INTER-RELATIONSHIPS AMONG STUDENTS' OCCUPATIONAL PREFERENCES, ACHIEVEMENT IN AND ATTITUDE TOWARDS MATHEMATICS IN METROPOLITAN ZARIA

BY

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BY

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CERTIFICATION

We, the undersigned, hereby certify that this thesis entitled INTER-RELATIONSHIPS AMONG STUDENTS' OCCUPATIONAL PREFERENCES, ACHIEVEMENT IN AND ATTITUDE TOWARDS MATHEMATICS IN METROPOLITAN ZARIA submitted by Ochepa, Isa Abubakar meets the regulations governing the degree of Master of Education (Curriculum and Instruction (Mathematics)) of Ahmadu Bello University, Zaria, and is approved for its contribution to scientific knowledge.

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In conclusion, I wish to point out that despite any assistance and suggestions rendered to me towards this work, any detected errors are strictly mine.

Indeed, I thank you all .

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DECLARATION

I hereby declare that this thesis has been written by me and it is a record of my research work. It has not been submitted in any previous application for a higher degree. All the sources of information have been acknowledged by means of references. The copy-right in respect of this report shall belong to the author and Ahmadu Bello University, Zaria.

ISA ABUBAKAR OCHEPA

1986

DEDICATION

This Thesis is Dedicated

to

Mallam Isa Fache Ochepa

(My beloved late father)

to

Mallama Mariam Ramat Isa Ochepa

(My beloved mother)

to

Mallam Muhammed Jimoh A. Isa Ochepa

(My darling brother)

ABSTRACT

This study was designed to investigate the inter-relationships among students' occupational preferences, achievement in, and attitude towards mathematics in metropolitan Zaria of Kaduna State.

The investigation was carried out with the fifth form students offering the general mathematics syllabus in Zaria area of Kaduna State. There were nine secondary schools with such fifth form students and of these, seven schools with form five student population of 2,121 were accessible for the study. A random sample of 50 students per school was chosen, giving a total of 350 students from the seven schools.

Data were collected through the use of questionnaires and informal interviews. The questionnaire included an adapted form of the Mathematics Attitude Scale (MAS) developed by Shumway and White (1981). The questionnaire also sought information about the respondents preferred occupations. Mathematics achievement scores were obtained from the mock G.C.E. examination results from the Education Resource Centre (ERC) Zaria.

After the data collection, the Pearson product-moment and biserial correlation coefficients were calculated to determine the nature of the relationship between the chosen variables of the study. The results were used to test three null hypotheses of the study and the findings revealed that:

(a) There is a significant high positive correlation between students' achievement in mathematics and their attitude towards mathematics.

(b) There is a significant positive relationship between students' attitude towards mathematics and their preferred occupations.

(c) Students' preferred occupations positively and significantly correlated with their achievement in mathematics.

It was concluded that students' achievement in, and attitude towards mathematics are not only related to each other but each of them also correlates significantly with students' preferred occupations.

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Definition of Terms and Abbreviations

Attitude:

For the purpose of this study, the term attitude refers to the type of feelings that a respondent has in relation to objects (e.g. mathematics) or ideas.

Occupational Preference:

This was taken to refer to the occupation which an individual will freely choose to engage in for some reasons best known to him. In this study, a respondent's first occupational preference refers to that occupation which he has freely expressed in writing, to be the first type of job he will like to do after training. Similarly, the second type of job he will like to do has been taken as his second occupational preference.

Achievement:

In this study, achievement is defined to mean the accomplishment of a set standard in the learning of mathematics.

Mathematics-Related Occupations:

This expression is an important aspect of this work which needs a clear working interpretation. The general notion by most mathematicians or mathematics educators is much towards the claim that mathematics is useful in all aspects of human endeavour.

This does not however imply that it is mandatory that before a person engages in any form of occupation,

he must possess some degree of mathematical knowledge. In this study mathematics-related occupations have been used to describe those occupations or professional areas that most Nigerian universities have set for people who attained at least a credit in the West African Examinations Council's ordinary level general certificate examination in mathematics. Therefore, occupations or professions which have not been specified for credit holders in O'level mathematics, by most Nigerian Universities have been taken as non-mathematics-related occupations in this investigation.

Zaria Area:

The expression 'Zaria Area' has been used synonymously with 'Zaria metropolitan' in this study. Either of the two was used to describe all the places that have been covered by the study. Thus 'Zaria area' has been used to mean Zaria city, Tudu-Wada, Sabon-Gari Wusasa and Samaru districts.

Public School:

This term has been used to refer to any secondary school which was open for any academically qualified child to attend. This is to say that such schools do not normally give any preferential treatment to anybody's child whenever they are making their admissions. Rather, admission of any child is usually based on the child's performance in the open national common entrance examination and a formal in terview.

Abbreviations

'ACMA' - Achievement in Mathematics

'ATMA' - Attitude Towards Mathematics

'MARO' - Mathematics-Related Occupations

'NOMARO' - Non-Mathematics-Related Occupations

G.C.E. - General Certificate of Education

W.A.E.C. - West African Examinations Council

E.R. - Educational Resource Centre

M.A.S. - Mathematics Attitude Scale

J.A.M.B. - Joint Admissions and Matriculation Board

CHAPTER 1

INTRODUCTION

1.1 Background and Rationale:

The idea of this study has its origin from the researcher's experiences in the teaching of mathematics to secondary school students. For instance, the researcher often observed that students in the arts classes did pay less attention to mathematics than students in science classes. Also, some students did express that they did not need to have credit or pass in mathematics before they could get into their anticipated career or profession.

Further, the usual derogatory remarks often expressed by fellow students of mathematics during the researcher's undergraduate studies also motivated him to start casual interviews of some individuals in various levels of institution as far back as 1981. The questions usually asked included: "Do you do mathematics? If not, why?, If so how do you feel about it? Do you think you will not require mathematics? How do you know?"

As a result of some of the responses from such informal interviews (e.g. that the rigours and abstract nature of the contents of mathematics outweigh the significance of such contents), the researcher finally decided to approach the issue of some problems concerning mathematics through a formal research technique.

Apart from the reported researcher's experiences, a lot of curriculum development and changes have taken place in the area of mathematics in this century. Some of the changes were meant to improve the contents of mathematics, some were to make mathematics serve the needs of the society and some were designed to serve the psychological needs of the learners. In spite of the various attempts made, either to improve upon the mathematics content of the secondary schools syllabus at a point in time or to improve the teaching and learining of mathematics, learners' achievement scores remain low. This low achievement in mathematics at the secondary school level has been reported by various bodies or individuals. For example, Lassa (1984) reported that "the details of the performances of candidates who sat for the West African School Certificate (WASC) examination in mathematics throughout the country has been poor over the years". He went further to assert that achievement scores in mathematics mostly lie between 0% and 40%. In his own contribution to the issues concerning mathematics at the secondary school level, Uzoma (1980) testified to the general low achievement scores in mathematics. In order to provide the means by which this low achievement can be improved upon, several calls have been made on those concerned. Examples of these calls include Lassa (1984), and the West African Examinations Council (WASC) chief examiner's report of 1975.

The concern for low achievement scores in mathematics might not have attracted many educationists, if it has nothing to do with learning. Achievement scores con s titute a measure of learning and the quality of a curriculum (Schwab, 1983).

Learning, as discussed in many psychology textbooks, takes place under certain conditions but in most cases, some form of motivation is required for learning to take place (Mukherjee, 1978). The relevance of this point to this study is that in our bid to improve upon the achievement scores in secondary school mathematics, we should be looking for possible ways of motivating the students. This could be by studying other interest areas of the students and the type of relationships that exist between such areas and the students' achievement in mathematics. One of such areas is the students' occupational preference. This interest might be a good reference point for tackling some problems facing mathematics because every parent has a reason for sending a child to school. The child, on the other hand, may have developed his or her own preference for certain occupations. Other interest areas could include attitude towardslearning mathematics, the type of teachers, the type of instruction and so on .

1.1.1 Why Study Relationships?

Since the dawn of history, man has been trying to make sense out of his environment. In his continuous search for such sense, he has been putting events into

relationships with each other. Dienes (1963) described what mathematics is when he asserted that in order to act in ways satisfactory to ourselves, we need to establish relationships with different aspects of our life. This relationship was the basis of science and, in particular, the basis of mathematics.

Though there are other conceptions of mathematics and its learning that exist in the literature (see section 2.2), it seems clear in most cases that mathematics is a subject of relationships. Understanding of relationships helps in making wise decisions.

1.1.2 Mathematics and Students' Occupational Preferences

It is a common finding in our secondary schools today that the students often ask questions such as "What am I going to do with all this mathematics, grammar, history, and so on, after leaving school?" This question seems to suggest that mathematics, and, perhaps, some other subjects are not meeting the expectations of these students in terms of how they relate to their anticipated life occupations. Mathematics, according to history, arose from the occupational demands of people (Hammer, 1964).

It might not be that mathematics as designed for the secondary school education is irrelevant to the students' out-of-school preferred occupations. It might be that awareness is lacking. Also, the pedagogy might have ignored the relationships between mathematics

and the real life occupations. It should be expected that a person will show a positive attitude towards a subject or a course of study which will have practical application in his preferred occupations. In the past years, there has been increasing evidence that learning (achievement) depends on not only gool teaching but also on the students' values and self-evaluation (Stein, 1971). Knowledge of the relationship between these variables may provide educators with some suggestions for curricular and class-room changes. Also, knowledge of the current status and the relationships of the variables may provide information for those wishing to instil changes in the values of the youth.

1.2 The Purpose of the Study:

The purposes of the study are to determine:

(a) Any existing relationship between students' preferred occupations and their attitude towards mathematics;

(b) The relationship between students' preferred occupation and their achievement scores in mathematics;

(c) The current state of relationship between students' achievement scores in mathematics and their attitude towards mathematics.

1.3 Significance of the Study:

In its simple form, the significance of a descriptive research is that it provides information concerning current status of a phenomena and such information helps either in decision making or in further research. As reported in the literature review (sections 2.2.2 and 2.2.3) there are many points of view among mathematicians and mathematics educators across nations regarding mathematics curriculum. These various viewpoints which have not allowed for unanimity indicate that mathematics education may reflect local interests which vary from place to place and changes over time. Now that this nation is placing much emphasis on technology and science, findings from this study will help to infer literally the situation with the students in Zaria area. For instance curriculum developers may use the findings from the study to assess the current mathematics syllabus. An example is that if a strong relationship is found to exist between students' occupational preferences and their attitude towards mathematics, curriculum developers can rely on this to draw out the awareness that need to be created in the students. Career counsellors can also capitalize on the nature of relationship between students' occupational preferences and their achievement in mathematics in discharing their duties. National policy makers may use some of the information from the

study to assess the occupational areas that are likely going to lack personnel in the future.

A study of the history of mathematics education revealed that it's goals change with the ebb and flow of different forces and issues that impinge on the society in general and the school in particular (NCTM, 1970). As the world wars and economic depression have affected both the mathematics curriculum and people's conception of mathematics in the past (NCTM, 1970), it may now be the time of the interest in technological growth to shape the students' attitude towards mathematics. This study will help in providing information on the current attitude of students towards mathematics and how it relates with the students' preferred occupations. This knowledge of relationships between mathematics and occupational preferences, or the relationship between occupational preferences and attitude towards mathematics can be of significance in classroom teaching, as shown in the next section.

1.3.1 Teaching Applications:

Though this study did not intend to imply any casuality from the relationships, it was hoped that the findings from it will provide quantitative (i.e. statistical) backing for some classroom teaching strategies. This will be in terms of the knowledge of what to use in motivating the students towards the learing of mathematics. The point here is similar to Osibodu's

(1984) assertion that

> the job of teaching mathematics is simply not done if we present mathematics purely as an intellectual structure, or even worse, as a series of isolated and meaningless tricks to be memorised. It is an important part of both the value and the heritage of mathematics to see and to practice its usefulness. Furthermore applications of mathematics are important in the motivation of students.

If a strong research evidence is reported about the relationship between occupational preference (the area to apply mathematics) and attitude towards mathematics teachers may be able to capitalize on it.

According to Preston Hammer (1964), the good teacher in whatever field, often returns to the society and his students much more than he is paid. Also, Osibodu (1984) expressed that the subject of mathematics must be taught with the hope of serving as "a functional tool in solving individual every day problems". As it seems clear that a good teacher needs to know much of his students, it is hoped that this study will go a long way to inform the teachers of mathematics, of the type of students they are handling. The effects of the information include a guide for the selection and sequencing of mathematics subject matter.

In addition to the forgoing significances, findings from this study may be used as a basis to further research. For instance if any significant relationship is found between any of the variables, interested

researchers may use it as a background for trying on a cause-effect (experimental) research.

