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A COMPARATIVE ANALYSIS OF THE MATHEMATICS CURRICULA COURSES OF SECONDARY SCHOOLS AND UNIVERSITIES: IMPLICATIONS FOR STUDENTS' ATTITUDE TOWARDS THE STUDY OF MATHEMATICS

A THESIS FOR THE AWARD OF THE DEGREE OF MASTERS IN MATHEMATICS EDUCATION

SUBMITTED TO THE COMMITTEE ON POST-GRADUATE STUDIES, DEPARTMENT OF EDUCATION
UNIVERSITY OF NIGERIA, NSUKKA

BY

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The above Postgraduate student in the Department of Sub-Science, Faculty of Education has satisfactorily completed the requirements for the Degree of Masters in Mathematics Education.

The work embodied in this Thesis is original and has not been submitted in part or full for any other Diploma or Degree of this or any other University.

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Dedication

This work is dedicated primarily to God ALMIGHTY. It is also dedicated to my dear father, Chief William Igwe Anyanka, my beloved husband, Engineer Jerry O. Nwichi, my beloved children, Uchechukwu, Ngozi, Ijeoma, Chiemezie, Onyekachi, Ikechukwu and Chukwuka.

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Abstract

The Mathematics curricula of Secondary Schools and Universities provide some of the most basic framework for the teaching and learning of Mathematics. These curricula have been in use and yet very few students apply to study mathematics at the tertiary level. Most students fail in mathematics and mathematics-based courses. Some students who were very good in mathematics in the primary and sometimes in the secondary schools detest the subject as they come up to the tertiary level. The analysis and comparison of the Mathematics curricula in senior secondary school (S.S.S.) and Universities becomes inevitable to confirm how these affect students' attitudes toward the study of Mathematics. Five research questions were posed and six hypotheses were formulated to guide the study. The entire university mathematics academic community constituted the target population. Systematic random technique was employed in selecting a sample size of 22 lecturers and 50 undergraduates. A face validated questionnaire with provisions for undergraduates' and lecturers' responses, constructed using the Likert method of 5-point scale, were administered to the subjects. Content analysis of the undergraduate university and S.S.S. Mathematics course content/curricula, were made. The tools for analysis included percentages, mean, standard deviation and Pearson-Product moment Coefficient of correlation 'r', which was subjected to a test of 0.5 level of significance. The major findings were that:

- there is significant relationship between high student enrolment in mathematics programmes and future prospects of mathematics.
- There is significant relationship between positive attitude towards the study of mathematics and effectiveness of mathematics curricula.

- except for few courses like Functional Analysis, Abstract Algebra, Real & Numerical analysis, partial differential equations and topology, there is significant linkage between University mathematics and senior secondary mathematics.
- there is significant relationship between good mathematics teaching and qualification of the teacher.
- there is significant relationship between high enrolment in mathematics programmes and incentives derived from mathematics.

Based on these findings, it was recommended that qualified mathematics graduates with knowledge of psychology of learning should be employed to teach secondary school mathematics. Students should devote more time on the study of mathematics. The areas of relevance of mathematics in the society should be emphasised while delivering lectures on the different courses at all levels.

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Chapter One

INTRODUCTION

Background of the Study

Mathematics is important and is studied so as to enable the learner to possess the necessary skills to solve problems. Yet very few students apply to study the subject at the tertiary level. Few students pass mathematics at the senior secondary school certificate (SSSC) and at the Joint Admission and Matriculation Board (JAMB) Examinations. Many cannot read their desired courses at the University due to their deficiency in mathematics. Many fail when admitted into courses like economics, physics, industrial chemistry et cetera, due to their deficiency in mathematics. Thus, it is clear that the importance of mathematics in the academic pursuit of the Nigerian citizen at the primary, secondary, and tertiary levels cannot be overemphasized. In recognition of its importance, government has made mathematics compulsory in the primary and secondary schools as well as at the 100 level tertiary science courses. The nature of mathematics has made it possible for it to span most, if not all other courses at the three educational levels. Knowledge in these courses are formally transferred to the students through the instrument of education

The Nigerian Government has invested so much on education and has put in place its National Policy on Education. One expects any citizen who has acquired this tool to be able to help in building up the nation. This is very true of mathematics and the science subjects.

The federal Government of Nigeria has adopted Education as an instrument par excellence for effective national development. It is only natural then that Government should clarify then philosophy and objectives that underlie its current massive investment in education and spell out in clear unequivocal terms, the policies that guide governments' educational efforts. The five main National Objectives of the Nigeria are: "The building of:

i) a free and democratic society;
ii) a just and egalitarian society;
iii) a united, strong and self-reliant nation;
iv) a great and dynamic economy;
v) a land of bright and full opportunities for all citizens" (F.M.I., 1981:7).

Consequent to the Five main national objectives, the quality of instruction at all levels has to be oriented towards inculcating values such as:

i) respect ;for the worth and dignity of individuals;
ii) faith in man's ability to make rational decisions;
iii) moral and spiritual values in interpersonal and human relations;
iv) shared responsibility for the common good of the society;
v) respect for the dignity of labour; and
vi) promotion of the emotional, physical and psychological health of all children.

The mathematics curricula should play the major role of inculcating all the six values since by its nature it filters into all other courses.

"The national educational aims and objectives to which the philosophy is linked are:

i) the inculcation of national consciousness and national with;

ii) the inculcation of the right type of values and attitudes for the survival of the individual and the Nigerian society:

iii) The training of the mind in the understanding of the world around;

iv) the acquisition of appropriate skills, abilities and competencies both mental and physical as equipment for the individual to live in and contribute to the development of his society as well as the development of a great and dynamic economy", (F.M.I. 1981: 8).

If these educational objectives are to be achieved, the contents of every mathematics curricula should reflect topics geared towards their achievement. Since their achievement means the future career development and survival of the individual and so the nation, the content of the mathematics curriculum should be such that will arouse willingness to study mathematics thereby leading to high student enrolment.

The objectives of the National Secondary Schools mathematics curriculum viz:

i) To generate interest in mathematics and to provide a solid foundation for every day living;

ii) To develop computational skills;

iii) To foster the desire and ability to be accurate to a degree relevant to the problem in hand.

iv) To provide necessary mathematical background for further education;

v) To develop precise, logical and abstract thinking;

vi) To develop ability to recognise problems and solve them with related mathematical knowledge;

vii) To stimulate and encourage creativity (F.M.E. 1998).

Furthermore, the objectives of the senior secondary mathematics curriculum are:

i) To help students develop conceptual and manipulative skills in mathematics and its applications;

ii) To ensure continuity with the curricula used in universities, polytechnics, Federal Colleges of Education, and Colleges of Science and Technology, so that graduates of these syllabuses will have a sound foundation of mathematical knowledge and skills on entering any of the above mentioned institutions;

iii) To produce potential mathematicians, engineers and scientists (F.M.E. 1985).

The aims of higher education mathematics curriculum which are closely linked with these are:

i) to prepare the individual for secondary and post secondary teaching;

ii) to prepare the individual for pure and applied research in an educational governmental or industrial setting;

iii) for thorough coverage of the theoretical aspects of mathematics;

iv) to emphasise the in-depth study of mathematical methods in order to prepare the graduate for the application of these methods and concepts to the solution of real life problems;

v) to offer courses in both pure and applied mathematics. (F.M.E. 1985). Precisely speaking, Higher Education mathematics should aim at:

i) producing mathematics teachers and researchers;

ii) producing mathematicians, engineers and scientists that apply mathematics as a universal subject as well as a means for describing the world;

iii) producing human being who can develop axiomatic theories and formularise them (pure mathematicians) or solve practical problems using applied mathematics (applied mathematicians).

> It should "produce mathematicians who can serve the needs of our scientists, who serve the needs of our technologists, who in turn, serve the needs of the country" (Kapur, 1976: 163).

These objectives are very sound and laudable and if achieved, could raise the nation to an enviable standard both morally and technologically. In spite of these laudable objectives, the system is continuously crumbling, innocent citizens are crying out for decorum to return to the system. It should therefore be the paramount concern of the elites in the society to address this issue. It also becomes imperative to reflect continuously on the nature of our mathematics curricula, their relevance to the needs of the nation and implications for students' attitude towards the study of mathematics.

The government supports this by her statement, "Since education is a dynamic instrument of change, this policy (as well as all its tools for transfer of education) will need to be constantly reviewed to ensure its adequacy and continued relevance to National needs and objectives" (F.R.N. 1981: 6).

Statement of the Problem

The Mathematics Curricula of secondary schools and Universities which provide the most basic framework for teaching and learning Mathematics have been in use in our schools for more than a decade now. This notwithstanding, very few students apply to study mathematics at the tertiary level, as shown in Table 1. There is need to preserve the link between the different levels of mathematics so as to sustain students' positive attitude towards the study of mathematics. Any missing link allows discontinuity.

Table 1: Respondents' Agreement on Enrolment Data into Mathematics Programmes - 1993 to 2001

YEAR	NO OF STDS 1 - 10		11 - 20		ABOVE 20	
	UNN (X)	ABSU (Y)	UNN (X)	A.B.S.U. (Y)	U.N.N.(X)	A.B.S.U. (Y)
1993	16 = 100%	6 = 100%	-	-	-	-
1994	100%	100%	-	-	-	-
1995	100%	100%	-	-	-	-
1996	100%	-	-	6=100%	-	-
1997	100%	-	-	-	-	-
1998	-	-	-	-	-	-
1999	-	100%	-	-	-	-
2000	100%	-	-	-	-	-
2001	100%	100%	-	-	-	-

If such a gap occurs, the University graduate may have a different view of what to teach at the lower level - that is, what he is expected to teach, he will not know. The lower level mathematics may be forgotten while learning an entirely different one that has no link with it. There may also be difficulty in conceptualising the new knowledge which has no link with the previous knowledge.

A close study of the tertiary and senior secondary mathematics curricula reveals that some courses in the tertiary curriculum appear to have no link with the lower level mathematics courses. For example, courses on Limits, Continuity, Differentiation, Integration and Computer Science seem to have no basis on the secondary school mathematics (See Table 2, 3a and 3b of the revised undergraduate academic programme 1990/91, Department of Mathematics, UNN and ABSU). Again some courses which have no link with the lower level courses also terminate prematurely, for example, Optimisation theory, Operations research, Discrete Mathematics (Table 2, 3a and 3b). Also some undergraduate mathematics students find it very difficult to acquire the knowledge of some mathematics courses. This is shown in the Mathematics results of years 1994 to 2000, (Table 2). There is need therefore, for regular comparative analysis of the curricula at the senior secondary and tertiary levels, so as to locate such missing link and suggest ways of closing the gaps.

