generally, educational and professional qualifications is not a significant contributing factor to effective teaching of mathematics.

TABLE 4.5.1

MEANS, STANDARD DEVIATIONS, AND CORRELATION COEFFICIENT FOR QUALIFICATIONS AND EFFECTIVE TEACHING.

Variables	Mean	Standard Deviation	Cases	Degree of Freedom	Calculated r	Tabulated r
X	2.3830	1.0332	47			
Y	43.8298	17.7621	47			
				45	-0.036	0.288

X = Qualifications

Y = Effective Teaching

r = Correlation Coefficient.

An examination of Table 4.5.1(a) support this conclusion. For among the Expatriate teachers in the sample, the X-factor is not significant, as calculated $r = -0.351$ and the tabulated $r = 0.369$ at the 0.05 level of significance and at 27 degree of freedom.

TABLE 4.5.1(a)

MEANS, STANDARD DEVIATIONS, AND CORRELATION COEFFICIENT OF X AND Y FOR EXPATRIATES TEACHERS

Variable	Means	Standard Deviation	Cases	Degree of Freedom	Calculated r	Tabulated r
X	1.8966	0.3099	29			
Y	40.4138	16.6509	29			
				27	-0.351	0.369

Among Nigerian teachers, the result of Hypothesis 1, is again, not significant. Table 4.5.1(b) shows that the calculated r = -0.257 is less than the tabulated r = 0.468 at 16 degree of freedom and 0.05 significant level.

TABLE 4.5.1(b)

MEANS, STANDARD DEVIATIONS, AND CORRELATION COEFFICIENT OF X AND Y FOR NIGERIA TEACHERS

Variable	Means	Standard Deviation	Cases	Degree Fredom	Calculated r	Tabulated r
X	3.1667	1.2948	18			
Y	49.3333	18.5759	18			
				16	-0.257	0.468

The difference noticeable in these sub-results for Hypothesis 1, is probably due to a number of factors which do affect the performance of a teacher in the classroom. These factors are often difficult to isolate or, put under control in a study that attempts to indentify only six other variables. The Nigerian teachers in the sample many have cultural and language advantage over their Expatriate counterparts. It could be that these factors were more prominent and dominant among the Nigerian teachers and so become more significant factors. Whereas, 'qualifications' was a more prominant and dominant factor among the Expatriate teachers.

However, the overall results do show that the possession of educational and professional qualifications alone does not necessarily make one an effective mathematics teacher.

The test for Hypothesis 2 seeks to establish the degree of relationship that exists between experience and effective teaching. Table 4.2.4 and 4.3.2 (in pages 84; 86) contain the breakdown and descriptive analyese of the experience-groupings and the classroom performances of the teachers in the sample. Table 4.5.2 shows the results of the Hypothesis test. In the table, experience is the X-factor and performance assessment which is the effective teaching indicator is the Y-factor. The calculated correlation coefficient r = 0. 160 is less than the tabulated r = 0.288 at the 0.05 level of significance and 45 degree of freedom. Therefore Hypothesis 2 is not rejected.

A closer study of the raw scores (Appendix E) used for calculating the index of correlation shows that cases numbers 14, 40, and 46 are "outliers". This probably explains why the overall test-results indicate

that experience is not a factor which significantly predicts effective teaching of mathematics. For instance, while a subject having 28 years experience obtained a classroom performance score of 51 percent, a subject with 10 years experience got 80 percent. Another member of the group studied, with eight years' experience, obtained 74 percent while a score of 72 percent was obtained by a teacher who had only one year teaching experience.

A number of reasons may account for these variations. The teachers' experiences were obtained from different countries where their students' have diverse experiential backgrounds. Other factors such as the teachers' own mastery of the language of instruction, attitude towards mathematics, and possible declining productivity associated with age-long routinely conservative methods of teaching, may account for the wide gaps between the scores. However, the results shows that experience cannot be the sole determinant of effective teaching of mathematics.

TABLE 4.5.2

MEANS, STANDARD DEVIATIONS, AND CORRELATION COEFFECIENT FOR EXPERIENCE AND EFFECTIVE TEACHING

Variable	Means	Standard Deviation	Cases	Degree Freedom	Calculated r	Tabulated r
X	8.3404	7.0380	47			
Y	43.8298	17.7621	47			
				45	0.160	0.288

X = Experience, Y = Effective Teaching

Hypothesis 3 is concerned with age and effective teaching variables. The test for this seeks to establish the amount of relationship that exists between teacher's age and his ability to teach effectively. The X-factor for the test is age while the Y-factor remains effective teaching as measured by the assessments of respondents' classroom performances.