1.4 Statement of the Problem

From the background survey of the secondary school students' achievements in, and attitude towards mathematics (sections 1.1, 2.3 and 2.4) it seemed clear that there is no consensus over the type of relationship that exists between these variables. There is therefore the need for further verifications. Now that Nigeria is placing much emphasis on science and technology to which mathematics is a major relevant subject, it should be statistically made clear, what type of relationships exist between students' occupational preference, their achievement in, and attitude towards mathematics. Therefore the major problem in this study was to find out the inter-relationship among students' occupational preferences, achievement in and attitude towards mathematics. To provide the solution to the problem, the following research questions were answered.

1. What is currently the level of students' attitude towards mathematics?
2. Is there any signifcant relationship between students' preferred occupations and their attitude toward mathematics?
3. Is there any significant relationship between students' occupational preference and their achievement scores in mathematics?

4. Is there any significant relationship between students' attitude towards mathematics and their achievement scores in mathematics?

In addition to the above major questions, the study in tends to provide an estimate of the proportion of students that are curretly willing to put up a high interest in the study of mathematics if they realise that mathematics is required for their preferred occupations.

1.5 Assumptions

The following assumptions are made in this study:

1. The respondents adequately represent the form five students in the secondary schools within Zaria area.
2. The respondents' scores from the joint mock G.C.E. assessment in mathematics fairly represent their achievement level in mathematics.
3. The fifth form students in secondary school have some knowledge of most familiar occupations within Nigeria and their occupational preferences are fairly realistic.

1.6 Scope of the Study

(1) Out of very many variables or interest areas that can have some relationships with the study of mathematics, only two have been taken for consideration in this study. They

are students' occupational preference and their attitude towards mathematics. Each of these two variables has been correlated with the students' achievement scores in mathematics.

(2) The study considered only the form five students offering the general mathematics in secondary schools within Zaria area of Kaduna State.

(3) The method of data collection was restricted to the research instrument supplemented by the informal interviews conducted by the researcher.

(4) Because of the large number of possible occupations which any individual can engage in (in real life), and the possibility that the researcher may not be able to list all such occupations, the study had only considered, those occupations which the respondents have expressed their preferences for.

1.7 Research Hypotheses

The following null hypotheses were tested.

H_{01}: There is no significant relationship between students' occupational preference and their attitude towards mathematics (ATMA).

H_{02}: There is no significant relationship between the students' achievement in mathematics (ACMA) and their occupational preference.

H_{03}: There is no significant relationship between the students' achievement in mathematics (ACMA) and their attitude towards mathematics (ATMA).

1.8 Summary

This chapter has discussed, among other things, the rationale, purpose, significance, problems, assumptions and the scope of the study.

By now, the reader should have learnt that:-

(1) Achievement scores in any school subject, and mathematics in particular, are measures of learning and the quality of a curriculum; learning takes place under some form of motivation and motivation implies a modification in behaviour (attitude). Therefore any attempt to study achievement scores in mathematics should also look at the attitude towards mathematics.

(2) There could be many ways of motivating a student towards learning. Because every individual has a reason for learning or going to school (e.g. to live a desired life), individuals occupational preference needs to be addressed.

(3) The purpose of the study was to find out if there is any significant relationships among students' occupational preference,

achievement in, and attitude towards mathematics.

(4) With the assumptions that the instruments validly measured the variables concerned in this study, findings from the study will significantly provide mathematics teachers and curriculum developers relevant information on:-

(a) how students' occupational preferences relate with their attitudes towards mathematics. A high positive correlation between occupational preferences and the selected variables may justifiably be used to improve their achievement in and attitudes towards mathematics;

(b) the proportion of students, especially in Zaria area, that are currently willing to go for occupations or profession which most Nigerian Universities have designated to candidate who had a good knowledge of ordinary level mathematics;

(c) the level of students' attitudes towards mathematics at this time of much emphasis on scientific and technological growth in this country.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The researcher could not find much local literature which directly relates to this study. However, the following issues which relate to the study in the available literature constitute the focus of this chapter.

(1) Some theoretical and historical background to the study.

(2) Studies on achievement in and attitudes towards mathematics.

(3) Studies on achievement in mathematics and career or occupational preference.

(4) Studies relating to occupations and attitudes towards mathematics.

2.2 Theoretical and Historical Background to the Study

This aspect of the literature survey reports some historical and theoretical expressions or issues that have touched the form of relationships which have been found to exist between any of the variables in this study. For instance the origin and teaching of mathematics, mathematics curriculum and the users' occupational preferences, attitude and some theories about it.

2.2.1 The Origin and Teaching of Mathematics

According to Hammer (1964), mathematics is a discipline which has been in existence since the period of antiquity and it arose from the needs of the people. Further, he stated that in Babylonia, as in ancient Egypt, there was much demand for the application of mathematics to the people's work and the nations' problems. For instance, the author reported that the Egyptian's early contribution to mathematics was motivated by the need for optimum utilization of the Nile valley.

Historical reports suggest that mathematics originated in relation with people's occupations. Thus the conception (feelings) about mathematics from its origin was not removed from the users' occupations. However, more recent developments in mathematics have posed two dimensions of mathematics teaching. According to Willoughby (1969) the major viewpoints centre around mathematics as an applied subject and mathematics as a subject to discipline the mind. Therefore an individual's attitude towards mathematics may significantly depend on what mathematics means to him or her. For instance, those who uphold the psychology of mental discipline in respect of teaching mathematics would take mathematics as a subject that would be of practical use some time in future. Hence such people may not see mathematics as abstract and they may show

a positive attitude towards mathematics in terms of its applicability.

Similarly, Willoughby (1969) reported that in a developing nation where man often has to depend on his own wit and practical knowledge, mathematics alone will not always help in providing everything of life. He opined that mathematics should be of practical use to the people and its teachings should relate to its area of applications.

The relationship between the reported views about what mathematics meant to various people and the present study is that while some people feel that mathematics is related to people's occupations, others feel that such relationship does not necessarily have to exist between mathematics and people's occupation.

As if Pekins (1957) was trying to inform curriculum developers in Nigeria of the need to understand the child before setting out to design a school curriculum, he examined the secondary school curriculum in Nigeria and he pointed out that there was the need to look at the relationships between secondary education and the demands of the people. He further warned about the risks in forcing any form of education on the child without considering the child's state of mind for such education. If this is to be followed in any mathematics curriculum development, it may literally imply that

students' feelings, including their occupational interests will correlate positively with their attitudes towards mathematics.

2.2.2 Mathematics Curriculum and the Users' Occupational Preferences

There have been some controversies in peoples' expressed views about what should be the relationships between education in general and society's occupational preferences. For instance Patterson (1971) expressed that individuals should be assigned to occupations or educational careers on the basis of interest or preference. In a similar note Foster (1965), Adaralegbe (1972), Awoyele (1977) and Daniel (1984) have all stressed the need to provide a student the education that will sustain him on the job he chooses to enage in. In particular, Awoyele (1977) pointed out that the man-power need of a nation does not necessarily imply sending children to various educational institutions against their wish. He maintained that when students are not provided with the education which put into consideration their wishes, we may end up ruining the nations economy. The claims by the people mentioned above seem to be close to what Shirley (1984) has reported to be the case of mathematics curriculum before the 1950s. Even in the 1970s, some educators made critical comments against the weaknesses in the "Modern" mathematics programme which had been in existence

since early 1950s. In particular, Kline (1973) made the first major critique of "modern" mathematics programme in his book entitled "Why Johny Can't Add". One of the points raised against "modern" mathematics was that it lacks relationship with peoples' occupations where the knowledge should be applied.

Though the reported views above seem to be critics of a particular mathematics programme in support of another the views bear some similarities to the present investigation in that they tend to express that there should be some relationship between what mathematics is and users' occupations. How a person views (feels about) mathematics is a form of his attitude towards mathematics. Hence one's conception of a mathematics curriculum if taken as his attitude towards the mathematics, seemed to have been viewed to be related to his occupational preferences.

However, other people seemed to have a different opinion about mathematics and the users' occupational preferences. For instance Napier (1972) regarded free choice of occupation and education as a luxury for developing countries. To him, both education and occupations in any developing nation should be planned from a central body, and directed to the people. In this view, in-dividual's occupational preference may be detached from (i.e. unrelated with) his education and academic performance.

2.2.3 Attitude and some Attitude Theories

The measurement of attitude is the psychological aspect of this study. Its discussion may assist in the understanding of its application in this work.

Various definitions of attitude exist in many psychology text-books. One of the definitions often used is that of Allport in Fisbein (1867). Attitude is defined as a mental and neutral state of readiness, organised through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations.

This implies that a person's attitude manifests in his responses to the object and situation with which it is concerned. Hence a student's attitude towards mathematics can be approximated from measures of his responses to questions that seek for his feelings about mathematics.

However, it seems that the definition given by Travers (1977) has a close interpretation to what attitude has been taken to mean in this study. According to Travers (1977), the term attitude means interest, values, approach and withdrawal tendencies. He defined attitude as behaviourial tendencies related to particular objects or ideas. This definition agrees with the summary of studies on attitude and attitude change given by Secord and Backman (1964) quoted in Shirley (1984). It was stated that attitudes have both

affective, cognitive and behavioural parts, all of which can influence a student's acceptance or rejection of an object or situation. Though no definition of attitude seemed to have clearly stated how attitude can be measured accurately, the instrument used to measure attitude towards mathematics include items that are along the definitions in literature (see section B of Appendix A).

However, it has been maintained by some educators that there is no valid measure of attitude towards mathematics which could be used to generalise any claim about the form of attitude towards the subject (Morrisett and Veresonhaler, 1965). In general, Allport (19&7) pointed out that attitude scale should be regarded only as the roughest approximation of the way in which attitudes actually exist in mental life of individuals. He went further to stress that attitude change and any investigations made under one set of conditions may not for long represent a true picture of any given group. The relevance of this point to the present study is that it puts the researcher on a very objective position to look forward to accept whatever the research findings are, in respect of students attitude towards mathematics irrespective of earlier research reports by educators such as Asebiomo (1977), Lassa (1978) and Ojo (1977).

In summary, from the foregoing sections of this chapter, it is clear that the importance of mathematics in various areas of work has been identified long ago. The significance of mathematics has been emphasised by Adebayo et al. (1984), Fakuade (1973) Lassa (1984) and Mathematical Association of Nigeria (1985). They all seemed to centre around mathematics as it relates to human needs in life. One of the major purposes of schooling is to provide students with the skills necessary to secure future employment. According to Daniel (1984), when students are not provided with these skills as anticipated, they become dissatisfied and alienated from the school, the consequence of which is negative behaviour. Therefore, whatever be the benefits of mathematics, there is little doubt that people will be more likely to be impressed by its tangible rewards. These rewards are perhaps only measurable in terms of how much the mathematics, which the students are taught, will relate to their preferred occupations.

2.3 Studies on Achievement in and Attitude Towards Mathematics

In recent times, some reports have been made concerning a general trend of low achievement scores in secondary school mathematics. Examples of such reports can be found in Lassa (1984), Owolabi (1985), Uzoma (1980). However, the researcher is not contending

the state of students' level of achievement in mathematics, rather he is investigating the relationship between students' achievement in mathematics and some other variables in section 1.2.

On the issue of achievement in and attitude towards mathematics, the common sense feeling may be that achievement ought to depend heavily on attitude, but from research findings it seems that there is no consensus among researchers over the strength of relationship between achievement in, and attitude towards mathematics.

For instance Lassa (1976) found that among the prospective grade two teachers from the Northern part of Nigeria, there was a linear correlation coefficient of 0.32 (which was significant at α-level of 0.01) between attitude scoeres towards mathematics and achievement in basic mathematics. The research was conducted by selecting six men teachers' colleges and six women teachers' colleges from Nothern Nigeria. Sixty final year students studying basic Mathematics and sixty of those taking arithmetic process were chosen from each set of the selected men and the women teachers' colleges. An attitude test and a mathematics test were administered to the selected students. Similar to the finding concerning the relationship between the students' attitude towards basic mathematics and their achievement scores in it,

Lassa (1976) also found that with a linear correlation coefficient of 0.33, and at α-level of 0.01, there was a significant relationship between the students' achievement in, and attitude towards arithmetic process.

Though the work of Lassa (1976) as reported above, concerned final year prospective teachers in post-primary institutions, the findings had clearly revealed that even with different mathematics syllabuses, students achievement in mathematics significantly correlate with their attitude towards the subject. However, it may be noted that as the subjects of the study were already on a professional (teaching) training, the findings from the study may differ from what may be the situation with the secondary school students.

Lassa's (1976) report is similar to what Aiken (1976), Atkinson (1979), Crosswhite (1972), Nwagwu (1977) have reported about the strength of relationship between achievement in mathematics and attitude towards mathematics. They reported that there is a low but significant positive relationship between achievement in and attitude towards mathematics. Other researches, as stated by Umar (1979), who made the same claim are Biggs (1959), Bahanemi (1962), Jordan (1941) and Sharpes (1969).