Purpose of the Study

The purpose of this study was to analyse and compare the New S.S.S. Mathematics with the University Mathematics Curricula in relation to how the former relates to the latter and how the former affects students' attitudes to mathematics. Specifically, the study was intended to:

TABLE 2.7

[illegible]

[illegible] SEMESTER EXAMINATION RESULTS: 1996/97 S[illegible]

200 LEVEL MATHEMATICS

S/N	NAME	MAT NO.	TOTAL UNITS REGD.	MAT 201 (3)	MAT 202 (3)	MAT 213 (2)	MAT 221 (3)	PHY 201 (3)	CSC 201 (2)	STA 211 (4)	STA 111 (4)	TOTAL UNITS PASSED	TOTAL UNITS CARRY OVE
1.	Jude, O. C	95/19387	24	40E	18F	18F	41E	47D	43E	46D	45D	19	5
2.	Ugbala, I R	95/19388	20	40E	37F	31F	31F	41E	58C	21F		8	12
3.	Ibenye, E C	95/19390	20	40E	17F	21F	41E	44E	40E	21F		11	9
4.	Eburaja, B C	95/19393	20	53C	34F	27F	36F	40E	20F	13F		6	14

	NAME	SIGNATURE	DATE
COORDINATOR	DR N.I ONUOHA	[signature]	4/8/97
DEAN			
REGISTRAR			

TABLE 2.

SCHOOL OF PHYSICAL SCIENCES
SECOND SEMESTER EXAMINATION RESULTS: 1996/97 SESSION

300 LEVEL MATHEMATICS

S/NO	NAME	MAT. NO	TOTAL UNITS REGD.	MAT 316 (3)	MAT 322 (3)	MAT 324 (3)	MAT 332 (3)	CSC 301 (3)	MAT 223 (3)	MAT 241 (2)	CSC 202 (2)	TOTAL UNITS PASSED	TOTAL CARRY-OVER UNITS
1.	Nwachukwu, Kenneth O.	93/15083	15	55C	63B	52C	67B	50C	CNR	CNR	CNR	15	-
2.	Osu, Eright O	93/15086	15	64B	79A	68B	78A	59C	CNR	CNR	CNR	15	-
3.	Ihekorom[illegible] C.	93/15087	21	15F	25F	08F	00F	40[illegible]	40[illegible]	66[illegible]	24F	8	13

	NAME	SIGNATURE	DATE
CO-ORDINATOR:	DR. N. OGBONNA	[illegible]	23/3/98
DEAN:	Dr. U. D. Okeke	[illegible]	15-4-98
REGISTRAR:			

TABLE 2

SCHOOL OF [illegible]

SECOND SEMESTER EXAMINATION RESULTS: 1996/97 SESSION

200 LEVEL MATHEMATICS

S/N	NAME	MAT.NO	TOTAL UNITS REGD.	MAT 251 (3)	MAT 241 (2)	MAT 231 (3)	MAT 224 (3)	MAT 223 (3)	MAT 214 (2)	CSC 202 (2)	GST 106 (2)	PHY 103 (3)	PHY 102 (3)	TOTAL UNITS PASSED	TOTAL CARRY OVER UNITS
1.	OFFOR, C.J.	95/19387	21	34F	50C	03F	35F	23F	40E	13F	-	25F	-	04	17
2.	Ugbala, R.I	95/19388	24	27F	44E	08F	58C	31F	43E	20F	-	54C	43E	13	11
3.	Ibenye, E.C.	95/19390	23	53C	60B	00F	41E	46D	40E	26F	60B	-	40E	18	5
[illegible].	Eburaja, B.C	95/1[illegible]	16	40E	40E	01[illegible]	[illegible]	29F	21F	04F	-	-	-	[illegible]	[illegible]3

COORDINATOR'S NAME: DR. N OKEONNA

SIGNATURE: [illegible]

DEAN: [illegible]

DATE: 23/3/9[illegible]

REGISTRAR:

TABLE 9

100 Level Mathematics

SCHOOL OF PHYSICAL SCIENCES

FIRST SEMESTER EXAMIN ATION RESULTS 1999/2000 SESSION

S/NO	NAME	MAT NO.	TOTAL UNITS REGD.	MAT 101 (3)	PHY 155 (1)	PHY 101 (3)	GST 101 (2)	GST 102 (2)	GST 103 (2)	STA 111 (4)	TOTAL UNITS PASSED	TOTAL CARRY OVER UNITS
1.	Nweke Ijeoma Anne	99/32046	17	45D	66B	40E	50C	46D	58C	72A	17	-
2.	Ezenwa Obinna Nixon	99/32047	17	57C	47D	ABS	19F	40E	58C	41E	12	5

	NAME	SIGNATURE	DATE
COORDINATOR	Dr. A. C. Okoroafor	[signature]	23/10/2000
DEAN	Dr M C Chike	[signature]	23/10/00
REGISTRAR			

1. examine the inter- and intra-relationships between each of the courses in the S.S.S. and University Mathematics Curricula in terms of their continuity, Sequence, Scope and variety.

2. determine whether effectiveness of the mathematics curricula is a factor on positive attitude towards the study of mathematics.

3. Determine whether high students' enrolment in mathematics programmes is an off shoot of future prospects of mathematics and incentives derived by mathematics lecturers and students.

4. determine whether premature termination of a course affects ability to conceptualise a knowledge of that course.

5. determine whether failure in mathematics is caused by lack of subordinate knowledge in mathematics courses.

The study also found out missing links and suggested topics to link up the different levels.

Significance of the Study

Mathematics is an important subject because it has applications in all areas of endeavour. Any issue which **affects** its learning needs to be investigated. To that extent, the theoretical significance of the study can be considered to be on the basis of establishing how secondary school mathematics contents relate with that of the undergraduate mathematics. In practical sense, if the findings indicate that lack of subordinate knowledge in mathematics courses leads to failure in mathematics, it implies that something is wrong with the approach to teaching or learning, or the content of the curriculum between secondary and undergraduate mathematics. It could be from poor teaching, gap in continuity or lack of devotion to the course. Such a result could create on the part of the teacher, a change in teaching approach, to the curriculum planners, a review the content of the curriculum between secondary and undergraduate mathematics. It could be from poor teaching, gap in continuity or lack of devotion to the course. Such a result could create on the part of the teacher, a change in teaching approach, to the curriculum planners, a review of the content of the curriculum to ensure continuity and on the part of the student a deeper approach to learning (or more devotion).

The findings of this study is expected to be of immense value to the mathematics units of the universities, who are expected to use the findings to improve the contents of the mathematics they teach. It will also help them to understand and appreciate the problems which their new students entering the universities have, with regard to their deficiencies in mathematics. When these problems are better understood and resolved, there will be enough mathematicians who can formulate mathematical problems from physical situations, solve and apply them for the alleviation of societal developmental problems.

Research Questions

The following research questions guided the study:

1. To what extent are the University mathematics course content and the senior secondary mathematics content related?
2. To what extent does effectiveness of the mathematics curriculum affect high student enrolment in mathematics programmes?
3. To what extent are the curricula of different Universities uniform?
4. To what extent do future prospects of mathematics affect students' enrolment in mathematics programmes?
5. To what extent does effectiveness of the mathematics curricula affect positive attitude towards the study of mathematics?
6. How effectively does the qualified mathematics graduate handle senior secondary mathematics?

Hypotheses

`The following hypotheses were formulated and tested at the 5% level of significance:

1. There is no significant relationship between University Mathematics course contents and Senior Secondary mathematics content.

2. There is no significant relationship between inability to conceptualise knowledge of a course and premature termination of a course.

3. There is no significant relationship between failure in mathematics and lack of subordinate knowledge in mathematics.

4. There is no significant relationship between positive attitude towards the study of mathematics and the effectiveness of the mathematics curricula.

5. There is no significant relationship between high student enrolment in mathematics programmes and future prospects of mathematics.

6. There is no significant relationship between good teaching of senior secondary mathematics and qualification of the teacher.

Scope

The study spanned the mathematics curricula content of senior secondary schools and the University Mathematics curricula contents for the 100 level to 400 level students.

Chapter Two

REVIEW OF RELATED LITERATURE

The literature review is treated under the following sub-headings:

1. Theoretical need for the continuity of mathematics curricula;
2. Empirical Review
   - Importance of mathematics in material development;
   - Importance of mathematics in human development;
3. Summary of literature review.

Need for the Continuity of Mathematics Curricula

All the planned educational programme of experiences designed to inculcate to the learner knowledge, skills, competencies and values under the guidance of an institution in order to effect certain changes in the behaviour, Mkpa (1987: 530) has been the practice in majority of school systems the world over, Nigeria inclusive. "Thus a curriculum of a subject is a set of prescriptions which ensures a good interplay between the teacher, the learner, the subject matter - its content, the methods of presentation and realisation, the physical and psychological environment where the programme is being executed", (Falayajo, et al, 1990: 27). Furthermore, "in order to make all these aspects of the curriculum into a unit whole for the purpose of making a success of the package, the curriculum must be governed by objectives, which are precise statements for the purpose of teaching the subject. Therefore a good mathematics curriculum must have a set of spelt out objectives which will facilitate the choice of the entire content of the curriculum - i.e The subject matter, methods, materials, analogues and teaching strategies; offer directions for anybody who may want to use the curriculum and make evaluation of what has been learnt effective and purposeful. Thus, objectives offer basis of measuring the effectiveness of the curriculum itself, the level or extent of realisation at the end of an instructional process", (Falayajo, 1990:27). Providing curricula that have continuity, relevance and depth based on the general objectives of teaching mathematics in the senior secondary school and the university is highly indispensable in any learning programme.

The transition period from S.S.S. to the university (an entirely new system) creates lots of problems if the continuity of the curricula is not carefully considered. "Mathematical contents of any learning programme should be keyed to the level of mathematical sophistication of the students" (Gagne 1963: 158). "An individual will not be able to learn a particular topic if he has failed to achieve any of the surbodnate topics that support it", (Gagne, 1963:162, 163). Again, "... content variables pertaining to the structure and organisation of knowledge being taught is also valuable to the learning of mathematics, (Gagne 1963: 164).

Since a good curriculum ensures an interplay between the teacher, the learner, the subject matter the physical and psychological environment it becomes necessary to discuss the role of the school and the mathematics teacher in ensuring high student enrolment rate in the mathematics discipline.