Table 4.5.3 shows the calculated means and standard deviations for the two variables. Their calculated index of correlation, r = 0.152 is less than the

tabulated index r = .288 at 45 degree of freedom and the 0.05 significance level. Therefore, the result is not significant and Hypothesis 3 is not rejected.

Among the 47 teachers in the sample, age, it would seem is not a significant contributing factor to effective teaching of mathematics. In fact, Appendix F for this test and Table 4.3.3 (in page 90) which explains the distribution of performance gradings among the respondents, shows that 53 percent are in the age range 21-30 years, while 47 percent are in the age range 30-60 years, and that a considerable proportion of the "young" teachers are Nigerians who have some advantage over their Expatriate counterparts. There is, it would appear, some consistency in the results of the tests for Hypothesis 2 and 3, as in the Nigerian context, age, is often associated with experience.

TABLE 4.5.3

MEANS, STANDARD DEVIATIONS AND CORRELATION COEFFICIENT FOR AGE AND EFFECTIVE TEACHING

Variable	Means	Standard Deviation	Cases	Degree Freedom	Calculated r	Tabulated r
X	31.8936	7.7270	47			
Y	43.8298	17.7621	47			
				45	0.152	0.288

X = Age

Y = Effective Teaching

Hypothesis 4 seeks to know whether there is a relationship between the variable sex and effective teaching. The intention is to determine whether a man is a more effective teacher of mathematics than a woman teaching the subject. Tables 4.2.1 and 4.3.3 contain a description of the sex pattern in the sample and an analysis of the teaching scores obtained by each group. Table 4.5.4 shows the result of the test for this Hypothesis.

The calculated means and standard deviations are also given. The X-factor is effective teaching while the Y-factor is sex. The correlation coefficient p= -0.46 is less than the tabulated r = 0.288 at 45 degree of freedom and 0.05 level of significance. Therefore, the calculated index is not significant and is not a determining factor for effective teaching of mathematics among the groups observed.

TABLE 4.5.4

MEANS, STANDARD DEVIATIONS, AND CORRELATION COEFFICIENT FOR SEX AND EFFECTIVE TEACHING

Variable	Means	Standard Deviation	Cases	Degree Freedom	Calculated r	Tabulated r
X	43.8723	17.7306	47			
Y	0.7447	0.4408	47			
				45	-0.046	0.288

X = Effective Teaching

Y = Sex

Hypothesis 5 is concerned with nationality as a determinant factor for effective teaching of mathematics among the teachers. Analysis of variance was used for this hypothesis. The18 scores obtained by Nigerians were placed against the 29 scores obtained by Expatriates. The t - Test was then used to determine the amount of difference that exists between the two groups (means).

Table 4.2.1 shows the percentage distribution of the teachers by nationalities. Appendix G shows the tabulated raw scores and the calculations made. Table 4.5.5 shows the result of the test. Calculated t = 1.71 is less than tabulated t = 2.05 at 45 degree of freedom at 0.05 level of significance. This means that the difference between the two groups (means) is not significant. Therefore, Hypothesis 5 is not rejected. Among the group tested, nationality could not be regarded as a significant factor for determining effective mathematics teaching.

TABLE 4.5.5

ANALYSIS OF VARIANCE

Group	Count	Means	Standard Deviation	S^2
Expatriates	29	40.41	16.65	277.25
Nigerians	18	49.33	18.58	345.06
Total	47	43.83		

Calculated t = 1.710

Tabulated t = (47; 0.05) = 2.005

Appendix H contains the raw score used for calculating the index of correlation between the two variables being examined in hypothesis 6. In this hypothesis, the X-factor is attitude towards mathematics and the Y-factor is effective teaching. The objective here is to find out the degree of relationship that exists between teacher's attitude towards mathematics and his effectiveness in teaching the subject. Table 4.5.6 shows the result of the test. Means and standard deviation for the 47 subjects were calculated, and 0.305 was obtained as the index of

correlation between the two scores. The tabulated correlation index is r = 0.288 at 45 degree of freedom and 0.05 level of significance. The calculated correlation coefficient is therefore greater than the tabulated coefficient. The coefficient r = 0.305 is thus significant. Hypothesis 6, which states that - there is no significant relationship between the attitude of teachers towards mathematics and their teaching effectiveness, is therefore rejected.