In contrary, there were some research reports that seemed to disagree with any notion of consistency in the belief that there is a significant positive correlation between attitude towards mathematics and achievement in mathematics. For example, Jackson (1968) in a review of research into the way in which favourable attitude to school, and school subjects generally, might enhance learning, concluded that nearly all investigations have found no significant relationship between attitude and achievement. Also Oguntebi (1983) has reviewed some research findings which seemed to suggest that there is no consistent body of research evidence to support the belief that there is a significant positive relationship between students' attitudes towards mathematics and their achievement in mathematics. One of such reports is that of Suydam and Weaver (1975). To them, there is little basis for believing that attitude towards mathematics and pupils achievement in the subject significantly correlate positively. Though the claims stated here seem clear, the reports given by Jackson (1968) and Oguntebi (1983) did not give the research methodology by which the claims were arrived at. In a fairly related study by Soyibo (1982), it was reported that students who indicated that Biology was their favourite subject did not significantly obtain different achievement scores from those who

indicated that Biology was not their favourite subject.

The study was carried out with 50 boys and 50 girls selected from three secondary schools in Ibadan. Some Biology questions were designed by the researcher and presented orally to the participants individually. The responses were tape-recorded, and later transcribed and scored using specifically predetermined criteria (this criteria was not stated in the report). In addition to the oral test, was a questionaire which included some items to reveal the science subjects offered by the students and whether Biology was the students' favourite. It was concluded that though a "NO" answer to the question concerning whether students' favourite subject was Biology or not did not necessarily mean that the students disliked Biology, there was no significant difference between the achievement scores of the students who said "YES" to the question and those who said "NO". This finding seem to imply that students achievement in mathematics is independent of their attitude towards mathematics.

The relevance of all the cited literature in this section to the present investigation is that in view of the conflicting positions so far, there is a need to carry out more research on students' achievement in and attitude towards mathematics.

2.4 Studies on Achievement and Occupational Preference

Research works concerning both achievement in mathematics and the occupational preferences of secondary school students are not common in Nigerian research literature. This may be due to the often held notion by most members of the disciplined community that the subject is a 'universal' one and it could be applied in any profession. To this notion of presenting mathematics as a universal subject, Osibodu (1984) has expressed that students "are not contended to be told to be patient and wait to see, someday, the usefulness of what they are learning". Implicitly therefore, students can show a negative attitude towards mathematics if the subject is not presented in a way that relates practically to their occupational ambitions. Hence there could result an adverse effect on the students' achievement in mathematics.

Some studies concerning achievement in other subject areas and students' occupational preference or interest have been reported in literature. For example, Udo and Olarewaju (1985) conducted a research concerning the motivating factors for occupational choice of some secondary school students in Ibadan and reported that 71.1 percent of the respondents indicated that good achievement in the related subjects has motivated them. The study

involved 76 students selected from the Chemistry students in classes four and five from three secondary schools in Ibadan. The randomly selected students completed a questionnaire which was developed by the researchers. The questionnaire include items that sought for answers to the following questions:-

1. Why do students choose Chemistry as their school subjects?
2. What are the jobs that these students would prefer to do after schooling?
3. What reasons motivated the students to choose their preferred occupation?
4. Who are the people mostly consulted by the students for advice on possible choice of occupation?

The data collected was analysed by frequency counts and percentages. The results revealed that 93.4 percent of the respondents choose jobs because they were interest in the jobs. The next mostly identified factor that influence students' choice of occupation was found to be good performance in the related subject. 71.1 percent showed that they opted for their chosen occupations because of their good performance in the related subject. Other findings from the study have been reported in section 2.5.

Because of the limitations in the statistical analysis employed by the above researcher, not much

can be inferred, in terms of the relationship that may exist between the identified factors. However, the report has presented a basis to think that there could be some positive relationship between students' occupational preferences and their achievement scores in the related subject.

In contrary to the finding of Udo and Olarewaju (1985), the research report of Obikwere (1974) tended to imply that secondary school students make their career choice independent of their achievement level in the subject leading to the career.

Obikwere's study involved 400 form five students from four secondary schools in Lagos city. He developed a questionnaire which include items that seek for the following information:-

1. The influence of parents on the choice of career;
2. The influence of societal values, prestige and money on choice of career;
3. The influence of teachers on choice of career;
4. The influence of interest in the career;
5. The influence of co-curricular activities;
6. The relationship between ability in related school subjects and choice of career.

In addition to the information collected in respect of the above stated factors, the researcher used the students' achievement scores in their MOCK WASC examinations.

The data collected was mostly analysed by the use of percentage counts. The results revealed, among other findings, that:-

(a) over 50 percent of the respondents preferred to go into careers that necessarily require computational skills, yet majority of the students indicated mathematics as their least liked subject;

(b) in all the occupational areas chosen by the respondents, from 97% to 100% of those who chose any occupation, go for subjects related to the occupation;

(c) interest in a subject highly related to career choice;

(d) in general, over 70 percent of the respondents performed above 60% in the subject related to their chosen careers.

The researcher failed to analyse the data, along the nature of relationship that exist between the students' occupational preference and their achievement in related subjects. However the study is related to the present investigation in respect of the level of students involved and the variables used.

Similar to the finding of Obikwere (1974), Ikeotuonye (1978) reported from his research work that there was no significant relationship (at α-level of 0.05) between students' aptitudes and their career aspirations. The

study of Ikeotuonye concerned 170 form five students from five of the secondary schools in Borno State. With the aid of instruments such as 'Differential Aptitude Test (DAT), Vocational Interest Inventory (VII) and Academic/Occupational Preference Scale, data was collected and analysed. He used the chi square statistics to test the relevant hypotheses which included the following:

1. There is no significant relationship between students' aptitudes and their career aspirations.
2. There is no significant relationship between the students' academic and career aspirations.

The two hypotheses were retained.

The study also used percentile ranks to analyse students' occupational and relevant interest and ability areas. It was found that students' percentile rank in relevant ability was higher than their scores in relevant interest areas. He asserted that

> In a number of cases the students aspirations tend towards a negative relationship with their capabilities and interests. There is not any significant realization among the students that one's profession depends on one's preparation or training. Hence their academic preferences are not significantly related to their career choice.

Though Ikeotuonye's work was not about the relationship among students' achievement scores in mathematics, their attitude towards mathematics, and their occupational preference, it is relevant to this study because it pointed out to the researcher that students' 'abilities' could be independent of their occupational preferences.

Since abilities can be seen in terms of one's achievement scores in a related discipline, achievement in mathematics can be taken for one's ability to engage in a mathematics-related occupations. Hence the report above which seemed to have contradicted other notions concerning the relationship between achievement scores and occupational or career ambitions, helped in putting the researcher on a more objective search for what the situation would be in Zaria area.

2.5 Studies on Occupational Preference and Attitude Towards a Related Subject

Most of the studies found in the literature tend to investigate the effect of school subjects in general, on students' occupational interest or preference. Those studies that are concerned with mathematics often look at mathematical applications, achievement in, or attitude towards mathematics.

From the study by Udo and Olarewaju (1985) which has been reported in section 2.4 they reported that 68.4 percent of the students were interested in Chemistry because it was found to be relevant to their future jobs. A total of 94.3 percent of the respondents indicated that their interest in Chemistry motivated them to choose their jobs. Benton (1979), Fakuade (1977) and Mesha (1979) have also reported claims that seemed to agree that a person's occupational preference are not independent of his feelings about related subjects.

However, the study by Eshiet and Inyang (1984) presented a finding which seemed to disagree with the notion that attitude towards a subject positively relates to preference for a related occupation. These researchers jointly carried out their study with 386 form five students from 20 selected secondary schools in Cross River State. They developed a questionnaire which sought to obtain students' combination in sciences at the WASC examination, their career preferences, parents occupations, and influencing factors in their choice of career.

The analysis which was mostly based on the measure of some central tendencies revealed that out of the 95 percent of the respondents that offered mathematics at WASC level, only 44 percent studied it because they were interested in it. But on the contrary to this low percentage that were interested in mathematics, it was found that about 60 percent of the respondents opted for occupations where at least a pass in mathematics at WASC level is required. The two findings reported seemed to indicate that students' interest in (attitude towards) mathematics is disjoint from their occupational preference.

Along a similar line with the findings of Eshiet and Inyang (1984), some of the findings of Obikwere (1974) revealed that students' occupational preference may not necessarily depend on their attitude towards a related subject. For instance, Obikwere reported that of the

400 respondents involved in his study, 80 percent of them in dicated that their least liked subject did not in any way affect their choice of career. Also, only 16 percent of the respondents liked a subject because of the subject's relationship with their preferred career.

The relevance of the literature reported in this section, to the present study is clearly on the variables involved and the controvercies as to whether occupational preference relates to attitude towards related subjects or not. The weaknesses in the statistical analysis employed in the reported works need to be checked for a more valid claim about the nature of relationship that exist between the two variables. This study has tried to use relevant correlational statistics, as stated in chapter three, to bring out the situation as it applied to the data collected.

2.6 Summary

There seems to be little doubt that school mathematics should be addressed in a way that it will be useful or relate to human needs. This claim has been reported in section 2.2.1 and 2.2.2. The issue appears to be what constitutes human needs and for what time; the case of 'modern' mathematics curriculum and 'traditional' mathematics curriculum in the 1950s through the 1970s centred more on this point. While

some of the literature reported tend to agree that there is a positively significant relationship between attitude towards mathematics and achievement in mathematics, there exist others which tend to disagree with the claims. This disagreement may be due to the difficulty in measuring attitude accurately. Attitude measures are only rough estimates of the real behaviour of an individual. It changes from time to time. Hence there is the need for its measurement from time to time in other to keep track with the contemporary situation.

Similar to the disagreements often reported about the nature of relationships that exist between attitude towards mathematics and achievement in mathematics, the survey of literature also reveals that there is no consensus over either the relationship between achievement in a subject and occupational preference, or the relationship between occupational preference and attitude towards related subject.

In order to reveal what the situation is in Zaria area, the next chapter discusses the methodology employed by the investigator.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter describes the design and the procedure for data collection and anslysis. Specifically, the following aspects of the study are discussed:-

1. The population and sample
2. The instrument and instrumentation
3. The procedure
4. The treatment of the data

3.2 Population and Sample

This study concerned the form five students in seven of the eleven secondary schools in Zaria. Only seven schools have been considered in this study because out of the eleven secondary schools within the area of the study, only nine offered the general mathematics up to form five. Further, of the nine schools, only seven were accessible to the researcher for his study despite the permission given to him by the authorities of the Zonal Ministry of Education. These selected seven schools have an estimated enrolment of 2120 students in form five. This number constitute the population of the study.

This level of students have been chosen because they were already looking ahead to their future career and they would be more realistic in their occupational ambition, and other self expressions concerning mathematics.

Zaria has been chosen for the study because:

i) since the environment has one of the 'largest' universities in the country, and other postsecondary institutions, where various professional and non-professional courses are offered to students, the students in the secondary schools within this area may be more aware of the various professional areas that they can engage in after training.

ii) the schools in Zaria fairly cut across the type of schools that exist in many other parts of the country (e.g. boys' schools, girls' schools and co-educational schools).

Because of the right to privacy, the seven schools used in this study were identified with letters A to G. A brief description of each of the schools is given under Appendix C.

In this study, a sample of 350 students have been used by the researcher. This size is above the standard sample size for a population of 2,120 (Krejcie and Morgan, 1970). At 95% confidence level, the theoretical minimum sample size for the above population should be about 300.

The sample random selection technique was used in deciding the respondents from each school. Hence each respondent chosen for the study was purely due to chance.

From each of the seven schools, fifty respondents were randomly selected.

3.3 Instrument and Instrumentation

There were three major variables that were looked at in the study. The variables were:-

i) students' attitudes towards mathematics, (Y)

ii) students' achievements in mathematics, (X) and

iii) students' occupational preferences (R & S).

The instruments used to measure the variables were:

(i) the students results in the 1985/86 joint mock general certificate examination (MOCK G.C.E.) in mathematics;

(ii) a questionnaire which included the following sections: students' occupational preference; a mathematics attitude scale (MAS); and a sub-attitude section used to estimate students' reaction to the use of mathematics in occupation.

3.3.1 The Joint Mock G.C.E.

The mock G.C.E. was a joint examination for all the form five students who were about to write their end of secondary education certification examination in Kaduna State. The examination was fairly dependable because it was similar to the general certificate of education (G.C.E.) examination conducted by the West African Examination Council (W.A.E.C.). For instance,

the mock G.C.E. usually covers all aspects of the secondary school mathematics syllabus. The examination was conducted by a central body (the Kaduna State Ministry of Education) which standardises and moderates the Mock G.C.E. examinations and the results. The Educational Resource Centre (ERC) Zaria which was a branch of the Ministry of Education was responsible for the examination in Zaria area.

For the reliability of the Mock examination results and that obtained in the West African Examination Council's (WAEC) examination. It was found that out of 2,138 candidates that sat for mathematics in the Mock examination, only 178 (that is about 10%) of them passed with Credit and above.