The Role of the School and the Mathematics Teacher

Schools provide the most basic frame work for the teaching and learning mathematics. Some mathematics can however be learned out of school for example, the traditional mathematics which involves knowing the number of seed yams for equal number of mounds (say) or the quantity of food for a given number of people et cetera. Mathematics is studied from primary through secondary to the university, unlike Physics, Medicine et cetera, which are not studied in the primary schools. The school should ensure that Mathematics teachers employed by her are adequately equipped for the job of teaching mathematics. According to (Tyler, 1949: 126) "Unless the objectives are clearly understood by each teacher, unless he is familiar with the kinds of learning experiences that can be used to attain these objectives, and unless he is familiar with the kinds of learning experiences that can be used to attain these objectives, and unless he is able to guide the activities of students so that they will get these experiences, the educational program will not be an effective instrument for promoting the aims of the school. Hence, every teacher needs to participate in curriculum planning at least to the extent of gaining an adequate understanding of these ends and means". Again the school plays the role of conducting studies of the learners, studies of life outside the school and in examining the reports of the subject specialist", (Tyler 1949: 126). In this way there will be information flow between the school, the learner and the community.

The multidisciplinary nature of Mathematics could be explored by schools in order to arouse students' interest in the subject. According to Mkpa (1987:139), "This could be achieved by an integration of similar or related areas of different disciplines into a coherent thought." Thus Mathematical aspects of different disciplines could be integrated into one coherent thought. This can act as an interest generator if taught as a course in mathematics. "An individual will not be able to learn a particular topic if he has failed to achieve any of the subordinate topics that support it, (Gagne 1963:162).

The schools should ensure that (i) what is learned at one stage has direct bearing with what is learned at another stage; (ii) There is a link between the mathematics programmes at every stage. This preserves continuity existing between the stages. When there is a gap, a problem emerges. It is important then that the senior secondary school mathematics be related to, relevant and appropriate for University mathematics work so that the interest they developed for mathematics in the lower stage could be sustained in the higher stage.

The teacher is a major learning resource in Mathematics at any level. If he is effective, he is a catalyst, a stimulator, an inspirer. He has to be able to facilitate learning by creating opportunities which enable the learner to investigate situations. He has to have internalised techniques which enable him to go beyond ordinary routine questions ending only at the knowledge level. Comprehension, application, analysis, synthesis and evaluation levels, which may together be called the higher intellectual skills and abilities have to be viewed as important attributes to be acquired by the students via the teacher. Activities and practical experiences are vehicles through which the teacher leads his students in pursuit of the achievement of the objectives. The teacher has to be effective. The beginning point of this effectiveness is mastery of the mathematics to the extent that he can teach it with confidence to his class.

The teacher's personality is also important. Ohuche (1988) reiterates, "... In the Nigerian context, he has to show warm affection to his students. Positive reinforcement is also necessary from time to time for the students, parents and teachers inclusive, in order for these objectives to be achieved". Sufficient motivation to parents and students include making them to see the values of Mathematics - That is, what will Mathematics make out of them? According to Machia Villa, "The means justifies the ends".

It is very unfortunate though, that most students shy away from this vital subject. According to statistics, the number of Mathematics undergraduates at all the levels of the Nigerian Universities is always less than 20 annually compared with over 200 students found in other disciplines like Medicine, Engineering, Sociology, Education, et cetera. This trend must be redressed if this country really hopes to have her place in the technological arena which remains the pride of nations. Reviewing the relevance of Mathematics in Human and Material development, the world over, cannot be over emphasized. Mathematics deals with the quantitative aspects of shapes, calculations, measurements, projections, logic, et cetera. These are basic tools needed by any society. Adamu (1979: 7) states, "The important problems facing the world are basically the social ones - feeding, clothing, housing, movement from place to place, protecting oneself against others et cetera". To meet these needs, science and technology should be innovating, improving, and exploiting means of solving the problems. Although various disciplines are required to deal with the above problems and their solutions, of all these disciplines, Mathematics with its features of being a basis for other disciplines provides a qualitative description of these problems thereby preparing them for easy solution. Adamu (1979) continuing says, "... for science and technology to provide means of getting all these social needs, mathematics has to develop the necessary man-made models required and emphasis will also be placed on the manipulable and computational aspects of Mathematics." Thus, in effect, social considerations should be the driving forces behind the practice and development of Mathematics.

Importance of Mathematics in Material Development

Culture is dynamic and for a good cultural change, a nation needs to know where she was, where she is at present and how she could blend the transferred cultures with the host culture to get to the future. This makes continuity possible.

Mathematics, being one of the cultural components of any society has played diverse roles in material developments. In textile industries, Engineering, food processing, housing, motor production, predictions, designing etc, mathematics has affected changes for the better.

Textile Industries:

Mathematics comes into play in the following ways:

i) Measuring accurate lengths or weights of fibre for thread production and hence for weaving any particular material;

ii) Volumes of chemicals for dye mixtures to produce assorted colours of materials;

iii) Quantity of polymer agents for the production of assorted synthetic fabrics.

Other Areas Affected by Mathematics :

iv Economy of materials for sewing garments etc, such as lengths of materials adequate for making a number of dresses for different sizes of individuals, number of buttons to be used for dresses, length and sizes of zips etc.

v) Buying and selling of clothes, blinds, beddings etc; to maximise profit.

Prior to this era, lots of wastage where incurred. Small-sized human beings were seen dressed in overflowing, shapeless garments. Interior decorations looked awkward, out of proportion and rough. These were so because accurate measuring instruments like tapes, rules, etc were lacking and where they are available, they were not being used because men's thought were not seriously inclined to Mathematics.

Engineering Technology and Motor Design and Production:

According to the Oxford English dictionary, "Engineering is the application of Science for the control and use of power especially by the use of machines". Technology on its part has been defined as, "the systematic application of tasks.

Scientific knowledge to the practical tasks in industry and for the control and use of power with the aim of solving problems for man". It is therefore clear that engineering technology has its foundation based on Science with mathematics as the bed-rock. Engineering technology as a field can be divided into two main areas - teaching and practice. In either cases, the knowledge of mathematics forms a great and indispensable tool.

a) Academic Field of Engineering Technology:

Together with scientific theories, problems are presented, analysed and tested mathematically in the teaching of engineering technology. The indispensable relevance of mathematics in Engineering Technology is further manifested in the pre-requisite subjects required by the institutions of higher learning everywhere in the world. Together with physics and chemistry, mathematics forms the core subject required by the Universities/Institutions as the basic prerequisite before any prospective student is offered admission to study Engineering.

On gaining admission into the University, a student of Engineering is taught and trained to see and use mathematics as a very useful tool. Various courses of mathematical bias are taught the students. These courses can go by any of the names like Advanced Mathematics, applied mathematics for technicians, and so on.

These courses prepare the student for the practical problems he will be facing in the field after graduation. The importance of mathematics in Engineering

Technology can further be x-rayed by the fact that scientific theories and discoveries made by scientists remain just an information until their mathematical models or formulas are developed. It is this mathematical model that will serve the Engineer as a tool after it has been tested and proved.

b) Practical Field of Engineering Technology

In the practical field, Engineering Technology spreads into areas of Mechanical Engineering, Electrical Engineering, Civil engineering, Chemical engineering, Petroleum engineering, Computer engineering et cetera.

The core areas of engineering practice include research, designed and manufacturing. In all these areas, mathematics is used as an essential tool to solve problems. The various branches of mathematics are brought into play in different ways in the industry. A worthy while description of the role of each branch is given below:

Arithmetic:

Arithmetic, as a branch of mathematics has been defined as "science of numbers". In the industry, numbers are used extensively. Numbers are used to quantify problems and targets. Goals are set and pursued in numbers (see table 3).

Table 3: Mercedes-Benz Anammco - 1992 Annual Production Programme

		Unit Per Year		Difference to Year Before	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
ıe	Model	Product-ion on 1991	Planned 1992		20	20	22	20	18	22	21	21	22	21	21	18
1/48W	353.002	1	-	-1	-	-	-	-	-	-	-	-	-	-	-	-
1/48C	353.002	158	212	54	20 20	22 42	22 64	20 84	20 104	20 124	14 138	14 152	15 167	15 182	15 197	15 212
911/36	353.001	12	33	21	-	-	-	-	-	-	3 3	6 9	6 15	6 21	6 22	6 33
ı11/42	363.102	4	-	-4	-	-	-	-	-	-	-	-	-	-	-	-
ı13/48	353.005	3	-	-3	-	-	-	-	-	-	-	-	-	-	-	-
1/42C	363.002	-	3	3	-	-	-	-	-	-	-	-	-	I 1	1 2	1 3
		.	.	.	.	.	.	.	.	.	.	.	.			
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
AND TAL		210	901	191	70 79	86 165	86 251	84 355	86 420	89 509	79 588	51 639	59 698	60 758	78 836	55 901

Taking the researcher as a case study, his experimental findings are often presented in the form of statistical array of numbers. ıed on these numbers, he develops a mathematical model which he tests by putting numbers as input while he equally gets as output numbers, from the model. The designer often gets specifications of what he is to design in the form of numbers telling the quantity and dimensions of what is expected of him. The manufacturer adheres to his dimensions presented in the form of numbers. Any deviation from the numbers specified by the designer renders the product ineffective in service. In computer technology, the design of the computer logic system is based on the binary system of numbers. This is just to mention a few of the numerous applications of numbers in Engineering.

Algebra

By definition, algebra is, "a branch of mathematics in which signs and letters are used to represent quantities". The mathematical models which form the essential tool of the scientist and engineer are algebraic formulae which are logical enough to represent practical problems. The researcher develops these algebraic models which the designers and manufacturers use in their work. Depending on the problem before the designer, he chooses from the numerous algebraic formulae he learnt during his training to make his design decisions and specification which he passes on to the manufacturer for implementation.

Trigonometry

Trigonometry is the branch of mathematics that deals with the relationship between the sides and angles of triangles. A lot of physical phenomena are represented mathematically with mathematical functions or models which are dependent on the trigonometrical functions such as the sine, cosine, tangent, et cetera, of angles.

The graphical constructions as well as the physical construction of some objects can only be achieved through the knowledge of trigonometry.