TABLE 4.5.6

MEANS, STANDARD DEVIATION, AND CORRELATION COEFFICIENT FOR ATTITUDE TOWARDS MATHEMATICS AND EFFECTIVE TEACHING

Variable	Means	Standard Deviation	Cases	Degree Freedom	Calculated r	Tabulated r
X	98.8723	5.5836	47			
Y	43.8085	17.7270	47			
				45	0.305	0.288

X = Attitude towards mathematics

Y = Effective teaching.

CHAPTER 5

SUMMARY, FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The intention of this study is to examine the teaching of mathematics in the first-three years of post-primary schools in Kaduna State. It is hoped that the study would produce results which would give it a wide relevance to other States in Nigeria, particularly those in the North where conditions
are similar to those in the State being researched. Specifically, the study investigates the extent to which teacher-factors such as: educational and professional qualifications, experience, age, sex, and attitude towards mathematics affect the effectiveness of teaching mathematics. The study also tries to find out how Nigerian mathematics teachers compare with their Expatriate counterparts.

In order to accomplish the research objectives, 10 post-primary schools were randomly chosen from a population of 59 institutions. Forty seven mathematics teachers were available for the study in the sample

schools.

A number of instruments were used to collect date and information about the respondents. The Staff Inventory Sheets, from the State Ministry of Education (Appendix A), supplied the information about age, experience, qualifications, sex and nationality of the respondents. Classroom performance was measured on the ten-point scale of the students' Teaching Practice Evaluation Form of the Department of Education, Ahmadu Bello University, Zaria (Appendix B). Teachers' lesson notes were examined to assess the adequacy of their lesson plans. Each respondent was observed twice and the better of his teaching scores was utilized for the final comparison. A slightly modified opinionnaire (Appendix C) developed by Lassa (1975) was used in assessing respondents' attitudes towards mathematics and mathematics teaching.

The observed classroom behaviours of respondents were analysed and compared with date obtained about their ages, experience, qualifications, sexes and nationalities.

Hypotheses, which relate to these variables, were statistically tested. To further find out the degree of relationship that exist between the variables, Pearson's correlation coefficient for each pair of variables was computed for Hypotheses 1, 2, 3, 4 and 6. The t-test was used to determine the degree of difference between the two variables in Hypothesis 5. The tabulated level of significance was set at 0.05.

5.2 The Findings

The following are the hypotheses and results of the tests.

Hypothesis 1. There is no significant relationship between mathematics teaching effectiveness and teacher factor such as educational qualifications.

Findings. There is no significant relationship between the variables. Hypothesis 1 is not rejected.

Hypothesis 2. There is no significant relationship between mathematics teaching effectiveness and experience.

Findings. There is no significant relationship between the two variable therefore, hypothesis 2 is not rejected.

Hypothesis 3. There is no significant relationship between mathematics teaching effectiveness and age of teacher.

Findings. There is no significant relationship between the two variables, therefore, hypothesis 3 is not rejected.

Hypothesis 4. There is no significant relationship between mathematics teaching effectiveness and sex of teacher.

Findings. There is no significant relationship between the two variables. Hypothesis 4 is not rejected.

Hypothesis 5. There is no significant relationship between Expatriate teachers and Nigerian teachers on mathematics teaching effectiveness.

Findings. There is no significant difference between the two variables. Hypothesis 5 is not rejected.

Hypothesis 6. There is no significant relationship between the attitude of teachers towards mathematics and their teaching effectiveness.

Findings. There is significant relationship between the two variables. Hypothesis 6 is rejected and the alternative accepted.

In summary, the results of the tests indicate that all the variables examined except attitude towards mathematics have no significant relationship with the effectiveness of teaching mathematics. A teacher's attitude towards mathematics is significantly related to the effectiveness with which he teaches the subject.

5.3 Observations And Conclusions

Some phenomena are worthy of note. Among the Expatriate teachers investigated, qualifications contribute significantly to their effectiveness as mathematics teachers; but among their Nigerian colleagues this factor is not as significant. One may wish to find out why this is so. An obvious explanation could be that other factors need to be considered

in determining the role played by qualifications in teaching effectiveness. However, the question still need to be answered.