Similarly, out of 2,257 candidates that sat for the G.C.E. examination in the same year, only 274 (that is about 10%) of them passed. Thus either of the examination did not show any statistical difference in the level of the students' performance in mathematics. Since the G.C.E. examination **is** a standardised and fairly reliable test, the distribution above tend to show that Mock examination is fairly dependable.

Further analysis based on the contigency table shown on page 39 showed that at 0.01 level of significance students' achievement in mathematics did not depend on the type of examination (that is Mock examination or G.C.E. examination).

TABLE 3.1

CONTIGENCY TABLE OF DISTRIBUTION OF STUDENTS' ACHIEVEMENT AND TYPE OF EXAMINATION

Type of Examination	Achievement: Passed	Failed	
MOCK	0.08 *(0.1)	0.92 (0.9)	1
G.C.E.	0.12 (o.1)	0.88 (0.9)	1
	0.2	1.8	2

*The values in the parenthesis indicated the expected (E) values while those without the parenthesis were the observed (O) values of the cell.

With 1 degree of freedom and using the Yetes correction form of chi-square test given by the formula

$$\chi^2_p = \Sigma \frac{(|O-E| - 0.5)^2}{E}$$

It was found that Z cal = $5.12 < {}^{Z}0.01 = 6.63$

Hence students achievement in mathematics was in dependent of the type of examination.

3.3.2 Mathematics Attitude Scale (MAS)

This scale was first developed by Shumway and White (1981). It was for measuring students' attitudes towards mathematics. The internal consistency reliability of

this scale, according to Shumway and White (1981) ranges from 0.82 to 0.92. This range was obtained as a result of test and retest of the reliability over some time. The scale which was used by Oguntebi (1983) has been adapted and used in this study. MAS was a six-item semantic differential scale with five options. For easier understanding, the researcher has adapted the Likert type of the scale in this study. This was done by using appropriate words to describe the points left most and the right most words that were used in the original MAS by Shumway and White (1981). This adapted form of MAS is as shown in section B of Appendix A.

The five options were assigned scores of 5 through 1 and a subject's response was marked on this basis. A score of 5 indicated the most favoured response while a score of 1 was used to indicate the least favoured response. The midpoints were therefore assigned the score of 3. This implies that with respect to this scale, a respondent's attitude towards mathematics can be regarded as favourable, neutral or unfavourable on the account of whether his attitude score was above, equal to or below 3 respectively. Thus a neutral attitude means a measure of 2.5 to 3.5. A respondent's attitude towards mathematics (ATMA) score was obtained from the average score on the six items of the attitude scale. This average score which was scored out of 5 was expressed in percentage and classified as variable Y in this study.

The validity of this instrument highly relies on its high consistency reliability as found and reported by Shumway and White (1981). Also, Oguntebi (1983) asserted that the mathematics attitude scale (MAS) validly measures the attitude of student towards mathematics.

3.3.3. Measurement of Occupational Preference

There are innumerable professions or jobs which an individual may take as his occupation for living. In this study, the respondents were asked to write down their first and second preferred occupations in this order. Thus the first preferred occupation was written down first and the second preferred occupation follows in the space provided on the questionnaire (see section A of Appendix A).

This variable (occupational preference) was dichotomously awarded the scores 1 or 0 per stated occupation. The score of 1 was used to indicate that the occupation was taken as 'mathematics-related' (MARO) while a score of 0 indicated that the occupation was classified as 'non-mathematics-related' (NOMARO).

Because some form of training would be required before a person can effectively engage in many professions or occupations, the researcher has used the stated requirements for admission into Nigerian Universities, to read various courses, for the classification of the occupations. For example, it was clearly

stated in the Joint Admission and Matriculation Board (JAMB) brochure (1984-85 session) that students may be admitted into the preliminary courses or the first year of the four year degree course provided that they possess the G.C.E. Ordinarly Level with passes, at credit level, in at least five subjects or the Teacher's Grade Two Certificate with credit/merit in at least five subjects. It was also stated that the five subjects should include English Language and Mathematics in the case of students seeking admission into degree programmes in "the Science, Medicine, Agriculture, Engineering and such other science based courses".

From the specifications found in the JAMB brochure, the two dichotomous groups given below were used to analyse the respondents' occupational preferences. However, it may be noted that the classification does not necessarily imply that mathematics is absolutely irrelevant to the occupations under the 'non-mathematics-related' group. Rather, for such occupations, a credit in mathematics has never been set as a pre-requisite for the training towards the practice of them.

TABLE 3.2A MATHEMATICS-RELATED OCCUPATIONS (MARO)

1. Engineering Services
2. Medical and Paramedical Services
3. Financial Services (e.g. Business, Accounting Auditing and Banking)
4. Agriculture Services

5. Teaching of Mathematics or a science subject
6. Computer Work
7. Mathematician and Scientist
8. Navigation services (e.g. Pilot and Sailor)
9. Architectural work

TABLE 3.2B NON-MATHEMATICS-RELATED OCCUPATIONS (NOMARO)

1. Administrative work (e.g. Principal or Public Administrator)
2. Contractual work
3. Journalism
4. Teaching of non-mathematics or a non-sicence subject
5. Legal services
6. Full-time religious work
7. Force
8. Secretarial services
9. Politicking
10. Social activities (e.g. Drama, Art, Entertainment)
11. Hotel and catering services

The list of occupations used in the two dichotomous groups were the occupations which the respondents gave as their preferred occupations. Because the respon dents were allowed to state their preferred occupations freely without any form of influence from anybody as at the time they were to complete the questionnaire, there should be a high reliability on these occupations.

This therefore implies that these respondents may likely state the same or similar occupations if asked for by any other person as at the time of this study.

3.3.4 Estimate of Students' Reactions to Use of Mathematics in Occupation

The questionnaire used in this study contained a sub-attitude section that was designed to have an estimate of the extent of students' reaction to either mathematics or their preferred occupation, if they discover that their preferred occupation require mathematics. The items in the section (see section C of Appendix A) were designed similar to Likert (1923) scale with five response options. Two of the items were used to estimate the extent that a respondent will like to retain his or her occupational preference despite any later discovery. The average score out of five on these items was taken as variable P for mathematical computational purposes. Similarly, two of the items were used to estimate the extent that a respondent will continue to like and study mathematics. The average score out of five on these items constituted variable Q. Taking an average score of 3 out of 5 as a neutral position, a score of 4 and above was considered as positively favourable reaction for this study. Though this section of the questionnaire was not one of the major problems of this study, the items have been written in simple English that could permit easy

readability and understanding. Hence the rough estimate of the students' reaction to the requirement of mathematics in their preferred occupations could be reliably obtained from their responses to the items.

3.4 Procedure

To start with, the researcher obtained an introductory letter from the Faculty of Education of his institution to the Zonal Ministry of Education Zaria. Further, permission was given to the researcher from the ministry to conduct this work in the schools concerned. The permission gave the researcher access to most of the schools where he administered all the instruments with the exception of the Mock GCE examination.

The conduct of the Mock G.C.E. examination as explained under section 3.3.1 was very much similar to the conduct of the WAEC Ordinary Level G.C.E. examinations. It was dependable because students were subjected to the conditions of any standard examination. For example, students had to be able to write the examination independently under an invigilator and a supervisor from the Ministry of Education. The examinations scripts were marked with a uniform marking scheme and standard given by the Ministry of Education; and all results were moderated by the ministry before they were finally released to the schools.

For the administration of other instruments which were put together under one questionnaire (see Appendix A)

the identified students in such school were made to complete them under the researcher's guide. These students were identified through a simple random selection technique.

The respondents were only assisted in cases where explanation of any words or sentences was necessary. This was minimal across the schools. Efforts were made by the researcher to ensure that the respondents were made to complete the questionnaires and submit them while the researcher was present. This made the questionnaires returned to be 100 percent.

Though there was not any specific time set for the completion of the questionnaire, the exercise did not take more than an hour in most schools. This time included the time spent on explaining any section of the questionnaire which the respondents found difficult to understand. Also, to minimise any problem of readability of the items on the questionnaire the researcher ensured that he read each item to the respondents. This was done to ensure maximum internal validity.

3.4.1 The Pilot Study

About three months before the major study, a pilot study was conducted in order to provide the researcher with some relevant information regarding the final research design. Specifically the purpose of the pilot study was to check and observe the best

mode to administer the questionnaires. A questionnaire was developed and administered to seventy (ten from each school) volunteers from the schools. Although volunteers were not used in the actual study, the use of volunteers for the pilot study was considered proper. This was because the result of the pilot study did not influence the statistical design and analysis of the study. The questionnaire which used some formats such as rank ordering, bipolar response mode, free response mode, and scale response mode were used to find out how much the students can accurately respond to items constructed in the various formats. These students were not given any form of assistance in the completion of the questionnaire. This was to enable the researcher to know the real situation about students' ability in responding to the items on the questionnaire.

The result of the pilot study showed that the students would best and most accurately complete a questionnaire on a scale response mode. Following the pilot study, the questionnaire had been modified for the real data collection for optimal validity.

3.5 Treatment of the Data

After the data collection the scores for each of achievement in mathematics (ACMA), and attitude towards mathematics (ATMA) which were on interval scale were

correlated using Pearson product-moment correlation. The numerical value of r was obtained through the use of the formula

$$r_{XY} = \frac{n\Sigma XY - \Sigma X\Sigma Y}{[(n\Sigma X^2-(\Sigma X)^2)(n\Sigma Y^2-(\Sigma Y)^2)]^{\frac{1}{2}}}$$

For details, see Appendix B.

The scores on the occupational preference were dichotomous; hence the product-moment correlation called point biserial correlation and denoted by r_{pbi} was used to find the relationship between these scores and any of ACMA or ATMA scores. The r_{pbi} was a modified form of the Pearson product-moment correlation coefficient used when one of the two variables to be correlated is dichotomously measured. The numerical value of it is given by the formula

$$r_{pb}XR = \left(\frac{\bar{X}_{.1}-\bar{X}_{.o}}{S_X}\right)\sqrt{n}\,\frac{n_1\,n_o}{(n-1)}$$

(see Appendix B for details)

The two correlation coefficients r and r_{pbi} were used to test the hypotheses H_{01}, H_{02} and H_{03} as stated in section 1.7. The test statistics used was

$$t = r\left(\sqrt{\frac{N-2}{1-r^2}}\right)$$

(see Appendix B for details)

The α-level (significance level) used was 0.05 with degree of freedom of 48 and 348 as applied to

each school and all the schools put together respectively. The results of the tests were as shown in the next chapter.

In order to find the explanations for other questions raised in chapter one, the data collected was subjected to some relevant statistical analysis. These included the calculation of some measures of central tendencies such as Mean, Median, Mode and Standard deviations for the non-dichotomous measures.

All the computations that lead to the various numerical results were obtained by the researcher through a hand-held calculator. To ensure the correctness of the calculations, the HP 86 Basic Micro-computer at the Computer Centre of Abubakar Tafawa Balewa College of Ahmadu Bello University Campus (ATBC/ABU) Bauchi was also used as a check for most of the numerical results that were obtained.

CHAPTER 4

ANALYSIS OF DATA

4.1 Introduction

This chapter reports the data collected from the various measurements. Also, the chapter presents a detailed analysis of the data as it applies to each school and all the schools taken together. The hypotheses tested are presented and discussed.

As already discussed in chapter 3, this study had some measurements which were dichotomous and some that were continuous.

To test the significance of the correlations obtained in respect of each of the null hypotheses, the Z-value equivalents were calculated from the relationship $Z_{cal} = r(\sqrt{\frac{N-2}{1-r^2}})$, (see Appendix B for details).

The values obtained were applied at 0.05 level of significance. The distribution of the pairwise correlation coefficients for all schools and from school to school appear in Appendix D.

For the purpose of a clear view of what this chapter has treated, the major areas are as follows;

1. Relationship between students' occupational preferences and their attitude towards mathematics
2. Relationship between students' achievement in mathematics and their attitude towards mathematics

3. Relationship between students' achievement in mathematics and their attitude towards mathematics.
4. Analysis of data concerning students' occupational preferences
5. Analysis of data concerning studetns' achievement scores in mathematics
6. Analysis of data concerning students' attitude towards mathematics
7. Analysis of data concerning studetns' reactions on realization that mathematics is required in their preferred occupations

4.2 Relationship Between Students' Occupational Preferences and Their Attitude Towards Mathematics

The significance of the relationship between the students occupational preferences (R or S scores) and their attitude towards mathematics (Y scores) was tested using the null hypothesis below.

The Null Hypothesis Tested:

There is no significant relationship between students' occupational preference and their attitude towards mathematics.

Symbolically this means

$$H_o: \quad \rho_{RY} = o$$

$$H_1: \quad \rho_{RY} \neq o$$

With the chosen 0.05 level of significance and setting

the critical level for two-tail test to be $Z_{0.25}=1.96$, the calculated value was obtained to be 6.3. Because the calculated value falls on the rejection area under a normal distribution curve, the null hypothesis H_o was rejected. Thus the correlation between the Y variable and the R variable was significant at 0.05 level.