Geometry

As a branch of mathematics, geometry is a science of the properties and relations of lines, angles, surfaces and solids. Expressed in another way, Geometry is a science of figures. It forms the nucleus of Engineering drawing, technical drawing and descriptive geometry all of which form the essential tool in engineering design. The researcher bases his mathematical models on the geometrical shapes like the circle, triangle, rectangles, trapezium, cone, and a host of others. The manufacturer on his part produces physical objects based on his knowledge of the geometrical shapes of the objects. Other branches of mathematics, which is inexhaustible, include Calculus - used to complete solutions to problems in engineering; mechanics - Taking moments is employed in weight balancing, levers and pulleys.

In motor construction, areas of aluminum sheets to be used in determining a particular size of car to be built, grades of nuts to be used in fixing the car parts (for example, 2mm by 3mm nut et cetera), voltages of the various electrical parts to be used, voltages of car batteries, bulbs, radio and television, all require the knowledge of mathematics. In car assemblage, mathematics is involved. For example, knowing the circumference of some holes, sectors or circles made in the body of the car and comparing it with whatever will be inserted therein, such as connection of wire cables, tyres et cetera. In battery charging, the volume of liquid acid to be added to the battery casing is mathematics. In refilling petrol and oil tanks, the volume of the tank and amount of liquid to be added entails mathematics.

In buying and selling of these cars or increasing the sizes of cars and number of seats to maximise profit, mathematics comes into play. Prior to this era, such engineering expertise was not enjoyed because people lacked a thorough knowledge of mathematics. To conclude this section, the researcher cites a typical practical engineering problem in an industry to see the relevance of mathematics in solving such a problem.

Problem (by Origbo, N.S. - Product Designer - ANAMMCO (1992)

A fire service station request for a fire fighting water tanker from a motor manufacturing company with the following specifications:

Tank capacity (V) 7,000 litres; Shape of tank - Elliptical; Major diameter (b) - 1,900mm; Minor diameter (a) 1,200mm; Total weight of tank (w) = 1000kg; Vehicle model - Mercedes-Benz 911 truck; Wheel base (m) - 5,170mm. The problem before the designer is given using numbers to state what is required. The designer applies his mathematical tools to get the problem solved the following way:

First Step

Applying his knowledge of Geometry, he designs the water tank to have the shape of an ellipse as shown in the figure 1 below.

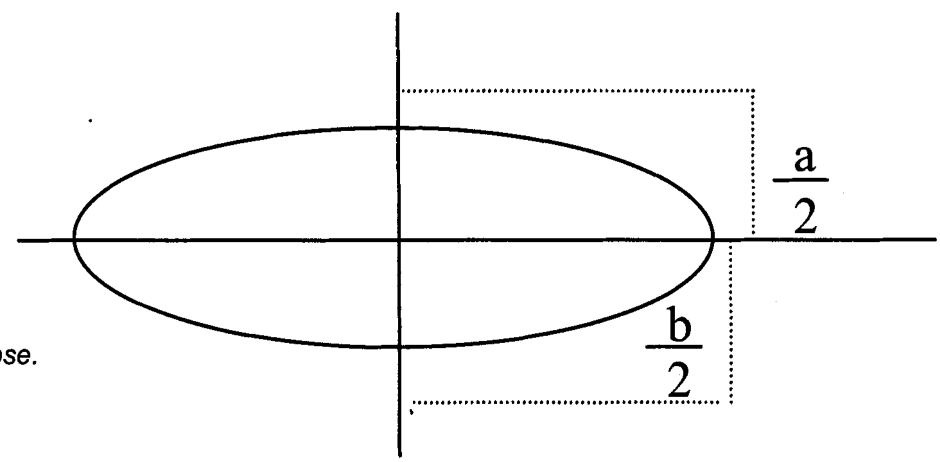


***Fig. 1** - A Ellipse.*

To determine the length (L) of tank that will contain 7,000 litres of water, the designer applies geometry and algebra to get the volume (V) of the tank as

To balance the tank on the truck as shown in figure 2, the following algebraic equation are applied:

$$E = \frac{w}{m} \times \text{Total weight of tank}$$

$$R = \frac{W(m-x)}{m}$$

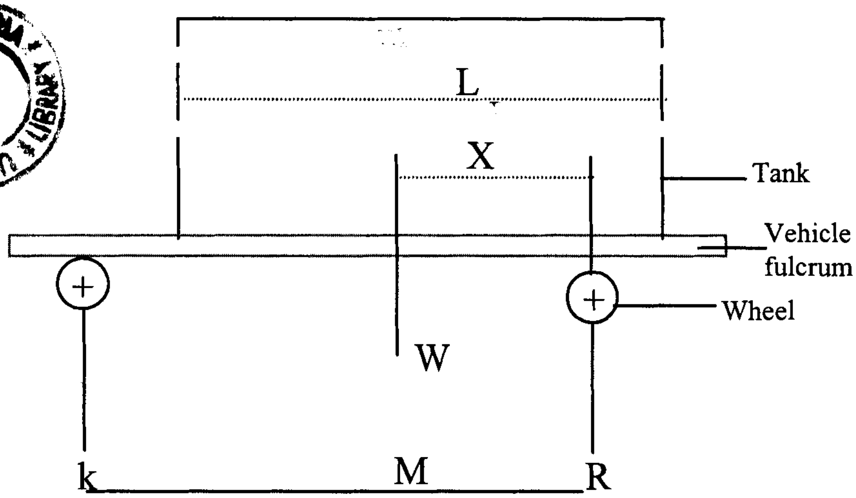


Figure 2: *Tank position on the vehicle*

Based on the result of the calculations done with the above formulae and others, the fire fighting water tanker is finally designed and drawn as shown in figure 3.

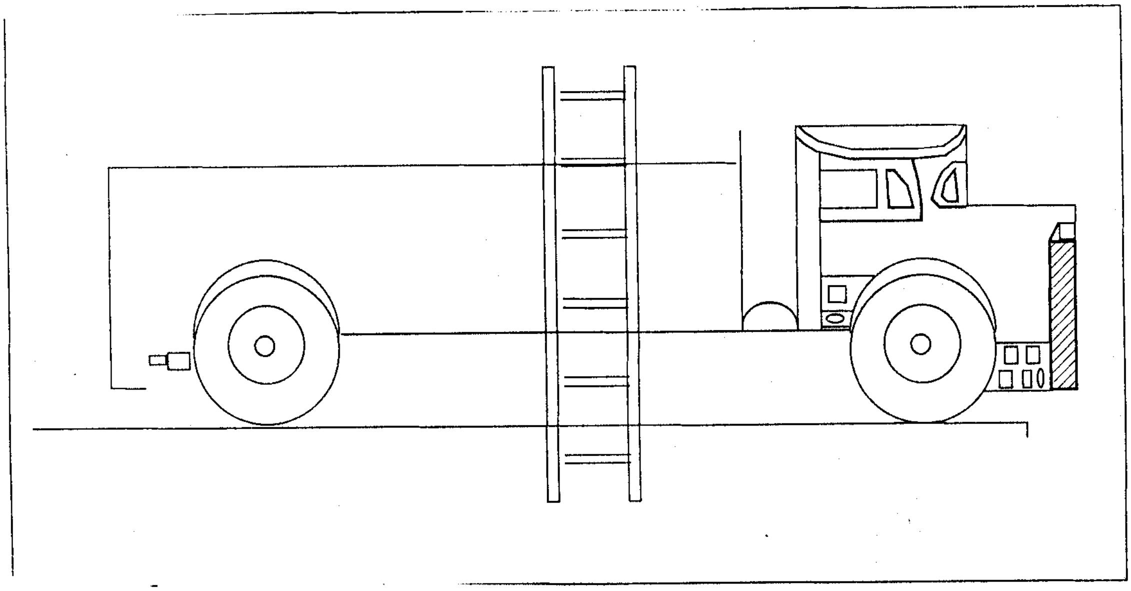


Figure 3: *Fire Fighting Water tanker.*

Following this final design drawing, the producer manufactures the fire fighting water tanker to be delivered to the customer. He achieves that by applying his knowledge of mathematic, trigonometry, mechanics and especially geometry to construct and assemble the parts.

Food Processing

Knowledge of the correct quantity of chemical food agents required for preparing mixtures for the processing and production of food such as bread, biscuits, maggi cubes/sauce/powder cetera involves mathematics. The quantity of preservative to be added to foods for it to last longer, requires some mathematical bias. In garri processing, the number of cassava tubers for a particular quantity of garri or foofoo, the number of people to peal the cassava and fry the garri at optimum time so as to maximise profit after sales and expenses (e.g. payment of labourers) require the knowledge of mathematics.

Housing

Equating the cost of building materials, equipment, tools and manpower with the amount of money available for the construction of the houses requires the knowledge of mathematics. In surveying, quantity surveyors require the knowledge of mathematics in the development of Estates. For example, estimating the number of houses that can occupy a piece of land, number of pumps, poles, cables, et cetera; quantity of cement, sand and concrete to be used for each house. If such houses are for sale, then quantifying the input materials so as to know at what price to sell it requires the knowledge of mathematics. Such is the diversity of the role of mathematics in different spheres of material development the world over. Prior to this era, people could not build well structured houses. They lived on trees, in caves and mud houses that could be destroyed by any strong wind. They had little inclination to mathematics and so remained behind the clouds until the new mathematics era emerged.

Importance of Mathematics in Human Development:

The structure of mathematics is clear, concise and transforms thoughts about relatively subtle ideas which may have been hitherto vague or non-existent. The language of mathematics is more efficient and less bulky than the written word; it reveals the assumptions being made in their naked simplicity. For example, "Let N be the set of natural numbers. For every element of the set of natural numbers, a_{n+1} is greater than a_n", can be simply written using mathematical language as $\forall\, n \in N\ a_{n+1} > a_n$.

It is more difficult to cheat conclusions with a mathematical argument. The results of a mathematical debate are precise and depend only on the initial assumptions. For given a set of assumptions the mathematical conclusions are accurately expressed. Their results cannot be argued with but the assumptions can be criticised. With a mathematical description, it is possible to arrive at optimal solutions which would not be obvious without the analysis. The structure of mathematics is versatile enough to allow one to clarify a point while at the same time allows researchers to be sure that a new result is proved without mistakes. The mathematical algorithm (that is procedures for carrying out a calculation) enables man to develop logical ways of attending to situations. It helps to build up the psychological state of man, lifting him from a state of confusion, rawness and roughness to a state of logical and systematic ways of dealing with situations. In the final analysis, a well-informed man results. A literate society where human rights are respected and accorded emerges.