The study shows that in both group of respondents, age, and experience, often considered important factors in measuring the effectiveness of a teacher, are not necessarily significant indices of the effectiveness with which he (teacher) would perform in the classroom.

In mathematics teaching, male teachers in both groups (Nigerian and Expatriates) have no significant edge over female teachers. Similarly, the the tests show that nationality is not a significant variable for predicting effective mathematics teaching. However, a closer look at the scores obtained by the Expatriates from the Indian sub-continent (the group with the largest number in the sample) reveals that only 41 percent were rated satisfactory as against 72 percent Nigerians who got satisfactory grades.

Evaluation of the Nigerian and Expatriate teachers showed that most of them had good mastery of the subject-matter. However, a considerable number of Expatriate teachers lack satisfactory language competence and communication skills needed for classroom teaching. It was also observed that 82 percent of the Expatriate teachers teach without adequate lesson plans. The 18 percent had lesson plans which were obviously hurriedly prepared. Most of the Expatriate members of the group, particularly the older teachers, feel that the preparation of lesson notes is an unnecessary burden.

On the other hand, the use of English as medium of instruction is not a particular problem among the Nigerians sampled. Perhaps it is because most of the Nigerians are young N.C.E. and Education degree graduates. Lesson notes preparation was considered by most as necessary and useful, even though not all respondents in this group had lesson notes when they were visited by the researcher.

In the area of actual classroom strategies the method commonly found in use among most teachers (Nigerians and Expatriates) in the study was the'chalk-and-board' method where the teacher puts an example, usually taken from the pupil's book, on the blackboard and works it. Brief remarks are made while this is being done, the teacher talking to the board most of the time. He is more concerned with getting "the answer" to the problem than making sure that his pupils participate in, understand, and are able to follow what he is doing. He works as if he were paid to demonstrate his mastery of the subject-matter.

It is also observed that visual aids and other mathematics teaching aids that could be improvised from local materials were seldomly and scantily used by respondents from both groups. Little regards was given to the highly differentiated range of the educational and environmental backgrounds of the students they teach.

5.4 Recommendations From Findings and Observations

1. As has been remarked in an earlier section, the results of the tests show that qualifications, age, experience, nationality and sex are not necessarily associated with effectiveness in mathematics teaching. Recrutment agencies for the teaching service in Nigeria weight these factors, perhaps, too highly in determining the suitability or otherwise of an applicant for employment. On the other hand, there is some evidence from the results of the tests, that attitude towards mathematics is significantly related to the effective teaching of mathematics. Strongly however, this possible "predictor - factor" is not considered by recruitment agencies when they are considering offers of appointments to fresh applicants.

There is a need to reconsider the weightings of these factors and to provide an effective attitude test to be administered to all prospective mathematics teachers.

2. Although results of the test show that nationality is not a significant index of mathematics teaching effectiveness, Nigerian teachers are

found to have decidedly language and cultural advantages over their Expatriate counterparts. It is therefore recommended that delibrate efforts should be made to increase the number of qualified Nigerian teachers and reduce the recruitments of Expatriate teachers. In order to increase the number of Nigerian teachers of mathematics in our post-primary institutions a number of options are available:

(i) All Advanced Teachers Colleges and the Universities in the country should be formally required by the Government to mount courses specifically designed to produce more mathematics teachers for post-primary schools.

(ii) Employing agencies should make conditions of service sufficiently attractive to ensure that most mathematics teachers stay on the job.

(iii) Condition of service, should include provision for in-service training for the up-grading and up-dating of those already on the job.

3. Educational Service Unit of the Ministry should intensify its efforts to provide teaching aids to schools for effective use by mathematics teachers. The more these materials are produced in the country and from local materials, the better.

4. The Inspectorate Division of the State Ministry of Education should increase its supervision of mathematics instructions in post-primary schools. In other to do this, it is necessary to increase the number of mathematics inspectors from one to at least three. One inspector is not enough to service effectively 350 mathematics teachers located in 59 post-primary schools in the State.

5.5 Recommendations For Further Research

It is hoped that this study has highlighted some problems related to mathematics teaching

effectiveness, and that these will generate interest in further investigations into the matter.