Similarly, the test was performed with Y and the S measures. In this case the calculated test statistic was 5.4 which was greater than the critical value (1.96). Hence the null hypothesis was also rejected. This further confirms that the correlation between the students' preferred occupations and their attitude towards mathematics was significantly positive at 0.05 level. This result tends to imply that students with positive attitude towards mathematics would prefer to engage in mathematics-related occupations more than those who have a negative attitude towards mathematics.

4.3 Relationship Between Students' Achievement in Mathematics and Their Occupational Preferences

The null hypothesis stated below was used to test the significance of the relationship between students' achievement in mathematics (X scores) and their occupational preferences (R or S scores).

The Null Hypothesis Tested:

There is no significant relationship between students' occupational preferences and their attitude

towards mathematics.

This means

$$H_o : \rho_{RX} = o$$

$$H_1 : \rho_{RX} \neq o.$$

At 0.05 level of significance the critical value was 1.96 and the calculated value was obtained to be 6.08.At0.05 significance level this value of 6.08 falls in the rejection area under the normal curve. Hence the null hypothesis was rejected. It follows that at 0.05 significance level, there is a significant correlation between students' achievement in mathematics and their occupational preferences. This hypothesis was also tested using the students' second occupational preferences (S scores). The calculated value for the test of significance was obtained to be 5.44. This value also falls to the rejection area of the normal curve at 0.05 level. Hence, further confirming that the correlation between students' occupational preferences and their achievement in mathematics was significant.

Thus the more students tend to prefer mathematics-related occupations, the more they would achieve higher scores in mathematics. In other words, the lower the mathematics achievement score of a student, the more such student would tend to disengage in mathematics-related occupations.

4.4 Relationship Between Students Achievement in Mathematics and Their Attitude Towards Mathematics

The correlation coefficient obtained in respect of the students achievement in mathematics and their attitude towards mathematics was put to test for significance at 0.05 level using the null hypothesis below.

Null Hypothesis Tested:

There is no significance relationship between the students achievement in mathematics and their attitude towards mathematics.

Symbolically this means

$$H_o : \rho_{XY} = o$$

$$H_1 : \rho_{XY} \neq o$$

The calculated value from the test-statistic was 18.27. This is greater than the 1.96 critical value. Hence the null hypothesis was rejected. Thus the correlation coefficient obtained in respect of the X and Y variables (see Appendix D) was significant at 0.05 level. This implies that there is a significant relationship between the students achievement in mathematics and their attitude towards mathematics.

4.5 Analysis of Data Related to Students Occupational Preferences

For the purpose of this analysis, Occupational prefences have been categorized into two dimensions: Mathematics-related and non-mathematics-related dimensions. To enable a clearer picture of what the

situation was in relation to each of the occupational areas identified in chapter three, tables 4.1A and 4.1B show the distribution of the percentage of students across schools along occupational preference lines. A dash "-" indicates that none of the respondents of the school involved preferred to go into the occupation. The colum headed 'All Schools' represents the analysis with respect to the total sample of 350 respondents used for this study.

TABLE 4.1A

MATHEMATICS-RELATED OCCUPATIONS AND THE PERCENTAGES OF RESPONDENTS' PREFERENCE FOR THEM ACROSS SCHOOLS

Occupations	Percentages of Preference															
	School A		School B		School C		School D		School E		School F		School G		All Schools	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Engineering Services	20	10	10	4	8	18	12	18	2	10	8	8	18	28	11.1	13.7
Medical & Paramedical Services	20	8	34	32	26	8	34	20	40	34	48	14	22	8	32	17.7
Financial Services (eg Business, Accounting, Auditing and Banking)	12	18	4	4	6	6	12	6	6	4	4	6	4	8	6.8	7.1
Agricultural Services	2	4	4	6	4	6	4	8	-	-	4	4	-	-	2.6	4
Teaching of Mathematics and a Science subject	-	4	4	2	6	2	4	-	16	8	4	4	-	2	4.9	3.1
Computer Work	-	-	2	4	-	4	2	4	-	-	2	-	-	-	0.9	1.7
Mathematician and Scientist	6	6	8	18	4	4	4	-	2	4	6	12	4	14	4.9	8.3
Navigation Services (eg. Pilot and Sailor)	-	4	2	6	2	6	2	2	4	-	2	8	-	4	2	4.6
Architectural Work	2	2	2	-	-	4	-	2	-	4	-	4	10	4	2	2.9

TABLE 4.1B

NON-MATHEMATICS RELATED OCCUPATIONS AND THE PERCENTAGES OF RESPONDENTS' PREFERENCE FOR THEM ACROSS SCHOOLS

Occupations	Percentage of Preference															
	School A		School B		School C		School D		School E		School F		School G		All Schs.	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Administrative work (eg Principal or Public Amin.)	-	2	8	8	18	16	-	-	4	-	-	2	4	8	4.8	5.1
Contractual Work	6	18	-	4	4	-	4	10	2	8	10	10	8	8	4.8	2.3
Journalism	4	2	-	4	2	-	2	10	10	4	-	4	6	2	3.4	3.7
Teaching of non-science/non-mathematics subject	2	-	4	2	2	2	-	2	6	10	2	4	-	-	2.3	2.9
Legal Services	12	6	4	2	2	-	12	4	2	4	4	8	6	-	6.0	3.4
Full Time Religious Work	-	-	-	-	2	2	-	2	2	4	-	2	-	2	0.6	1.7
Force	10	14	14	2	14	14	4	2	-	-	6	2	16	12	9.1	6.6
Secretarial Services	-	-	-	-	-	-	-	2	-	-	-	-	2	-	0.3	0.3
Politicking	-	-	-	-	-	6	2	2	-	-	-	-	-	-	0.3	1.1
Social Activities (eg. Drama, Art, Entertainment)	4	2	-	2	-	-	-	2	2	4	-	6	-	-	0.9	2.3
Hotel and Catering Services	-	-	-	-	-	-	2	2	2	2	-	-	-	-	0.6	0.6
Others	-	-	-	-	-	2	-	-	-	-	-	2	-	-	-	0.9

If students' occupational preferences were to spread evenly across the twenty major identified occupational areas, then each occupation should have a maximum of 5% of the respondents. With this fraction of 5% as a reference point, the results as shown in Tables 4.1A and 4.1B indicate that occupations in the area of Engineering and Medical services were preferred by relatively high percentage of the respondents. For example in each of the seven Schools, those who opted for mecical and paramedical services as first preference was at least 20%.

Further, an observation of the second preference column in each of the tables, almost reflects a similar trend to that of the first preference columns; with medical and paramedical occupations outscoring mostly all other occupations. The analysis showed that the range of the respondents' preference for this type of occupation was 8% to 34%. Next to medical and paramedical services was Engineering. With the exception of School E, Engineering work attracted a range of 8% to 20% of the respondents in each school. The situation in School E which was purely a girls' school showed a relatively lower percentage of preference for Engineering work.

In the case of preference for the teaching occupation, a relatively low percentage of the respondents opted for teaching. For instance the overall average

showed that only about 8.3% of the respondents made teaching their first preferred occupation and only 7% of them made teaching their second preferred occupation. Taking all the respondents together, the proportion of them that indicated teaching of either a science subject or Mathematics as their first preference was about 4.9%. Only 3.1% of them made Teaching of either a Science subject or Mathematics as their second preference.

In addition to the above analysis concerning each occupation, the data on occupational preference was analysed using the dichotomous groups as discussed in section 3.3.3. The number and percentage of the respondents who made Mathematics related occupations as their first preference were as shown in Table 4.2.

TABLE 4.2

NUMBER AND PERCENTAGE OF RESPONDENTS WHO MADE MATHEMATICS-RELATED OCCUPATION AS FIRST PREFERENCE

Schools	No. of Respondents*	Percentage
School A	31	62
School B	35	70
School C	29	58
School D	37	74
School E	36	72
School F	39	78
School G	29	58

*The total number of respondents per school was 50

Using the percentage column of the table (i.e. Table 4.2) it was realised that on the average 67.4 percent of the respondents made Mathematics-related occupations as their first preference. The standard deviation was calculated to be about 7.5.

When a similar analysis was done for the respondents' second preferred occupations, an average of about 63.1 percent of the respondents showed their preference for Mathematics related occupations. The standard deviation was 6.4. The distribution of the number and the percentage of the respondents who made mathematics-related occupations their second preferences was as shown in Table 4.3.

TABLE 4.3

NUMBER AND PERCENTAGE OF RESPONDENTS WHO MADE MATHEMATICS-RELATED OCCUPATIONS AS SECOND PREFERENCE

Schools	No. of Respondents	Percentage
School A	28	56
School B	38	76
School C	29	58
School D	30	60
School E	32	64
School F	30	60
School G	34	68

When the preference for individual identified occupational area is to be considered, then the column of "ALL SCHOOLS" in Tables 4.1A and 4.1B presented the relevant information. For instance, if 5 percent is taken as an average percentage of students expected to prefer an occupation, or occupational area, then only five occupational areas attracted a percentage above this average point. These occupational areas were Medical and Paramedical Services, Engineering Services, Force, Financial Services (e.g. Business, Banking, Accounting, or Auditing), and Mathematician/ Scientist's work. Tables 4.1A and 4.1B bring this out clearly.

4.6 Analysis of Data Concerning Achievement Score in Mathematics

Achievement score in mathematics was one of the major variables that was used in this investigation. As explained in the previous chapter, the scores were obtained by the respondents in their Mock GCE results in mathematics. The measurements of this variable has also been discussed in chapter three. The analysis of the data obtained by using the instrument as discussed in section 3.3.1 is presented in this section. In particular, the data concerning the distribution of scores across the schools is presented in Table 4.4 in grouped form.

TABLE 4.4

DISTRIBUTION OF ACHIEVEMENT SCORES ACROSS SCHOOLS

Achievement Scores Per 100	Frequences in School							Total	Relative Frequency
	A	B	C	D	E	F	G		
1 - 10	-	4	-	1	3	1	9	18	5.1
11 - 20	15	14	9	7	23	10	14	92	26.3
21 - 30	24	13	18	22	19	23	14	133	38
31 - 40	5	3	13	11	4	9	10	55	15.7
41 - 50	5	5	5	5	-	3	-	23	6.6
51 - 60	2	4	2	1	1	4	-	14	4
61 - 70	-	3	2	3	-	-	1	9	2.6
71 - 80	-	2	1	-	-	-	2	5	1.4
81 - 90	-	1	-	-	-	-	-	1	0.3
91 - 100	-	1	-	-	-	-	-	1	0.3
	50	50	50	50	50	50	50	350	

The analysis of the data in Table 4.4 revealed that 38% of the total number of the subjects obtained their scores within 21% and 30% and as high as 80% of them obtained their scores within 11% and 40%.

When the mean of all the 350 scores was calculated, it was found to be approximately 28.9%. The standard deviation was around 14.5. This low level of achievement in mathematics seemed to cut across all the schools. For instance, there was no school with an average score of up to 34%. Also, less than 10% of the subjects in six of the

seven schools scored above 50%. The only school whose level of achievement score above 50% was higher than 10% was school B. This is to be expected as this school is to be a unique one out of all the schools involved in this study (see Appendix C).

4.7 Analysis of Data Concerning Attitude Towards Mathematics

The instrument used in the collection of this data has been described in section 3.3.2.

The figures used to measure the level of attitude that a student has towards mathematics were expressed in percentages. The actual measures were obtained from the six attitude items in the questionnaire. From the scale used in measuring the students' attitude towards mathematics, an attitude measure of 3 out of 5 (i.e. 60%) means a neutral position between a low and a high attitude towards mathematics. However, in this study, an attitude measure of 50% to 70% was taken as neutral. In a similar way therefore, a fairly high or high positive attitude towards mathematics can only be claimed in this study if the measure was about 80% and above.

Table 4.5 shows the distribution of the attitude scores across the schools.

TABLE 4.5

DISTRIBUTION OF ATTITUDE SCORES ACROSS SCHOOLS

Attitude Score Per 100	Frequencies in School A	B	C	D	E	F	G	Total	Relative Frequency
21 - 40	2	6	1	2	-	1	3	15	4.3
41 - 60	9	16	7	4	3	14	8	61	17.4
61 - 80	22	14	18	19	25	22	11	131	37.4
81 - 100	17	14	24	25	22	13	28	143	40.9
Total	50	50	50	50	50	50	50	350	

With an attitude measure of 50% to 70% as a neutral point on the scale used for the data collection, the analysis of the distribution in Table 4.5 showed that only about 76 (about 22%) of the students demonstrated either a negative or neutral attitude towards Mathematics.

The mean values and the standard deviation which resulted from the individual attitude scores was as shown in Table 4.6.