The engineer now thinks of using the techniques of calculus to complete solutions to problems. The medical worker then uses the differential equation theory to make precise decisions concerning glucose tolerance for diabetes and the like. The experimental worker comes up with computers and statistics. Matrix methods are then employed in the estimation of future population. The business man employs simple book-keeping or accounting techniques to get optimal results. Thus, the knowledge and applications of mathematics has resulted to the emergence of a literate society.

We conclude then that mathematics has an important role to play in a wide range of applications, so long as we are realistic about what it cannot do, as well as what it can do.

Summary of Literature Review:

Mathematics we know, is the bedrock of science, technology and business. A positive attitude by all towards the study of mathematics is required to attract high enrolment of students in mathematics programmes in order to produce more graduates of mathematics. There is need for the continuity of mathematics curricula at all levels to avoid break in the transfer of knowledge. Gagne (1963:164) reiterates that content variables pertaining to the structure and organisation of knowledge being taught is also valuable to the learning of mathematics. Continuing, Gagne (1963:168) emphasises that mathematical contents of any learning programme should be keyed to the level of mathematical sophistication of students. Mathematics is relevant in human and material development. Adamu (1978:7) points out that the important problems facing the world are basically social ones - feeding, clothing, housing, movement from place to place, protecting oneself against others et cetera. To meet these needs, science and technology should be innovative, improving and exploiting means of solving the problems. Although various disciplines are required to deal with the above problems and their solutions, of all the disciplines, mathematics which deals with the quantitative aspects of shapes, calculations, measurements, projections, logic et cetera, forms a basis for other disciplines and provides a quantitative description of these problems, thereby preparing them for easy solution. Adamu (1970) continues" ... For science and technology to provide means for getting all these social needs, mathematics has to develop necessary man-made models required and emphasis will also be placed on the manipulable and computational aspect of Mathematics". Mathematics comes into play in Textile industries, Engineering Technology, Food Processing, Housing et cetera. In human development, the mathematical algorithm enables man to develop logical ways of attending to situations. It helps to build up the psychological state man, lifting him up from a state of confusion, rawness and roughness to a well informed man. The Engineer now thinks of using the techniques of calculus to complete solutions to problems. The medical worker then uses the differential equation theory to make precise decisions. The experimental worker comes up with computers and statistics. The business man employs simple book-keeping to get optimal results. The society requires enough mathematics undergraduates who will graduate to become lecturers and teachers of mathematics.

It is disheartening that few studies were conducted in this areas. For example Wole Falayajo et al (1989:36) conducted studies on curriculum coverage in mathematics in relation to student's attainment. The study's test difficulty score of 19% tried to ascertain that there is much more to mathematics than curriculum coverage in the secondary schools. The study ignored continuity of the contents of the curricula and pre-requisite knowledge of students. This study intends to close this gap. Harbor-Peters et al (1989:55) conducted studies on a survey of primary school teachers mastery of primary school mathematics content". The study revealed that primary school teachers have no adequate mastery of primary school mathematics content. The study neither dealt with the mathematics graduate teachers nor the secondary school mathematics content. This study also intends to close the gap.

None of these studies dealt with the implications of the curricula on students' attitude towards the study of mathematics. This study intends to compare the mathematics curricula in terms of the relevance, continuity and sequence of their content; the prospects of mathematics after graduation as it affects attitude towards the studies of mathematics. It is hoped that the result of this study if implemented will help improve students enrolment into mathematics programmes.

Chapter Three

RESEARCH METHODOLOGY

In this chapter, the research methodology is presented under the following subheadings:

- Design of the study
- Area of study
- Population of study
- Sample and sampling technique
- Development of the instrument
- Validation of the instrument
- Scoring of the Instrument
- Administration of the instrument
- Method of Data Analysis
- Interpretation of 'r'.

Design of the Study:

The design of the study is correlational. Harbor-Peters (2000: 7 - 8) reiterates that "This design of research seeks to find the relationship between two or more variables. Such studies show the direction and magnitude of the relationship between such variables". This study analysed comparatively the mathematics curricula in secondary schools and universities and found their implications for students attitude towards the study of mathematics. To that extent, it is correlational.

Area of Study:

The study was conducted in two local government areas; viz Isuikwato Local Government Area in Abia State and Nsukka Local Government Area in Enugu State. As the study involved Academic communities, the Abia State University Uturu and University of Nigeria, Nsukka were considered to represent the state and federal universities, respectively.

Population of Study:

The population comprised all the Federal and State University mathematics lecturers, the undergraduate mathematics students, the products of the mathematics curricula such as the Engineers, Scientists, Mathematicians, Accountants and Economists.

Sample and Sampling Technique:

Out of the twenty-four Federal Universities and Fifteen State Universities in Nigeria, one Federal University, namely, the University of Nigeria, Nsukka (UNN) and one state university, namely Abia State University, Uturu (ABSU) were systematically sampled. Harper (1971:24) opined that "the systematic sample simply is a short-cut method for obtaining a virtually random sample. If all the items in the population are listed and a 10% sample (say) is required, then the sample can be selected by taking every tenth item on the list, provided there is no regularity within the list such that items ten spaces apart have some special quality". The list of Federal and State Universities as found in the Joint Admission and Matriculation Brochure 1999/2000 was compiled. 41/6% ($^{1}/24$ and $6^{2}/3$% ($^{1}/15$) respectively of the Federal and State Universities were systematically selected. All the 22 mathematics lecturers and 50 mathematics undergraduates of these sample universities were used for the study due to the relatively small size. This was done because, Harper (1971:18) reiterates, "If the population is relatively small and easily surveyed, we may well examine every item in the population".

Instruments for Data Collection:

The questionnaire was used for data collection. One hundred copies (100) of the questionnaire were produced and distributed. Each questionnaire had parts A and B.

Development of the Instrument:

In developing the instruments, the topic, purpose of the study and the research questions were considered. It was ensured that the wordings of the items in Part A reflected the purpose of the study squarely. The content of the mathematics curricula of senior secondary schools and universities were also sources that aided development of the items. Part B items were developed to elicit responses which reflected opinions of University mathematics lecturers and undergraduate on the implications of the curricula on students attitude towards the study of mathematics.

Validation of the Instrument:

A face validation of the instruments was conducted. Three experts in Measurement and Evaluation from the Sub-Department of Science Education, Faculty of Education validated the instrument. Some items were completely rejected and new ones were constructed. Other items were recast while some were approved.

Scoring of the Instrument:

The respondents indicated the extent of agreement or disagreement with the statements. The instrument was scored on a five point Likert scale basis.

Administration of the Instrument:

The respondents were served a copy of the questionnaire each in their respective offices and classrooms. Some copies of the questionnaire were collected on a latter date as the subjects were very busy at the time of administration.

Methods of Data Analysis:

Research questions 1 - 5 were answered using Pearson's Product Moment Correlation Coefficient 'r'. Hypotheses 1 - 6 were tested by subjecting the obtained 'r' to a test of significance of correlation coefficient 'r' using table for significant 'r'.

Table 2, 3a and 3b were also used to answer the questions on continuity of the curricula.

To measure the degree of linear relationship between the two variables, on a five point rating scale, the researcher employed the Pearson Product Moment Coefficient of Correlation, symbolised as 'r'.

$$R = \frac{\sum xy - n\bar{x}\bar{y}}{n\sigma_x \sigma_y}$$

Interpretation of r

i) r may be positive (between zero and 1.00), zero or negative (between zero and -1.00) ie ($-1 \leq r \leq 1$).

The interpretation given to any magnitude of a correlation coefficient is often not easy. However, one guideline provided by Nwana (1979) to aid one in correlating a large number of pairs of scores/responses is presented in Table (4) below:

Table 4a: Interpretation of Correlation by Nwana (1979)

Correlation	Interpretation
0.08 to 1.0	Very High
0.6 to 0.8	High
0.4 to 0.6	Medium
0.2 to 0.4	Low
0.0 to 0.2	Very low (no relationship)

Another interpretation guide has been posited by Downie and Heath (1974) as shown in table (4b) below.

Table 4b: Interpretation of Correlation by Downie and Heath (1974)

Correlation	Interpretation
0.8 and above	High
Above 0.3 and below 0.8	Moderate
0.3 and below	Low

The researcher used Nwanna (1979) interpretation since it is the more recent one.

Chapter Four

PRESENTATION AND ANALYSIS OF DATA

In this chapter, the analysis of data generated from S.S.S. Mathematics curriculum (Table 5), the Tertiary Mathematics curricula (Table 5A and 5b) are presnted. Research questions 1 - 5 were analysed using percentages, Mean, Standard Deviation and Pearson's product Moment Correlation Coefficient, 'r'.

Computation of the significance of the difference between the correlation coefficients r_u and r_1, for each hypothesis, was carried out using a two - tailed test, at the 0.05 level of significance.

Research Question 1:

To what extent are the University Mathematics content and the Senior Secondary Mathematics content related?

These basic experiences required for movement from a lower level Mathematics to a high level mathematics ought to be arranged to link up with the higher level mathematics so as to preserve the continuity of experiences.