A study could be made of the inter-relationship that exist between all the teacher-factors examined in this research. The study could attempt to indentify the relative roles and significance of these variables as they affect mathematics teaching effectiveness.

A study of the significance of mathematics communication and understanding, of language and cultural advantages which Nigerian mathematics teachers have over their Expatriate colleagues could be undertaken. This would be a rewarding research exercise and a welcomed contribution towards the growth of knowledge about mathematics teaching.

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APPENDIX A

MATHEMATICS TEACHING STAFF INVENTORY

1. Name of School_____

2. Name of Staff _____ Age _____

3. Nationality _____

Qualifications

	Year Obtained	Subject Offered
1.		
2.		
3		

5. Teaching Experience (In Other Schools)

Year	Name of School	Type	Age-Group Taught	Subject Taught
i.				
ii				
iii				
iv				
v				
vi				

6. Teaching Load at this School

	Class	Subject	Periods
i			
ii			
iii			
iv			

7. Other Activities (State What Other Extracurricular Duties you have at this school).

_____

_____

8. Date Posted to (This School)_____

APPENDIX B

STUDENT TEACHING PRACTICE EVALUATION FORM

Name of Student-teacher _____ Subject___

Name of School/College _____ Class____

Date _____

		/10
1.	Does the teacher make a clear statement of attainable lesson objectives?	/10
2.	Does the teacher introduce the topic clearly and arouse the students interest in thelesson?	/10
3.	Does the teacher include the sequential steps in the lesson consistent with thes objectives?	/10
4.	Does the teacher have mastery of the subject matter? Does he understand it and communicate it well?	/10
5.	Does the teacher make adequate use of resource materials?	/10
6.	Does the teacher have a good mastery of the language skills necessary for a clear explanation of the topic?	
7.	Does the teacher evaluate the students progress and understanding during the lesson? Does the teacher seek feedback?	

8.

8.	Does the teacher keep the students involved in the lesson in a meaning manner?	/10
9.	Does the teacher respect the students' integrity by using positive attitudes?	/10
10.	Does the teacher attain most, if not all of the lesson objectives?	/10
	Total:	%

Other remarks:

Name of Supervisor of Lesson _____Signature_____

A = 70+%

B+ = 60 - 69%

B = 50 - 59%

C+ = 45 - 49%

C = 40 - 44%

D = 35 - 39%

E = Less than 35%.

APPENDIX C

DEPARTMENT OF EDUCATION
AHMADU BELLO UNIVERSITY, ZARIA

ATTITUDE SCALE FOR TEACHERS OF MATHEMATICS

Candidate's Name _____

Qualifications _____

Age _____

Name of School _____

Subject Taught — Modern Maths or Traditional Maths (Tick One) _____

Sex: M or F

Directions:

Each of the statements on this opinionnaire expresses a feeling or attitude towards Mathematics or Mathematics teaching. You are to indicate on a five-point scale, the extent of agreement between the attitude expressed in each statement and your own personal feeling. The five points are:

Strongly Disagree (SD); Disagree (D);
Undecided (U); Agree (A); Strongly Agree (SA).

Draw a circle around the letter or letters giving the best indication of how closely you agree or disagree with the attitude expressed in each statement.

1.	I am always under a terrible strain when teaching mathematics class.	SD D U A SA
2.	I do not like mathematics, and it scares me to have to teach it.	SD D U A SA
3.	Mathematics is very interesting to me, and I enjoy teaching mathematics	SD D U A SA
4.	Mathematics is fascinating and fun.	SD D U A SA
5.	Mathematics makes me feel secure, and at the same time it is stimulating.	SD D U A SA
6.	My mind goes blank and I am unable to think clearly when teaching mathematics.	SD D U A SA
7.	I feel a sense of insecurity when teaching mathematics.	SD D U A SA
8.	Teaching mathematics makes me feel uncomfortable, restless, irritable and impatient.	SD D U A SA
9.	The feeling that I have toward mathematics is a good feeling.	SD D U A SA
10.	Mathematics makes me feel as though I am lost in a jungle of number and can't find my way out.	SD D U A SA