TABLE 4.6

MEAN VALUES AND STANDARD DEVIATIONS OF THE ATTITUDE SCORES (Y)

Schools	Mean Of Y (%)	Standard Deviation
A	72.7	15.9
B	67.3	20.8
C	77.4	16.7
D	80.6	17.8
E	79.5	12.5
F	71.5	16.6
G	78.6	20.0

The above means distribution is equivalent to saying that on the average, the students' attitude towards mathematics varies from 67.3% to 80.6% (i.e. from about 3.4 to about 4.0 on the five point attitude scale). Thus, the attitude towards mathematics is more of positive than negative. This may be expected during this time of much emphasis on scientific and technological education which hihgly depend on mathematics.

4.8 Analysis of Data Concerning the Respondents' Reactions if they Realise that Mathematics is Required For Their Preferred Occupation

As already discussed under section 3.3.4, the data obtained in this case was simply an estimate of what the students' attitude may tend to be if they realise that their preferred occupations require mathematics. The attitude here referred to the extent they will still like to engage in such occupations (P scores) and the extent that they will like to engage in the study of mathematics (Q scores).

From the instrument issued to obtain data concerning this section 4.8 (see section 3.3.4), only any score of above 3 indicated a positively favourable attitude or reaction in this study.

The distributions of some measures of central tendencies obtained across schools were as shown in Table 4.7A.

TABLE 4.7A

MODE, MEDIAN, MEAN AND STANDARD DEVIATION OF RESPONDENTS' REACTION TO THEIR PREFERRED OCCUPATIONS (P Score) AND THEIR ATTITUDE TOWARDS MATHEMATICS (Q Scores)

School	Mode		Median		Mean		Standard Deviation	
	P	Q	P	Q	P	Q	P	Q
A	5	5	4	4	4	3.9	0.9	1.0
B	4	3	4	3.5	3.9	3.5	0.9	1.0
C	5	3	4	4	4.2	3.8	0.7	1.0
D	4	5	4	4	3.8	3.8	1	1.2
E	3.5	5	3.5	3.5	3.5	3.6	1.1	1.1
F	3.5	3	3.75	3.5	3.8	3.5	0.8	0.9
G	4	5	4	4.5	4.1	4.1	0.7	1.0

It is clear from the above table that all measures of the central tendencies are above 3 showing a positively favourable reaction to the preferred occupations by the students from each school; also showing that the students indicated a favourable reaction to their attitude towards mathematics. A simple interpretation of the above figures is that in each of the schools, any measure of central tendency shows clearly that the students reacted favourably in terms of their attitude towards mathematics. This is to say that if the students get to realise that their preferred occupations require mathematics, they will tend to show a positive attitude towards the study of mathematics while still maintaining their preferred occupations.

Further analysis was made on the proportion of the total population of 350 students that would maintain at least a fairly high positive attitude towards the study of mathematics if mathematics was realised to be required in their preferred occupation. It was found that only about 54% of the respondents showed at least a fairly high attitude towards the study of mathematics (see Table 4.7B). With the case of the students' reaction to their preferred occupation, it was realised that about 62% showed at least a fair positive reaction (see Table 4.7C). A fair positive reaction means a score of 4 on the 5-point tool that was used in obtaining the data.

TABLE 4.7B

FREQUENCY DISTRIBUTION OF Q SCORES

Q Scores	Frequency	*Relative Frequency
1	6	1.7
1.5	8	2.3
2	16	4.6
2.5	32	9.1
3	51	14.6
3.5	49	14
4	52	14.9
4.5	48	13.7
5	88	25.1
Total	350	

*The values are approximations

TABLE 4.7C

FREQUENCY DISTRIBUTION OF P SCORES

P Scores	Frequency	*Relative Frequency
1	4	1.14
1.5	1	0.29
2	11	3.14
2.5	32	9.14
3	25	7.14
3.5	60	17.14
4	90	25.71
4.5	54	15.43
5	73	20.86
Total	350	

*These values are approximations

4.9 A Comparative Analysis of the (Dichotomous) Groups' Achievement in, and Attitude Towards Mathematics

The dichotomous groups were those who preferred mathematics-related occupations (MARO Group) and those who preferred non-mathematics-related occupations (NOMARO Group). When the average achievement scores in mathematics for the two groups were computed across schools, it was found that those who preferred Mathematics-related occupations outscored those who preferred the non-mathematics-related occupations in all the schools. For example, while the average performance of those whose first preference was mathematics-related occupations ranged from 23% to 38.9%, that of those of non-mathematics-related

occupations ranged from 16.2% to 26.9%. Table 4.7D brings this out clearly. However, the table is in respect of the respondents first preferred occupations. A similar trend occurred in respect of the respondents achievement scores in mathematics for the groups formed out of the second occupational preference. This is to say that when the respondents were grouped into two by their second occupational preference, it was found that the average performance in mathematics of those whose preferences were mathematics-related occupations, was better than that of those who preferred non-mathematics-related occupations.

TABLE 4.7D

MEAN ACHIEVEMENT SCORES IN MATHEMATICS OF RESPONDENTS IN THE TWO (DICHOTOMOUS= GROUPS ACROSS SCHOOLS

Schools	Mean Achievement (%) in Maths	
	MARO Group	NOMARO Group
A	29	21.9
B	38.9	18.9
C	36.4	26.9
D	34.3	23.7
E	23	21.8
F	30.9	26.4
G	30	16.2

To test for any significant difference between the mean achievement scores in mathematics for the two

groups, a t-test was done by the use of the formula.

$$t = \frac{\bar{X}_1 - \bar{X}_o}{\left[\left[\frac{(n_1-1)\ S_1^2 + (n_o-1)\ S_o^2}{n_1 + n_o - 2}\right]\left[\frac{n_1 + n_o}{n_1 \times n_o}\right]\right]^{\frac{1}{2}}}$$

(see Appendix B for the details of the formula)

The result revealed that there is a significant difference in the groups' mean achievement scores in mathematics. This finding of a significant difference in the groups' achievement scores in mathematics also applied in most of the schools (see the distribution of the t-test results in Table 4.7E.

TABLE 4.7E

DISTRIBUTION OF THE t-TEST RESULTS FOR THE GRUPS' MEAN ACHIEVEMENT SCORES IN MATHEMATICS

t-Test Results	Schools							All the schools
	A	B	C	D	E	F	G	
Along 1st Occupational Preference	2.5*	3.2*	2.5*	2.6*	0.5	1.1	3.2*	6.0*
2nd Occupational Preference	2.2*	2.6*	2.2*	2.2*	0.7	2.5*	3.2*	5.3*

*Significant at 0.05 α-level.

Concerning the case of the respondents' attitude towards mathematics, it was found that the average attitude of those whose first occupational preference was mathematics-related ranged from 71.6% to 87.2%. The mean distribution of the attitude scores of these groups (i.e. respondents with mathematics-related occupations) were higher than the mean attitude scores

of those whose first occupational preference was non-mathematics-related across the schools. For example while the average scores of those with mathematics-related occupations ranged from 71.6% to 87.2%, that for those preferring non-mathematics-related occupations ranged from 57.3% to 74.8%. This trend was similar when the respondents second occupational preferences were used for the dichotomous groupings. These differences are clearly brought out in Table 4.7F.

TABLE 4.7F

MEAN ATTITUDE OF THE TWO (DICHOTOMOUS) GROUPS ACROSS SCHOOLS

Schools	Mean Attitude (%) Towards Maths	
	MARO Group	NOMARO Group
A	74.7	66.8
B	71.6	57.3
C	82.1	71
D	85.1	68
E	81.9	74.8
F	73.4	64.6
G	87.2	66.7

A t-test was also done for the difference between the means of the attitude scores of the dichotomous groups. The result revealed a significant difference in the mean attitude scores of the two groups (see Table 4.7G).

TABLE 4.7G

DISTRIBUTION OF THE t-TEST RESULTS FOR THE GROUPS' MEAN ATTITUDE SCORES

t-Test Results Along	Schools A	B	C	D	E	F	G	All the schools
1st Occupational Preference	*2.2	*2.3	*2.5	*3.3	*1.7	*1.7	*4.1	*6.2
2nd Occupational Preference	0.8	*2.2	*2.1	*2.2	*2.3	*2.0	*3.6	*5.3

* Significant at 0.05 level of significance

In summary of the foregoing section 4.9, it was found from the data analysis that students who preferred mathematics-related occupations did not only significantly show more positive attitude towards mathematics than those who preferred non-mathematics-related occupations, they also significantly outscored the NOMARO group in the mathematics achievement test. Other conclusions and the summary of this study are presented in the next chapter.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary and Findings

The study has touched some areas which the researcher considered important. These areas included the three major variables of the study which were; achievement in mathematics, attitude towards mathematics, and occupational preference. In all the cases, various sources were used to extract useful information. Such sources which included the library and some individuals, revealed some theoretical, historical, experimental and statistical information. This information helped in one way or the other for a better structuring of the purpose and methodology of this research.

Therefore, this section presents a summary of:-

a) the purpose of the study

b) methodology

c) related literature

d) the Null Hypotheses tested, and

e) findings

5.1.1 Purpose of the study

The study was purposely designed to investigate the inter-relationships among students' occupational preference, achievement in, and attitude towards Mathematics. Other purposes were to provide some information on the current level of students' attitude

towards mathematics, to provide the teachers with any likely way of making the students to engage more in the study of Mathematics, to provide some statistical information for further research. The significances of some of the above purposes were discussed in various sections in chapter one. For instance in section 1.3.1, the point made by Hammer (1964) concerning teachers and the students' tend to show that it is important that the teachers know of almost everything about their students. Also section 1.3 brought out clearly the significances of the purposes listed in the present section.

5.1.2 Methodology

To start with, a pilot study was conducted to have some knowledge about the feasibility of the study. The final work was based on the data collected through the use of questionnaires and some records kept by the schools used in the study. The questionnaire method was used to collect information from the sampled subjects. The information sought included areas concernin g attitude towards mathematics, occupational preference, and how the subjects would react if they realised that mathematics was required in their preferred occupations. The respondents' achievement scores in mathematics were obtained from the various schools' records.

In all, 350 subjects were selected from seven secondary schools in Zaria area and all these subjects completed the questionnaires. This 100% rate of return was possible because of the researcher's presence and close supervision during the time for the completion of the questionnaires. The information obtained from the questionnaires was converted to numerical data and analysed statistically to provide answers to the various questions and hypotheses raised in the study.

On the instrumentation, the researcher ensured that all the respondents, who were selected from each school by simple random selection technique, sat down in a classroom. The purpose of the questionnaires was discussed with them and they freely completed the items on the questionnaires. However, the researcher had to guard against the respondents' influencing each other's responses. All questions were to be directed to the researcher. The effects of this close supervision include a desirable degree of free response, attention to every item on the questionnaire, and an absolute success of questionnaire return.

In addition to the information extracted from the completed questionnaires, the respondents' achievement scores in mathematics were obtained from the joint Mock GCE examination results of each school. The joint Mock GCE examination has been discussed in section 3.3.1.

For any further details on the instrument and instrumentation for this study see sections 3.3, 3.3.1 to 3.3.4 and 3.4.

5.1.3 Related Literature

Some works that have been done in related areas were reviewed and reported in chapter two. This literature review was mainly to give guidelines for the development of this study. Major parts of the review centred on the issues of the nature or strength of relationship between achievement in, and attitude towards mathematics. For example Oguntebi (1983) reported series of works which revealed that there has been no concensus over the nature and strength of relationship between these variables. Hence the review summarily showed the need to make more efforts to provide supportive evidence concerning any claims about the nature of relationship between the variables.

The issues of the considerations for occupational preference in relationship with either attitude or achievement, as they affect mathematics, were reviewed. Most of the reviewed literature tend to show that students' ability in a subject and their career or occupational ambitions were not significantly related. For example Ikeotuonye (1978) established that no significant relationship existed between

the students' academic aspirations and their abilities. Similar report was made by Obikwere (1974).

On the other hand, occupational preference has been identified to correlate with attitude towards some related subjects. In particular, Benton (1979) clearly asserted that a person who was fearful of mathematics would avoid and reject careers that were desirable.

Attitude towards mathematics is another significant area that was reviewed. As summarised towards the end of chapter two, attitude manifestation depends highly on situations surrounding the organism or object of the manifestation. This apart, it was also believed by some researchers and psychologists that any attitude measure from a scale is only a rough estimate of the way in which attitudes really exists in mental life of an individual. In summary therefore, the validity of an attitude measure depends on the validity of the measuring instrument employed. Section 2.2.5 narated some detailed literature on attitude and attitude theories. However, some researchers, especially in Nigeria, tended to claim that students' attitude towards mathematics is not encouraging and more negative. For example, Lassa (1978) showed that if "84-60" was regarded as a neutral interval on a continum scale for attitude, then most students showed negative

attitude towards mathematics. Out of the population of 434 respondents involved in Lassa's study, the average mean for attitude towards mathematics was found to be 73.45 which is short of the measure that could be termed as positive.