Table 5: **Arrangement of Mathematics Topic in the New S.S.S. Curriculum**

CATEGORY: S.S. 1	S.S. 2	S.S. 3
A) Number and Numeration	Number and Numeration	Number and Numeration
B) Algebraic Processes	Algebraic Processes	Algebraic Processes
C) Mensuration	-	Mensuration
D) Plane Geometry	Plane Geometry	-
E) Trigonometry	Trigonometry	Trigonometry
F) Statistics	-	Statistics
G) -	Probability	-

ARRANGEMENT OF MATHEMATICS TOPICS IN THE REVISED UNDERGRADUATE ACADEMIC PROGRAMME 1990/91 OF THE DEPARTMENT OF MATHEMATICS UNIVERSITY OF NIGERIA, NSUKKA (UNN)

TABLE 5A

100 LEVEL

1) MTH 111
Elementary Mathematics I (Algebra and Trigonometry) (3units)

2) MTH 112
Elementary Mathematics II (Calculus) (3units)

3) MTH 113
Elementary Mathematics I (Vectors, Geometry and Dynamics) (3units)

4) MTH 131
Elementary Mechanics (3units)

5) STA 203, 206
Statistics for Physical Sciences (2units)

6) C.S. 101
Introduction to Computer Science (2units)

7) STA 111
Probability (2units)

8) STA 131, 132, 133
Inference and Laboratory for Inference (4units, 2units, 2units) respectively

9) Other borrowed courses from Physics, Biology, Chemistry, English, Social Sciences, Geology

200 LEVEL

1) MTH 211
Set, Logic and Algebra (3units)

2) MTH 212, 214
Linear Algebra I and II (2units each)

3) MTH 221
Real Analysis (2units)

4) MTH 241
Mathematical Methods I (3units)

5) MTH 222
Elementary Differential Equation I (3units)

6) MTH 213
Analytic Geometry (2units)

7) MTH 231
Elementary Mechanics II (2units)

8) MTH 223
Introduction to Numerical Analysis (3units)

9) C.S. 201
Computer Programming (4units)

10) STA 211, 212
Probability III and IV

11) G.S. 207, 208
Humanities I and II (2units)

300 LEVEL

1) MTH 311
Abstract Algebra I and II (3units)

2) MTH 321
Metric Space Topology (3units)

3) MTH 324
Vector and Tensor Analysis (3units)

4) MTH 331
Introduction to Mathematical Modeling (3units)

5) MTH 322
Elementary Differential Equations II (3units)

6) MTH 323, & 325
Complex Analysis I and II (3units)

7) MTH 326
Real Analysis II (3units)

8) MTH 334
Analytical Dynamics (3units)

9) MTH 335
Dynamics of a Rigid Body (3units)

10) MTH 332, 333
Optimisation theory I and II (2units each)

11) MTH 336
Introduction to operations Research (3units)

12) MTH 341, 342
Discrete Mathematics (2units each)

13) MTH 313, 314
Geometry I and II (2 units each)

14) MTH 315
Differential Geometry (3units)

15) Other borrowed courses from Statistics and Computer Science

400 LEVEL

1) MTH 411
Abstract Algebra III (3units)

2) MTH 421
Ordinary Differential Equations (3units)

3) MTH 422
Functional Analysis (3units)

4) MTH 423
Partial Differential Equations (3units)

5) MTH 424
General Topology (3units)

6) MTH 425
Lebesque Measure and Integration (3units)

7) MTH 426
Measure theory (4units)

8) MTH 427
Field theory in Mathematical Physics ([illegible])

9) MTH 431
General Relativity (3units)

10) MTH 432
Electromagnetism (3units)

11) MTH 433
Fluid Dynamics (3units)

12) MTH 434
Elasticity (3units)

13) MTH 435
Quantum Mechanics (3units)

14) MTH 436
Analytical Dynamics (3units)

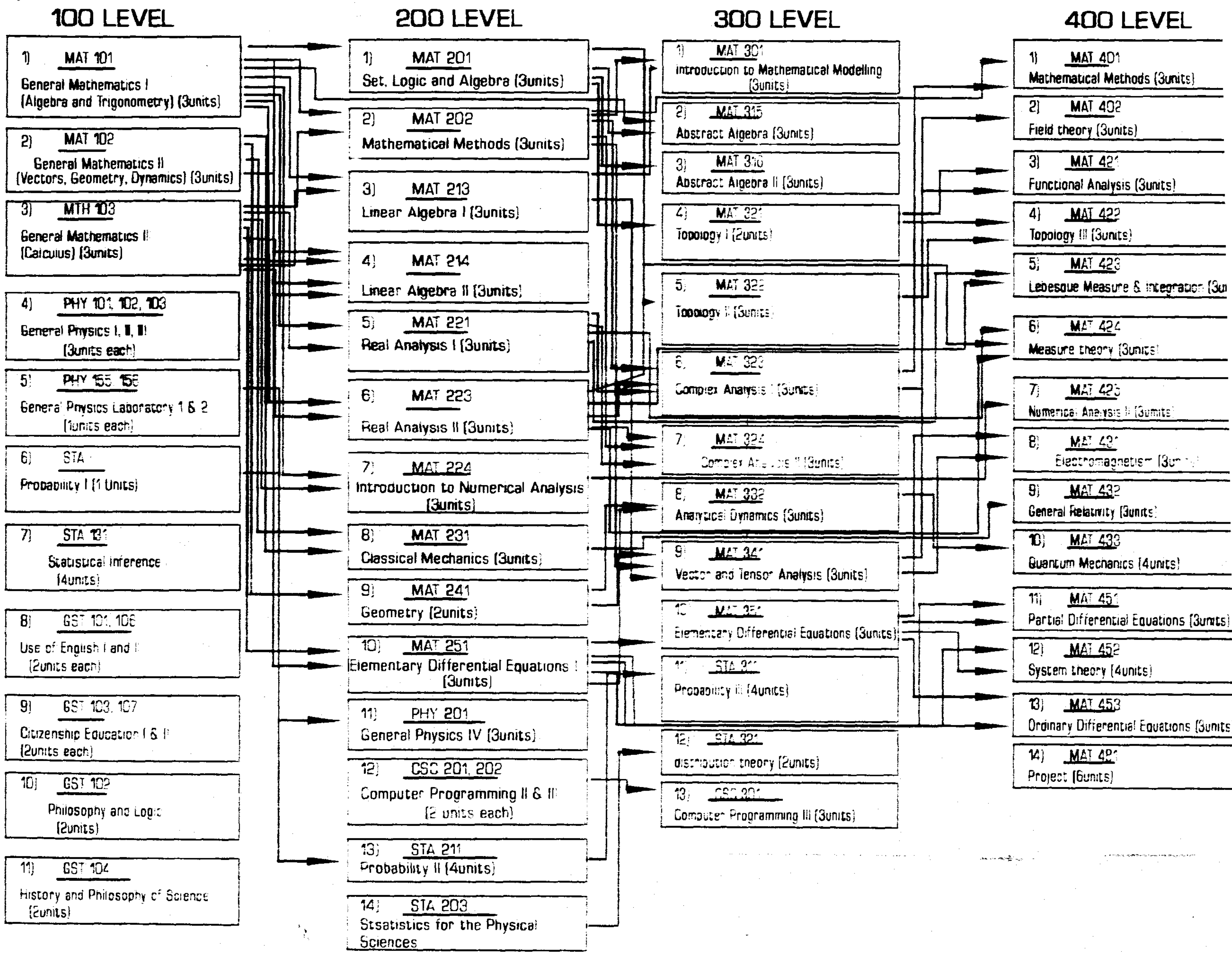
15) MTH 437
System theory (4units)

16) MTH 441
Mathematical Methods (3units)

17) MTH 451
Projects (4units)

ARRANGEMENT OF MATHEMATICS TOPICS IN THE REVISED CURRICULUM FOR MATHEMATICS IN LINE WITH THE NATIONAL UNIVERSITY COMMISSI[ON] MINIMUM STANDARDS, SEPTEMBER, 1991 OF THE DEPARTMENT OF MATHEMATICS, ABIA STATE UNIVERSITY, UTURU. (ABSI

TABLE 3.5B



To find out how far this is true between the Secondary and Tertiary Mathematics curricula and within the tertiary mathematics departmental curricula of the two sample Universities, this study attempts an analysis of the data generated from the different curricula under the following headings:

(a) **Nature and Scope of Link Between Secondary and Tertiary Mathematics**

A close study of the two levels of mathematics topics (secondary and tertiary levels) reveals the following:

1. General Mathematics 1 (Algebra and Trigonometry) has its basis as the S.S. 3 Algebraic processes and Trigonometry.

2. Experiences in S.S. 1 and S.S. 2 plane geometry, S.S. 1 and S.S. 3 Mensuration will aid the quick understanding of the 100 - level General Mathematics II (Vectors, geometry and dynamics).

3. General Mathematics III (limits, continuity, differentiation and Integration et cetera) has no link with any S.S. 3 Mathematics topic and so may pose some problems in the quick understanding of the course.

4. S.S. 3 Statistics and probability are advanced in the borrowed courses statistics for physical science, inference I and probability I.

5. Fundamentals of physics I and II as well as elementary mechanics I, may have been taken care of by S.S. 3 physics.

6. Introduction to computer sciences has no link with any S.S. course and so may pose some problems of difficult acquisition of the knowledge on introduction.

7. The course on general studies (G.S. or G.S.T.) May have their basis on other borrowed areas (like - English, Chemistry, Biology, Geography, History et cetera).

b) **The Relationship and Variations Between the Different Levels of University Mathematics Programmes**

Algebra and Trigonometry

Algebra and Trigonometry, titled Elementary Mathematics I (MTH III) in U.N.N) and

General Mathematics I (MAT 101) in ABSU is a 100 level 3 unit course in both Universities.

It forms a pre-requisite knowledge for five 200 level course in U.N.N.: namely:

i) Set, Logic and Algebra 1 (Mth 211) - 3units

ii) Linear Algebra I (Mth 212) - 2units

iii) Linear Algebra II (Mth 211) - 2units

iv) Real Analysis (Mth 221) - 2units

v) Mathematical Methods I (Mth 241) - 3units

Set, Logic and Algebra

At the 300 level, at U.N.N., the following 3 courses require a pre-requisite knowledge of set, logic and Algebra.

i) Abstract Algebra I (Mth 311) - 3units

ii) Abstract II (Mth 312) - 3units

iii)

iv) Metric space Topology (Mth 321) - 3units

Also at the 400-level of U.N.N. Mathematics programme abstract algebra I and II form pre-requisite knowledge of only one course namely abstract algebra III (Mth 411) - 3 units while metric space topology (Mth 321) form pre-requisite knowledge for:

i) Functional analysis (Mth 422) - 3 units

ii) General Topology (Mth 424) - 3 units

iii) Measure theory (Mth 426) - 4 units

Linear Algebra I and II

These are pre-requisites for three 300 level, 3 units courses namely:

i) Abstract I and II (Mth 311 and Mth 312 respectively) which link up with only one 400 - level course - Abstract Algebra III (Mth 411) - (3 units.

ii) Vector and Tensor Analysis (Mth 324) - (3 units).

This in turn branches to three 400 level 3 unit courses namely:

Field Theory in Mathematical Physics (Mth 427) - 3 units,

General Relativity (Mth 431) - 3 units,

Electro Magnetism (Mth 432) - 3 units.

Real Analysis

This links up with two 300 level courses namely:

i) Complex Analysis I and II (Mth 323, Mth 325 respectively) - 3 units each

ii) Real analysis II (Mth 326) - 3 units

Each of these in turn forms a basis for some 400 - level courses as follows:

Complex Analysis I and II form basis for two 400 level courses namely:

(ia) Functional analysis (Mth 422) - 4 units

b) Mathematical methods (Mth 441) - 3 units
Real Analysis II forms a basis for only

iib) Lebesque measure and integration (Mth 425) - 3 units.