11.	Teaching mathematics is something that I enjoy a great deal.	SD D U A SA
12.	When I hear the word 'mathematics I have a feeling of dislike.	SD D U A SA
13.	I approach mathematics teaching with a feeling of hesitation, resulting from a fear of not being able to do mathematics.	SD D U A SA
14.	I really like teaching mathematics.	SD D U A SA
15.	Mathematics is a course in school that I have always enjoyed teaching	SD D U A SA
16.	It makes me nervous to even think about having to do a mathematics problem before my class.	SA D U A SA
17.	I have never like teaching mathematics and it is my most dreaded subject.	SD D U A SA
18.	I am happier teaching mathematics than any other subject.	SD D U A SA
19.	I feel at ease teaching mathematics, and I like it very much.	SD D U A SA
20.	I feel a definite positive reaction toward mathematics teaching, it is enjoyable.	SD D U A SA
21.	I like mathematics because there is always a correct answer.	SD D U A SA
22.	All students should be required to take mathematics.	SD D U A SA.

APPENDIX D

RANKED SCORES FOR COMPUTING MEANS, STANDARD DEVIATION AND COEFFICIENT CORRELATION FOR QUALIFICATIONS AND EFFECTIVE TEACHING

Case No	X	Y
1	1	47
2	1	76
3	1	48
4	1	59
5	1	51
6	1	73
7	2	37
8	2	31
9	2	28
10	2	25
11	2	49
12	2	47
13	2	32
14	2	23
15	2	35
16	2	26

Case No	X	Y
25	2	40
26	2	74
27	2	20
28	2	55
29	2	22
30	2	52
31	2	22
32	2	64
33	2	44
34	3	42
35	3	29
36	3	37
37	3	72
38	3	30
39	3	53
40	3	29

Case No	X	Y	Case No	X	Y
17	2	32	41	4	80
18	2	31	42	4	62
19	2	26	43	4	69
20	2	28	44	4	69
21	2	72	45	5	30
22	2	51	46	5	29
23	2	22	47	5	28
24	2	54			

APPENDIX E

RANKED SCORES FOR COMPUTING MEAN, STANDARD DEVIATION AND CORRELATION COEFFICIENT FOR 'EXPERIENCE' AND TEACHING EFFECTIVENESS

No Case	X	Y	No Case	X	Y
1	28	51	25	7	25
2	26	48	26	7	64
3	22	73	27	6	40
4	20	37	28	6	22
5	19	55	29	5	28
6	17	31	30	5	32
7	17	62	31	4	30
8	16	69	32	4	59
9	16	23	33	4	28
10	13	20	34	3	47
11	12	31	35	2	29
12	12	54	36	1	42
13	11	30	37	1	29
14	10	80	38	1	76
15	10	32	39	1	37

No Case	X	Y
16	10	52
17	10	49
18	9	72
19	9	22
20	8	35
21	8	26
22	8	53
23	8	51
24	8	74

No Case	X	Y
40	1	72
41	1	49
42	1	47
43	1	28
44	1	26
45	1	29
46	1	69
47	1	22

APPENDIX F

RANKED SCORES FOR COMPUTING MEAN, STANDARD DEVIATION AND CORRELATION COEFFICIENT FOR 'AGE' AND TEACHING EFFECTIVE-NESS

No Case	X	Y	No Case	X	Y
1	58	51	28	29	37
2	52	48	29	29	72
3	45	37	30	28	47
4	43	23	31	28	59
5	42	73	32	28	74
6	41	62	33	27	76
7	40	31	34	27	64
8	40	55	35	26	42
9	39	54	36	26	29
10	37	69	37	26	28
11	37	26	38	26	26
12	37	31	39	26	28
13	34	72	40	25	49
14	34	20	41	25	53
15	34	52	42	24	30

No Case	X	Y
16	33	47
17	33	80
18	33	22
19	32	32
20	31	32
21	31	40
22	31	49
23	30	30
24	30	35
25	30	51
26	30	22
27	29	25

No Case	X	Y
43	24	69
44	23	29
45	23	22
46	22	28
47	21	29

No Case	X	Y
16	10	52
17	10	49
18	9	72
19	9	22
20	8	35
21	8	26
22	8	53
23	8	51
24	8	74

No Case	X	Y
40	1	72
41	1	49
42	1	47
43	1	28
44	1	26
45	1	29
46	1	69
47	1	22

APPENDIX G

RANKED SCORES FOR COMPUTING MEANS, STANDARD DEVIATION AND CORRELATION COEFFICIENT FOR "TEACHING EFFECTIVENESS" AND "SEX"