5.1.4 The Null Hypotheses Tested

As this study required testing of the significance of any relationship between the major variables investigated, some helpful and relevant statistical tools were researched into. This was done to provide a valid claim of whatever stand was to be taken concerning the various hypotheses to be tested. Also, the statistical research provided guidelines for the right measuring scale that could best be used in the relevant areas of the study. It was with the aid of the statistical tools obtained from the research that the following null hypotheses were formulated.

Hypothesis 1: There is no signifcant correlation between students' occupational preference and their attitude towards mathematics.

Hypothesis 2: There is no significant correlation between students' achievement in mathematics and their attitude towards mathematics.

Hypothesis 3: There is no significant correlation between students' achievement in mathematics and their preferred occupation.

Correlation coefficients were used to test the above stated hypotheses.

There were other questions which involve the use of statistical analyses like the measure of central tendencies. Some of these questions have been stated in chapter one. For example:-

a) What is the level of students attitude towards mathematics?

b) What proportion of students will show a fairly high interest in the study of mathematics if they realise that mathematics is required in their occupational preference?

5.1.5 Findings

The analysis of the various data collected in respect of this study was presented in the fourth chapter of this report. In this section the major findings from the analysis is presented.

Foremost in these findings were the results of the test of hypotheses. Section 4.2 tp 4.4 involve the test of the three hypotheses concerning the

relationship between the three major variables of this study. The findings from the statistical analysis were as follows;

Hypothesis 1

This hypothesis was rejected and the conclusion was that a significant and positive correlation exists between students' achievement in mathematics and their attitude towards mathematics. Students who achieved highly in mathematics tended to exhibit a relatively positive attitude towards mathematics.

Hypothesis 2

The hypothesis was rejected. Therefore there was a significant and positive correlation between students' preferred occupations and their attitude towards mathematics. Students who preferred to engage in mathematics-related occupations tended to show a positive attitude towards mathematics and those with negative attitude towards mathematics tended not to prefer engaging in mathematics-related occupations.

Hypothesis 3

This hypothesis was rejected and the conclusion was that a significant and positive correlation exists between students' achievement in mathematics and their preferred occupations. Those students who preferred to engage in mathematics-related occupations

tended to have relatively higher achievement scores in mathematics than those who preferred non-mathematics-related occupations. In other words students who preferred to engage in non-mathematics-related occupations tended to achieve lower in mathematics than the students who opted for mathematics-related occupations.

Apart from the significantly positive correlation found to exist between the paired variables as indirectly mentioned in the three hypothesis above, the statistical analyses showed that the coefficient of correlation between attitude and achievement was higher than any other correlational coefficient from the study. There was a stronger relationship between attitude towards mathematics and achievement in mathematics than either of the relationship between achievement and occupational preference or the relationship between attitude and occupational preference.

Other statistical analyses employed showed that:

1. The average achievement score in mathematics for the whole sample of 350 respondents was not up to 30 out of 100.
2. In each of the seven schools, no average achievement score in mathematics was up to 34.
3. Less than 10% of the respondents in all the schools but one obtained an achievement score in mathematics that was above 50.

4. On the average the attitude of students towards mathematics rangedfrom 67.5% to 80.6%. It tended to show a positive attitude towards mathematics though some researchers may report this as unfavourable attitude towards mathematics.
5. The students often prefer to engage in Engineering, Medical or Paramedical Services, Force, and Financial institution work more than any other occupational area.
6. Majority (above 63%) of the respondents preferred to engage in occupations which were identified as mathematics-related in section 3.3.3.
7. Most students tended to show high interest in the study of mathematics if they realise that mathematics is required in their preferred occupations.
8. Students tended to still retain their preferred occupations even if they realise that mathematics is required in the occupations. This can be seen from table 4.15A where the median and the mean scores were approximately 4 out of 5.
9. On the average, students who preferred to engage in mathematics-related occupations had better achievement scores in mathematics

than those students who preferred to engage in non-mathematics-related occupations.

10. Students who preferred to engage in mathematics-related occupation maintained better attitudes towards mathematics than the students who opted for non-mathematics-related occupations.

Most of the teachers of mathematics interviewed informally within the research area were of the opinion that students were not willing to study mathematics and they tended to generalise that students had negative attitude towards mathematics. These teachers seemed willing to assist in any research work that would lead to the decrease of this negative attitude. On the other hand, some teachers tended to over rate their students' achievement in mathematics. For instance, some teachers commented that their students were not doing badly whereas in all the schools involved, no average score was up to 40 out of 100 marks.

On the part of the students, it seemed that many of them had not strongly made up their mind on the type of occupation to go into. Some students felt reluctant to complete the questionnaires until they were convinced on why they should do so.

Out of so many occupations that an individual can engage in, only a few were mentioned by the respondents. Students therefore were not very much familiar with many possible occupations in which mathematics could be required or utilized.

The result of the informal interview conducted by the researcher also revealed that a majority of people who engaged in one profession or the other tended to agree that mathematics is useful. On the contrary, some literate ones also felt that some of what they learnt in mathematics could not be applied directly in their occupations.

5.2 Conclusions

A number of conclusions from the findings are now presented.

5.2.1 Students' Preferred Occupations and their Attitude Towards Mathematics

As it has been established by this study that most students preferred some occupations which could be classified as mathematics-related this could be a pointer for classroom teachers' tool for motivating the students to pick up a positive attitude towards mathematics. Students who show negative attitude towards mathematics may not necessarily be looking ahead for a non-mathematics-related occupations. Students who may have negative

attitude towards mathematics but are interested in mathematics-related occupations would like to engage in the study of mathematics so that they can retain their occupational preference. As examples from literature reveal, mathematics developed as a result of peoples' interest in solving problems related to their jobs. Now that these students are mostly showing preference for 'mathematics-related' occupations and with their assertions that they would like to study mathematics if it is required in their occupations, perhaps channelling mathematics through its area of application could yield some positive results.

Using a range of 50 to about 70 as a neutral position of the attitude scale, students' attitude towards mathematics still need to be improved. On the average the attitude which is about 75.3% is not positive enough. This low attitude towards mathematics agrees with some of the reports in the literature which stated that students attitude towards mathematics is not encouraging. However, as one of the findings had it, preference for mathematics-related occupations had some significant relationship with attitude towards mathematics. It cannot be concluded from this study, however, that either occupational preference cause attitudes towards mathematics, or vice versa.

The likely conclusion is that there could be some reciprocity between these two variables. Since it has been found from the study that even a student with preference for non-mathematics related occupations will like to develop more positive attitudes towards mathematics if it is required in their occupation s, it may be possible to use students occupational preference to influence students attitude towards mathematics.

On the other hand, it may seem illogical that students' showed a high preference for mathematics-related occupations yet such students have not demonstrated a fairly high positive attitude towards mathematics. It might be that these students were lacking the awareness necessary to link their occupational ambitions to the mathematics which they were studying. This could be a point that need to be watched closely in the classroom, and out of school programmes that involve mathematics. For instance, some of the reviewed literature supported that every person has his reasons for going to school and when the school subjects fall short of individual's expectations there could be alienation .

5.2.2 Students' Achievement in Mathematics and their Occupational Preference

Literature reports showed some evidence in support of the findings that achievement in mathematics

was low and students attitude towards mathematics was below fair. However, students' low achievement in mathematics seemed not to have any much influence on their occupational preference. A student who achieved low in mathematics could be interested in taking up a mathematics-related occupation and he could go ahead studying mathematics more, so that he could retain the preferred occupation. This claim is perhaps what the low but significant correlation between achievement in mathematics and occupational preference as revealed by this study means.

The doubts that some students do express over the West African Examination Council's system of marking students' scripts may not be any reason for their poor performances in school certificate mathematics examinations. This is because the result of the joint mock GCE examination was even not good.

Students' high preference for mathematics-related occupations despite their low achievement in mathematics may not be surprising in this era of technological, and scientific ambition in this nation. Students could be aware of the current areas of job opportunities but they may not be aware that such opportunities have something to do with mathematics.

5.2.3 Students Attitude Towards Mathematics and Achievement in Mathematics

Though there have been some disagreements on the nature of relationships that exist between attitude towards mathematics and achievement in mathematics, this study has in its findings added to one of the existing dimensions. Students' attitudes towards mathematics was below fair but it was more positive than negative. On the other hand, a comparative analysis showed that students' achievement in mathematics does not match with their attitude towards mathematics. This is to say that if the two measures were to be put on the same scale, then attitude towards matmematics would be higher than achievement in mathematics. The often expressed feelings by the teachers of mathematics that students have a negative attitude towards mathematics may be far from the empirical truth. But the notion that students' attitude towards mathematics is related to their achievement in mathematics has been confirmed to some extent by this study's finding of a high positive correlation between the two variables. The high correlation found between achievement in, and attitude towards mathematics could be an indication for the need to start looking

forward for an indepth investigation into any possible causality between the variables.

5.3 Students' Reaction to Mathematics and Their Occupations

The often held notion that students' attitude towards mathematics is negative and that the students seem to resist any attempt to change their negative attitude has been tested in this study. It was revealed from the data analysis that students may maintain a 'fairly favourable attitude' towards mathematics if they realise that their preferred occupations require mathematics. This is to say that the respondents have mostly indicated on the measuring instrument that they will show a fairly high interest in the study of mathematics if it is required in their occupation. This is in line with the natural human tendencies to be always ready to move positively towards the achievement of self-desired goals. It has been stated that a majority of the respondents were indifferent in their occupational preference even if they realise that it requires mathematics. This strong interest of the students for their preferred occupations could be utilized by mathematics teachers if only they can present the subject in line with the preferred occupations.

5.4 Limitations

The limitations as stated below apply to this study.

1. The results which apply only to the selected form five secondary school students in Zaria area depended on the honesty of the respondents in completing the research questionnaires, and the reliability of their achievement scores as obtained from the Mock GCE assessment in mathematics.
   Because the researcher could not have any other more dependable assessment of the respondents' achievement in mathematics as at the time of data collection, the study had to be based on the Mock G.C.E. result from the Kaduna State Ministry of Education. The Mock G.C.E. assessment is not a norm reference test but a criteria reference test which has undergone standardization by experts chosen by the Kaduna State Ministry of Education. Though some of the authorities conducting the Mock G.C.E. examination claimed that it is equivalent to the West African Examination Council's (WAEC) ordinary-level examination and students achievement scores in mathematics was independent of any of the two examinations,

this study has been limited to the relevant measurement from the Mock G.C.E. examination.

2. The availability of the relevant materials which the researcher needed for the study highly determined the generalizability of the findings. For instance, the researcher could only have access to seven out of the nine schools that was intended for the study.

5.5 Recommendations

Based on the various findings and conclusions of this study, some recommendations are presented here for the consideration of various bodies or individuals. Of particular concern are recommendations for the teachers, curriculum experts, Ministries of Education or States and Federal Governments, and for further research.

5.5.1 Recommendation to the Teachers

1. There is a need for means of improving students' attitude towards mathematics. Teachers therefore can approach the teaching of mathematics by addressing the practical applications of mathematics always.
2. Apart from high achievement scores, high favourable attitude towards mathematics should also be the teachers major concern. For this reason, evaluation of mathematics achievement

should include some items to test student's attitude towards mathematics. This could be on:-

a) how much time a student spend attending mathematics classes in a given period of time;

b) how many assignments a student completes within a given time;

c) how often a student goes to a library to study mathematics;

d) what is the extent of coverage of the study items in a mathematics text;

e) how often a student answers or asks good questions in a mathematics class, and so on.

3. Teachers should be aware that mathematics can be taught in a way that will show its relevance to many occupational areas. They should have this awareness, and create the same in the minds of their students. This awareness can be created through the use of visitations to industries, market places, judicial departments, medical institutions, and many other professional establishments. Also, practitioners from various walks of life should occasionally be invited to talk

to students on some of the relevances of mathematics to their work.

4. Every teacher of mathematics should endeavour to find out the occupational areas that his students are hoping to pursue after school. He or she should make students realise the areas where mathematics will be required in the students' preferred occupations.
5. Teachers should endeavour to join useful professional bodies such as the Mathematics Association of Nigeria (MAN) and the Science Teachers Association of Nigeria (STAN). This will give them the opportunity to have current ideas on what is going on in their profession.

5.5.2 Recommendation to Curriculum Planners

1. Mathematics curriculum should be designed to take care of the various interest groups. Therefore, mathematics curriculum should not be mainly centred on theoretical reasons, rather students' needs, societal needs in the real life applications should be looked into.
2. Curriculum planners should ensure that apart from the general basic mathematical knowledge, there should be mathematics for the scientists,

humanities, arts and social sciences, commerce and so on, available at the secondary school level. This will provide students additional area of mathematical uses. They should be aware that whatever the students feelings toward mathematics, students will show a high interest in the study of mathematics if they can see its relevance in their preferred occupations.