Mathematical Methods I

This is a pre-requisite for three 300 - level courses namely:

i) Vector and Tensor analysis (Mth 324) - 3 units

This in turn branches off to three 400 - level courses namely:

(ia) Field Theory in Mathematical Physics (Mth 427) - 3 units (ib) General relativity (Mth 431) - 3 units

(ic) Electro Magnetism (Mth 432) - 3 units

(ii) Introduction to Mathematical Modelling (Mth 331) - 3 units which terminates at this level.

iii) Complex Analysis I and II (Mth 323, Mth 325 respectively) which branches off to two 400 - level courses namely:

iiia) Functional analysis

iiib) Mathematical methods as stated above.

Abia State University

In Abia State University, the General Mathematics I (Mat 101) forms a sub-ordinate knowledge for eight 200-level courses. These are:

i) Set, logic and Algebra (Mat 201) - 3 units

ii) Mathematical Methods I (Mat 202) - 3 units

iii) Linear Algebra I (Mat 213) - 3 units

iv) Linear Algebra II (Mat 214) - 3 units

v) Real analysis I (Mat 221) - 3 units

vi) Real analysis II (Mat 223) - 3 units

vii) Elementary Differential Equation I (Mat 251) - 3 units

Set, Logic and Algebra

In Abia State University, some 300 level courses also require a pre-requisite knowledge of set, logic and algebra.

i) Abstract I (Mat 315) - 3 units

ii)	Abstract Algebra II (Mat 316)	-	3 units
iii)	Topology I (Mat 321)	-	3 units
iv)	Topology II (Mat 322)	-	3 units

Some of these in turn, form pre-requisite knowledge for some 400 level course as follows:

Abstract Algebra I and II terminates at the 300-level while topology I forms a basis for:

i)	Functional analysis (Mat 421)	-	3 units
ii)	Topology III (Mat 422) 3 units and Topology II also forms a basis for topology III.		

Mathematical Methods I

This has direct link with some 400 level course namely;

i)	Mathematical Methods II (Mat 401)	-	3 units and four 300 level course namely:
ii)	Complex Analysis I (Mat 323)	-	3 units which branches off to two 400 level courses namely (see iia - iic below).
iii)	Introduction to Mathematical Modelling (Mat 301)	-	3 units which terminates at this level.
iiia)	Mathematical Methods II (Mat 401)	-	3 units
iiib)	Functional Analysis (Mat 421	-	3 units
iiic)	Complex Analysis II terminates at the 300	-	level
iv	Vector and Tensor Analysis (Mat 341)	-	3 units

This in turn branches off to three 400 level courses namely:

iva) Field Theory (Mat 402) - 3 units

ivb) Electromagnetism (Mat 431) - 3 units

ivc) General Relativity (Mat 432) - 3 units

Linear Algebra I and II

Linear Algebra II terminates at the 200 - level while Linear Algebra One forms a basis for two 300 - level courses namely:

i) Introduction to Mathematical Modelling (Mat 301) - 3 units which terminates at this level as indicated above;

ii) Vector and Tensor analysis (Mat. 341) - 3 units

Real Analysis I and II

These are pre-requisite for two 300-level, 3 units courses namely:

i) Complex analysis I (Mat 323) which in turn forms a basis for two 400-level course namely:

ia) Mathematical Methods II (Mat 401) - 3 units

ib) Functional Analysis (Mat 421) - 3 units

ii) Complex Analysis II (Mat 324), which terminates at this level.

Real analysis I and II also link up directly with two 400 level courses namely:

iii) Lebesque Measure and Integration (Mat 423) - 3 units

iv) Measure Theory (Mat 424) - 3 units

Introduction to Numerical Analysis

This has a direct link with only one 400 level, 3 unit course namely:

i) Numerical analysis II (Mat 425) - 3 units
It has no link with any 300 - level course.

Elementary Differential Equations I

This course forms a basis for one 300 level course namely:

Elementary Differential Equations II - 3 units which forms a basis for:

(ia) Electromagnetism (Mat 431) - 3 units

(ib) Partial Differential Equations (Mat 451) - 3 units

(ic) System theory (Mat 452) - 3 units

(id) Ordinary Differential Equations (Math 453) - 3 units

It also has direct link with three of the 400-level courses mentioned above namely:

i) Partial Differential Equations

ii) Systems theory, and

iii) Ordinary differential Equations.

Some Courses Without Pre-requisites and Level of Termination

	Course	Level of Introduction	Level of Termination
1.	Optimization Theory I & II Mth 332, Mth 333 respectively.	300 level	300 level
2.	Introduction to Operations Research (Mth 336) - 3 units	300 level	300 level
3.	Discrete Mathematics I & II (Mth 341, Mth 342 respectively). This forms a basis for abstract Algebra II (Mth 411).	300 level	300 level

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2. Computer Programming I and II (CSC 201, CSC 202 respectively, 200 level courses of 2 units each.

- form a pre-requisite for (CSC 301) a 300 level course of 3 units.

Relationships and Variations Observed

From the results given above, one observes that some relationship exist between the Mathematics programme of the sample universities. These include the following:

(ia) Algebra and Trigonometry,

(ib) Calculus as well as

(ic) Vectors, Geometry and Dynamics as 100 level courses in both sample universities.

ii) They form major basis for understanding the 200-level courses.

iii) At the 300 levels, Set, Logic and Algebra, a 200-level course, forms a basis for the understanding of abstract algebra and Topology in both universities.

iv) At the 400-level, both courses link up with functional analysis and Topology. Some observable variations include:

i) The absence of two courses at the 200-level of U.N.N. programme: Introduction to Numerical analysis and Elementary differential Equations I which are contained in ABSU 200 level Mathematics programme.

ii) Abstract Algebra terminates at the 300 level ABSU programme but extends to the 400 level U.N.N. programme.

iii) Measure theory does not have metric space topology as it's pre-requisite in ABSU programme.

iv) Some content of some of the course vary as well.

v) The description of course also vary.

vi) Some contents of some of the courses differ.

For the links between the other courses at the 200 level and the other levels, see the arrangement of Mathematics topics in the two sample universities (Tables 5A and 5B).

Vectors, Geometry and Dynamics

Vectors, Geometry and dynamics entitled Elementary Mathematics III (Math 113) in U.N.N. and General Mathematics II (Mat 102) in ABSU is a 100 level 3 units course in both universities.

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It forms a basic knowledge for three 200 level courses in U.N.N. namely;

i)	Linear Algebra I (Mth 212)	-	2 units
ii)	Linear Algebra II (Mth 214	-	2 units
iii)	Three Dimensional (3-D) Analytical Geometry (Mth 213)	-	2 units

Linear Algebra I AND II

At the 300 level in the U.N.N. Mathematics programme linear algebra forms a basic knowledge for:

i)	Abstract Algebra I (Mth 311)	-	3 units
ii)	Abstract Algebra II (Mth 312)	-	3 units
iii)	Introduction to Mathematics Modelling (Mth 311)	-	3 units

These courses branch off to the 400 level as pre-requisite for some course as follows:

Abstract Algebra I and II for the basis for I only

i)	Abstract Algebra III (Mth 411)	-	3 units

Introduction to Mathematics Modelling terminates at the 300 level.

3-D Analytic Geometry

Again, the 200 level course namely 3-D Analytic Geometry form a pre-requisite knowledge for the following:

i) Geometry I (Mth 313) - 3 units

ii) Geometry II (Mth 314) - 3 units

iii) Differential Geometry (Mth 315) - 3 units

These form pre-requisite knowledge for only one 400 level course namely:

i) Field theory in Mathematical Physics (Mth 427) - 3 units

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In A.B.S.U. this course forms a basic knowledge for three other 200 level course namely:

i) Linear Algebra II (Mat. 214) - 3 units

ii) Classical Mechanics (Mat. 231 - 3 units

iii) Geometry (Mat 241) - 2 units

Linear Algebra II:

In ABSU Mathematics programme, linear Algebra II terminates at the 200 level.

Classical Mechanics

Classical mechanics form a basis for only one 400 level course namely:

i) General relativity (Mat 432) - 3 units

It has no link with any 300 level course.

Geometry

Geometry links up with two 300 level courses namely:

Analytical Dynamics (Mat 332) - 3 units

Vertical and Tensor Analysis (Mat 341 - 3 units

These in turn branch off to the 400 level as pre-requisite knowledge the following courses as follows:

Analytical Dynamics link up with

i) Field Theory (Mat 402) - 3 units

ii) Electromagnetism (Mat 431) - 3 units

iii) General Relativity (Mat 432) - 3 units

Some relationships observed include:

i) Some courses such as Introduction to Mathematical Modelling terminates at the 300 level.

ii) Some courses are represented in both programmes.

The variations observed include the following:

i) Contents of some similar courses are more elaborate (or comprehensive) than others.

ii) Abstract Algebra which terminated at the 300 level in one university extended to the 400 level in the other.

See the arrangement of Mathematics topics for the link between other 200 level courses and other levels.

Calculus

This is titled Elementary Mathematics II (Mth 112) in U.N.N. and General Mathematics III (Mat 103) in A.B.S.U.

It is a 100 level 3 unit course in both universities.

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It forms a basic knowledge for six 200 level courses in U.N.N. namely:

i) Linear Algebra I

ii) Linear Algebra ;II

iii) Real analysis

iv) Mathematical Methods I

v) Elementary Differential Equations I (Mth 222) - 3 units

vi) Introduction to Numerical analysis (Mth 223) - 3 units

Linear Algebra I and II

At the 300 level, the UNN Mathematics programme has linear algebra as a pre-requisite for some courses namely:

i) Introduction to Mathematical Modelling (Mth 331) - 3 units which terminates at this level.

ii) Abstract Algebra I and II (Mth 311 and Mth 312) which extends to Abstract III (Mth 411) at the 400 level. All being 3 unit courses.

iii) Vector and Tensor Analysis (Mth 324) - 3 units

These in turn branch off to form the basis for 400 level courses as follows:

Vectors and Tensors form a pre-requisite for:

i) Field Theory (Mth 427) - 3 units
ii) General Relativity (Mth 431) - 3 units
iii) Electromagnetism (Mth 432) - 3 units

Real Analysis

Also Real Analysis I forms a basis for:

i) Complex Analysis I (Mth 323) - 3 units

ii) Real Analysis II (Mth 326) - 3 units

iii) Complex Analysis II (Mth 325) - 3 units

Each of these branches off as follows at the 400 level. Complex Analysis I and II shoots off to

i) Functional analysis (Mth 422) - 3 units

ii) Mathematical Methods (Mth 441) - 3 units

Real Analysis II shoots off to only one course

i) Lebesque Measure.