No Case	X	Y	No Case	X	Y
1	80	1	28	32	1
2	76	1	29	32	1
3	74	0	30	32	1
4	73	1	32	31	1
5	72	1	32	31	1
6	72	1	33	30	1
7	69	0	34	29	1
8	69	1	35	29	1
9	64	0	36	29	1
10	62	1	37	28	1
11	59	1	38	28	1
12	55	0	39	28	1
13	54	0	40	26	1
14	53	1	41	26	1
15	52	0	42	25	1

No Case	X	Y
16	51	1
17	51	1
18	49	0
19	49	1
20	48	1
21	47	1
22	47	1
23	42	1
24	40	0
25	37	1
26	37	1
27	35	1

No Case	X	Y
43	23	1
44	22	0
45	22	0
46	22	0
47	20	0

APPENDIX H

RAW SCORES FOR COMPUTING t-TEST FOR COMPARING CLASSROOM PERFORMANCES OF NIGERIAN AND EXPATRIATE TEACHERS

FOR EXPATRIATE

No Case	Rank	Scores	No Case	Rank	Scores
1	1	48	15	2	26
2	1	51	16	2	28
3	1	73	17	2	72
4	2	37	18	2	51
5	2	31	19	2	22
6	2	28	20	2	54
7	2	25	21	2	40
8	2	49	22	2	74
9	2	32	23	2	20
10	2	23	24	2	55
11	2	35	25	2	22
12	2	26	26	2	52
13	2	32	27	2	22
14	2	31	28	2	64
			29	2	49

FOR NIGERIANS

No Case	Rank	Scores	No Case	Rank	Scores
1	1	47	13	4	62
2	1	76	14	4	69
3	1	59	15	4	69
4	2	47	16	5	30
5	3	42	17	5	28
6	3	29	18	5	29
7	3	37			
8	3	72			
9	3	53			
10	3	30			
11	3	29			
12	4	80			

APPENDIX I

RAW SCORES FOR COMPUTING MEAN, STANDARD DEVIATION AND CORRELATION COEEFFIC-IENT FOR "ATTITUDE TOWARDS MATH" AND "TEACHING EFFECTIVENESS"

No Case	X	Y	No Case	X	Y
1	110	37	28	98	54
2	110	62	29	98	74
3	110	72	30	97	25
4	110	40	31	97	64
5	109	22	32	96	80
6	109	31	33	96	49
7	107	32	34	96	32
8	106	42	35	96	29
9	106	76	36	96	69
10	106	28	37	95	30
11	106	69	38	95	37
12	106	48	39	95	28
13	106	51	40	95	52
14	106	72	41	95	22

No Case	X	Y
15	106	55
16	101	22
17	100	29
18	100	72
19	100	47
20	100	35
21	100	59
22	100	59
22	100	20
23	99	47
24	99	49
25	98	26
26	98	53
27	98	51

No Case	X	Y
42	92	30
43	88	23
44	88	31
45	88	26
46	72	29
47	68	28

APPENDIX J

t - TEST COMPUTATION: FOR HYPOTHESIS 5

$$t = \frac{\bar{x}_1 - \bar{x}_2}{Sd} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{2\frac{s^2}{n}}}$$

$$= \frac{49 \cdot 33 - 40 \cdot 41}{\sqrt{302 \cdot 87 \left(\frac{18 + 29}{522}\right)}}$$

$$= \frac{49 \cdot 33 - 40 \cdot 41}{5.22}$$

$$= \frac{8 \cdot 92}{5.22} = 1.71$$

$H_o : M_1 = M_2$

$H_1 : M_1 \neq M_2$

$t\ (1 \cdot 71) < t\ 45;\ 0.05\ \ (2.005)$

Therefore H_o is not rejected.

The 2 groups (means) are the same.

APPENDIX L

PEARSON'S CORRELATION COEFFICIENT AND T-TEST FORMULEA

(i) PEARSON'S r

$$\Sigma XY - \frac{\Sigma X \Sigma Y}{n}$$

$$r = \frac{}{\sqrt{\left[\Sigma x^2 - \frac{(\Sigma X)^2}{n}\right]\left[\Sigma Y^2 - \frac{(\Sigma Y)^2}{n}\right]}}$$

(ii) T.TEST

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{25^2}{n}}}$$