3. Mathematical applications should be integrated with the secondary school mathematics curriculum. Possibly, a separate curriculum should be planned for the use of mathematics for teachers at the secondary school level. This could be made easier through the preparation of teachers' guides for various academic levels.

5.5.3 Recommendations to the Ministries of Education

The following recommendations are meant for all the authorities concerned with educational policy making including both the State and Federal government.

1. Teachers should be encouraged to take students out on practical or applied mathematics. This should be by providing all the necessary materials (such as transport, feeding, practical mathematics guides, authoritative letters, security, etc.) that will enhance

the practicability of the practical mathematics field trips. In addition to this, every school should be provided with a mathematics laboratory with essential tools such as an overhead projector.

2. Encouragement should be given to students to study mathematics at higher levels. This could be by giving either State or Federal (or both) scholarships for mathematics students.
3. Mathematics graduates should be given automatic employment.
4. Preferential treatments should be given to mathematics teachers. This will motivate more people into the teaching of mathematics and those on the job can develop a desirable attitude towards their work.
5. There should be a body set up to develop mathematics programmes for broadcast and television. These programmes should involve mathematics in our daily life and mathematical needs in the scientific and technological fields. This will help in creating awareness of mathematics in the minds of many people in the society.

6. Government should employ some mathematics educationists to take care of the inspection of school mathematics teachers in order to direct them on the appropriate approaches to be used in the teaching of mathematics.
7. The government should financially support regular workshops for the teachers to exchange ideas on ways of m aking the teaching of mathematics more practicable and more interesting to the learners.

Summarily, the Federal government should realise that if this nation really needs scientific and technological growth, mathematicians cannot be left out in every step towards that growth. The mathematician and the mathematics educator need all the necessary encouragement to enable the nation obtain her desired mathematics-oriented goals.

5.5.4 Recommendations For Further Research

1. Further study is necessary to find out whether there will be any significant change in students' attitude towards mathematics if they are made to realise the various applications of mathematics in various walks of life. The study should be an experimental one which uses pre-test and post-test analysis to compare the students' attitudes towards mathematics after exposing them to various real life applications or relevances of mathematics.

2. There should be a replication of this study at other places and other academic levels so that the generalizability of the results of the present study can be increased.
3. Further research is necessary on the comparative analysis of teachers' attitude towards the teaching of mathematics, and students attitude towards mathematics or their achievement in mathematics.

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APPENDICES

APPENDIX A

QUESTIONNAIRE FOR THE STUDENTS

General Instruction

Please this questionnaire is not a test. It is only meant to find out from you some of the problems you are having with mathematics so that we can find the ways of helping you. Please be as honest as possible in filling this questionnaire,

Thanks.

Personal Data

Name: _____

School: _____

Sex: Male ☐ or Female ☐ (tick ✓ as appropriate)

Section A

Occupational Preference

Please write below in order of preference, the first (1st) and the second (2nd) Occupation that you will like to do in your life.

(a) 1st Occupation _____

(b) 2nd Occupation _____

(c) If your Occupation is teaching, what subject do you want to teach?_____

Section B

Mathematics Attitude Scale (MAS)

Instruction

Below are some list of statements and questions to find out what you think or feel about mathematics. Read each item carefully and tick (✓) in the box that best agrees with your feelings. If you are not very sure of your feelings, tick (✓) in the box under "Undecided".

1. I feel that mathematics is:

Bad	Fairly bad	undecided	Fairly Good	Good
☐	☐	☐	☐	☐

2. How do you feel about mathematics?

Sad	Fairly sad	Undecided	Fairly Happy	Happy
☐	☐	☐	☐	☐

3. Which of the followong best explains how you feel about mathematics?

Boring	Fairly boring	Undecided	Fairly Exciting	Exciting
☐	☐	☐	☐	☐

4. Which of the following best explains how you feel about studying mathematics?

Jump in readily	Jump in slowly	Undecided	Hold back a bit	Hold back
☐	☐	☐	☐	☐

5. I feel that mathematics is:

Hard	Fairly Hard	Undecided	Fairly easy	Easy
☐	☐	☐	☐	☐

6. I feel like having:

More maths	Fairly more maths	Undecided	Fairly less maths	Less maths
☐	☐	☐	☐	☐

SECTION C

Reaction to Use of Mathematics in Occupation

Please read the following directions carefully and react to the four questions that follows.

Directions

The four questions below are asked to know the extent that you will react to mathematics in your choice of occupation if you discover that mathematics is required in that occupation. Place X in the space that best describes the extent of your reaction.

Questions

If you realise that mathematics is required for the occupations that you prefer to go into, answer the following questions.

	Very high	High	Ave-rage	Low	Very low
1. To what extent will you like to go into the occupation?					
2. To what extent will you like to change your occupation?					
3. To what extent will this make you to continue to like and study mathematics?					
4. To what extent will this not make you like and study mathematics?					

APPENDIX B

Statistical Tools

A variety of statistical techniques were used to analyse the various data collected. This appendix in tends to give a brief description of the techniques or formulae.

The research is based mainly on correlational varifications. Various correlations exist but every correlational coefficient is calculated on the basis of the scale by which the variables are measured. In this study the Pearson product-moment correlation coefficient and the biserial correlation coefficients have been applied. The Pearson product-moment correlation coefficient is for the variable on the interval scale while the biserial correlation coefficient is used for dichotomous variables.

The formula for the calculation of the Pearson product-moment correlation coefficient is usually given as:

$$r_{XY} = \frac{n\Sigma XY - \Sigma X\Sigma Y}{\sqrt{(n\Sigma X^2-(\Sigma X)^2)(n\Sigma Y^2-\Sigma Y)^2)}}$$

where X and Y are the two variables to be correlated.

The correlation coefficients usually lie between -1 and +1. The sign shows whether the relationship between the variable being correlated is positive or negative. The closer the absolute value of the coefficient is to +1 the more perfect the relationship.

This is saying that a correlation coefficient of zero (0) means no correlation.

The above formula was applied in this study to calculate the correlation between the attitude scores (Y) and the achievement score (X) as they relate to mathematics.

The correlation which involves the dichotomous measures from the students preferred occupations was calculated using the point biserial correlation coefficient formula. The formula is a modified form of the Pearson product-moment correlation coefficient used for nominal dichotomously measured variable. The formula is:

$$r_{pbXR \text{ (or XS)}} = \frac{\bar{X}_{.1} - \bar{X}_{.o}}{S_X} \sqrt{\frac{n_1 n_o}{n(n-1)}}$$

where $\bar{X}_{,1}$ means the mean on X of those who score 1 or R (or S as the case may be). The variables R and S represented the students' first and second occupational preference respectively.

$\bar{X}_{.o}$ means the mean on X of those who scored O on R (or S as the case may be)

S_X is the standard deviation of all the n scores on X

n_1 is the number of those scoring 1 on R (or S as the case may be).

n_o is the number of those scoring O or R (or S as the case may be)

$n = n_o + n_1$

In a similar way the coefficient between Y and R (or S) was obtained by the use of the formula

$$r_{pb}\ YR\ (\text{or } S) = \frac{\bar{Y}_{.1} - \bar{Y}_{.o}}{S_Y} \sqrt{\frac{n_1\ n_o}{n(n-1)}}$$

The significance of each of the correlation coefficients was tested for at a chosen α-level of 0.05. The test statistics used in this respect is the formula

$$t = r \sqrt{\left(\frac{N-2}{1-r^2}\right)}$$

where r is the correlation coefficient whose significance is being put to testing. The degree of freedom is N-2.

With a large sample of size n (n>30) this test statistics best approximates the standard Z curve (Gilbert 1976) and it can be used to test a null-hypothesis H_o: ρ=o.

The value of t which has been written as 'Z_{cal}' in this study was compared to $Z_{0.025}$ (i.e. $Z_{\frac{\alpha}{2}} = Z_{critical}$) to test the hypothesis stated in respect to the concerned variables. However it should be noted that apart from the comparison with $Z_{\frac{\alpha}{2}}$, there is often a t-distribution table to check the significance of the correlation coefficients at various significance levels. A hypothesis is rejected if $Z_{cal} > Z_{critical}$ otherwise the hypothesis is retained.

For the purpose of testing the differences of the means in ACMA and ATMA for the dichotomous groups,

the test statistics used is given by the formula

$$t = \frac{\bar{X}_1 - \bar{X}_o}{\left[\left[\frac{(n_1-1)\ S_1^2 + (n_o-1)S_o^2}{n_1 + n_o - 2}\right]\left[\frac{n_1+n_o}{n_1 x n_o}\right]\right]^{\frac{1}{2}}}$$

This was in respect of ACMA. $\bar{X}_1$ means the mean ACMA scores of the respondents who scored 1 in occupational preference. n_1 means the number of respondents who scored 1 in occupational preference. n_o means the number of respondents who scored 0 in occupational preference. S_1^2 is the variance of the ACMA scores of those who scored 1 in occupational preference.

S_o^2 is the variance of the ACMA score of those who scored 0 in occupational preference.

For the test that involved the ATMA (Y) variable, the computation is similar with the exception that the variable ATMA was substituted for the ACMA (X) variable.

APPENDIX C

Description of Schools

School A

Established in 1952, School A is the third oldest secondary school within Zaria. It was a boys school with a population of 1,963 students in 1985/86 session. Out of this population the form five students were 350. The school was located at Kufena village which is about 18 kilometers from Zaria city. Information gathered from the year five students' mathematics teacher indicated that the students' academic standrd in mathematics was very low. The school was comprised of both boarding and day students. It was a public school where admission of students was equally open to every interested candidate.

School B

This school was established in 1982. It was meant to serve as a model for the public schools and to assist in the training of the children of Ahmadu Bello University (ABU) staff. Hence most of the students have educated parents or guardians and are assumed to have a high standard of 'education'. The school with 22 streams and a population of about 870 students and only 125 form five students during the 1985/86 session. It was co-educational. Though the school was having her first set of form five students

during the time of this study, information from the head of mathematics and some members of staff suggested that the academic standard of the school was good but the students' attitude towards mathematics was not encouraging. The school was located within the main campus of the University which is a distance of about 20 kilometers from the city. Because of the location of this school and the type of students, it is assumed that most of the students were aware of the various professional courses offered in the University. Hence their occupational choice may be more realistic than those of their counterparts in the public schools.

School C:

This school was the second largest secondary school in Zaria by the time that this study was conducted With a total number of 3,513 students, there were 375 form five students. The school which was for boys only was established in 1922. Information from the inspectorate division of the Zonal Ministry of Education, Zaria revealed that the school has been one of the most standard schools within the area. However the head of mathematics section of the school informed the researcher that on the average, the students' performance in mathematics was often below "average" (i.e. below 50 percent). The school comprised of both day and boarding students and it was located at a distance of about 8 kilometers from the city. It was a public school.

School D

Established in 1979, the school had a total population of 1,905 students during the time of this study. Out of this population there were only 333 form five students. It was a public co-educational school located within the city. Like in many other schools, the students' academic standard in mathematics was stated as below average. This was revealed by the two mathematics teachers in charge of the year five students. The school was one of the five largest schools in Zaria area.

School E

Out of the seven schools that were considered for this study, this school was the only one which was completely a female school. Established in 1980, the school had 150 form five students as at the time of this study. Its location was at a distance of about 4 kilometers from the city. It was a public school and the general academic performance in mathematics has been reported to be very low by the head of mathematics.

School F

Established in 1980, the school had 1,503 students in the 1985/86 session. Out of this students population, the form five students were 206. It was a public school located in Samaru village which is about 20 kilometers from the city. It was co-educational.

In terms of academic standard, the principal of the school informed the researcher that though the general academic standard of the students had not been very encouraging, the situation in this school has been relatively fair. As regards the students' performance in mathematics, the head of the section and the teachers of the subject claimed that only few students were good but the general average had been low. Also it was claimed that the students do not take the study of mathematics seriously.

School G

The school was established in 1912 and as at the time of the data collection for this study, the students population of the school was about 4,001. Out of this number, 582 students were in form five. The school which was only for boys was situated within the city and it had both boarding and day students. Similar to the reports about other schools above, the researceher gathered from the year five group master and the head of the mathematics section, some information about the students' academic standard. It was made known to the researcher that generally, these students detest mathematics in particular and their average performance had always been low.

APPENDIX D

Distribution of Correlation Coefficients Across Schools

Schools	Correlation Coefficients				
	r_{XY}	r_{XR}	r_{XS}	r_{YR}	r_{YX}
A	0.85*	0.33*	0.17	0.29*	0.11
B	0.78*	0.41*	0.35*	0.32*	0.30*
C	0.74*	0.34*	0.30*	0.33*	0.30*
D	0.70*	0.35*	0/30*	0.43*	0.31*
E	0.58*	0.07	0.09	0.30*	0.31*
F	0.73*	0.15	0.33*	0.22	0.23*
G	0.68*	0.42*	0.42*	0.15	0.46*
All Schools	0.70*	0.31*	0.28*	0.32*	0.28*

*Significant at 0.05 level of significance