Mathematical Methods

Mathematical methods forms a basis for three 300 levels courses namely:

i) Vector and Tensor Analysis (Mth 324) - 3 units
This branches off as indicated above.

ii) Introduction to Mathematicsl Modelling (Mth 331 - 3 units
This terminates at this level as earlier described.

iii) Complex Analysis I and II (Mth 323, Mth 325 respectively) which also branches off as indicated above.

Elementary Differential Equations I

Elementary Differential Equations I (Mth 222) - 3 units forms a basis for two 300 level courses namely:

i) Introduction to mathematical modelling (Mth 331) - 3 units which terminates at this level as stated earlier.

ii) Elementary Differential Equations II (Mth 322) - 3 units.

This in turn forms a basis for four 400 level courses namely:

iia) Ordinary Differential Equations (Mth 421) - 3 units

iib) Partial Differential Equations (Mth 423) - 3 units

iic)	Electromagnetism (Mth 432)	-	3 units
iid)	Systems theory (Mth 437)	-	4 units

Introduction to Numerical Analysis

Introduction to Numerical analysis (Mth 223) - 3 units forms a basis for only one 300 level course namely:

i) Elementary Differential Equations II (Mth 322) - 3 units which branches off as described above.

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In ABSU, Calculus forms a basic knowledge for seven 200 level courses. These are:

i)	Mathematical Methods I (Mat 202)	-	3 units
ii)	Linear Algebra I (Mat 213)	-	3 units
iii)	Real Analysis I (Mat 221)	-	3 units
iv)	Real Analysis II (Mat 223)	-	3 units
v)	Introduction to Numerical Analysis (Mat 224)	-	3 units
vi)	Classical Mechanics (Mat 231)	-	3 units
vii)	Elementary Differential Equation I (Mat 251)	-	3 units

Mathematical Methods I:

At the 300 level, Mathematical Methods I forms a basis for four 3 unit courses namely:

ia) Introduction to Mathematical Modelling (Mat 301), which terminates at this level.

ib) Complex analysis I (Mat 323) which also branches off to two courses at the 400 level namely;

bi) Mathematical Methods II (Mat 401) - 3 units

bii) Functional analysis II (Mat 421) - 3 units

ic) Complex analysis (Mat 342) which terminates at this level.

id) Vector and Tensor Analysis (Mat 341) - 3 units

This in turn branches off to three 400 level courses namely: - 3 units

di) Field Theory (Mat 402)

dii) Electromagnetism (Mat 431)

diii) General Relativity (Mat 432).

Mathematical Methods I also has direct link with Mathematical Methods, a 400 level course.

Linear Algebra I

Linear Algebra I links up with two 300 level courses namely:

ii Introduction to Mathematical Modelling with terminates at this level as stated above and

ii Vector and Tensor analysis which also extends described above.

Real Analysis I and II:

Real Analysis I and II are pre-requisites for two unit courses namely:

i) Complex analysis I (Mat 323) which links up two 400 level courses as stated above.

ii) Complex Analysis II (Mat 324) which terminates at this level.

They also form a direct basic knowledge for two 400 level courses namely:

ii Lebesque measure and integration (Mat 423) - 3 units

ii Measure Theory (Mat 424) - 3 units

Introduction to Numerical Analysis

This has no link with any 300 level course but links directly with one 400 level course namely,

i) Numerical Analysis II (Mat 425) - 3 units.

Classical Mechanics

This has no link with any 300 level course but has a direct link with one 400 level course namely:

i) General relativity (Mat 432) - 3 units

Elementary Differential Equations I

This course is a pre-requisite for two 300 level courses namely:

ii) Introduction to Mathematical Modelling (Mat 301) - 3 units which terminates at this level.

iii) Elementary Differential Equations II (Mat 351) - 3 units.
It is also a direct pre-requisite for three 400 level courses namely:

iv) Partial Differential Equations (Mat 451) - 3 units.

v) System Theory (Mat 452 - 3 units

vi) Ordinary Differential Equation (Mat 453 - 3 units
Elementary Differential Equations II forms a basis for some other 400 level courses namely:

iia) Electromagnetism (Mat 431) - 3 units

iib) Partial Differential Equations

iic) Partial Differential Equations

iid) System Theory

iie) Ordinary Differential Equations.

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4a) Elementary Mechanics (Mth 131) is a 100 level 3 unit course present in the U.N.N. programme and absent in ABSU programme.

It forms a sub-ordinate knowledge for Elementary Mechanics II (Mth 231) (2 units) a 200 level course.

At the 300 level, Mechanics II branches off as a basic knowledge for two courses namely:

i) Analytical Dynamics, (Mth 334) - 3 units

ii) Dynamics of rigid body (Mth 335) - 3 units

At the 400 level, these two courses branch off a basic knowledge for higher level courses of greater complexity accordingly. Thus Analytical Dynamics branches off to five 400 level course namely:

i) General Relativity (Mth 431) - 3 units

ii) Fluid dynamics (Mth 433) - 3 units

iii) Elasticity (Mth 434) - 3 units

iv) Quantum Mechanics (Mth 435) - 3 units

v) Analytical Dynamics II (Mth 436) - 3 units

Dynamics of a rigid body branches off to four 400 level course namely:

i) General Relativity (Mth 431) - 3 units

ii) Fluid Dynamics (Mth 433) - 3 units

iii) Elasticity (Mth 434) - 3 units

iv) Quantum Mechanics (Mth 435) - 3 units

4b) In ABSU Similar Courses,

General physics I, II, III, (Phy 101, 102, 103 respectively) are each 100-level 3 unit course not found in the U.N.N. programme.

General Physics Laboratory I and II (Phy 155, 156) respectively are also each 100 - level I unit course not found in the U.N.N. programme.

These courses form basic knowledge for General Physics IV (Phy 201), a 3 unit course which terminates at the 200 level.

(5a)

i) Statistics for Physical Science (Sta 203, 206) - 2 units

ii) Inference and Laboratory for inference (Sta 131, 132, 133) 4 units, 2 units and 3 units respectively are 100 level courses in the U.N.N. programme which terminate at the 100 level.

iii) Probability (Sta III) is a 2 unit course which forms a basic knowledge for two 200 level courses namely:

Probability III (2 units)

Probability IV (2 units).:

This terminates at this level.

(5b) the A.B.S.U:. programme contains:

i) Statistical Inference I (Sta 131), a 100 level 4 unit course which terminates at this level.

ii) Probability I (Sta III): A 4 unit course which forms a basic knowledge for probability II (Sta 211), a 200-level 4 units course as well as Statistics for the Physical Science (Sta 203) a 3 unit course.

These two form a basis for two 300 - level courses namely at this level:

(6) Introduction to Computer Science (CS 101) forms a basic knowledge for a 200 level course namely:

Computer Programming I (CS 201).

This is a 4 unit course which forms a basic knowledge for some borrowed courses at the 300 level and thereafter terminates.

In A.B.S.U. the Mathematics programme for the 100 level students excludes Computer but it is introduced at the 200 level as:

i) Computer Programming I (CSC 201).

ii) Computer Programming II (CSC 202)

These are each 2 units courses and they form a pre-requisite knowledge of only one 300 level course namely

(i) Computer Programming III (CSC 301), a 3 unit course. CSC 301 terminates at this level.

Other borrowed courses from disciplines other than Mathematics that is from physics, Biology, Chemistry, English, Social Science, Geology, form part of the content of U.N.N. Mathematics programme at the 100 level.

These accordingly form the basic knowledge for related courses namely:

i)	Humanities I (GS 207)	-	2 units
ii)	Humanities II (GS 208)	-	2 units, at the 200 level and therefore terminates.

In A.B.S.U. borrowed courses from the Humanities namely:

i)	Use of English I (GST 101)	-	2 units
ii)	Use of English II (GST 106)	-	2 units

iii) Citizenship Education I (GST 103) - 2 units

iv) Citizenship Education II (GST 107) - 2 units

v) Philosophy and Logic (GST 102) - 2 units

vi) History and Philosophy of Science (GST 104) - 2 units
are 100 level courses which do not extend to the 200 level.

Arrangement of Courses That May Lead to Distorted Learning:

Some arrangement of courses that may cause distorted learning include the following:

i) Probability is only introduced in S.S. II Mathematics curriculum. Nothing is mentioned again about it until at the 100 level University Mathematics programme. It immediately terminates at the 200 level.

ii) Computer Science/Programming lacks continuity since the course terminates at the 200 level in U.N.N. and 300 level in A.B.S.U.

Hence knowledge in these courses may be distorted.

iii) Introduction to Mathematical modelling which terminates at the 300 level may not be thoroughly imbibed by the students.

iv) Optimisation theory and Introduction to Operations Research studied only at the 300 level cannot give enough opportunity for thorough acquisition of knowledge.

Research Question One:

To what extent does effectiveness of the Mathematics curricula affect high students' enrolment in Mathematics programmes?

This question was answered by computing the means, standard deviations and Pearson's Product Moment Coefficients of Correlation for item 5a on the questionnaire and the percentage responses to item 5b that measure these attributes (effectiveness of Mathematics Curricula and students' enrolment).

The statement of each of the item number is in Appendix II.

Table 6: **Mean scores, standard deviations and correlation coefficient as a Measure of effectiveness of Mathematics curricula as it affects students' enrolment**

No of subject U.N.N. (X)	ABSU (Y)	Statement	$\bar{x}$	$\bar{Y}$	$\bar{x}$	$\bar{Y}$	r
Lecturers (L) 16	6	See Appendix	3.2	1.2	4.12	1.6	0.75
Undergraduates (U) 27	23	2	5.4	4.6	6.97	5.7	0.99
		Average mean and standard Deviation.	4.3	2.9	5.545	3.65	

Results show that effectiveness of mathematics curricula affecting students' enrolment scored below average for lecturers and above average for undergraduates. The overall mean is 4.3 for U.N.N. and 2.9 for ABSU (see Table 6).

This result depicts that the sampled respondents have fairly high level of agreement that effective mathematics curricula affects students' enrolment in mathematics programmes. The 0.75 and 0.99 Correlation Coefficient respectively show moderate and high correlation.

The 88.9% of the undergraduates respondents from U.N.N. who prefer deleting lebesque measure and Abstract Algebra from the programme suggest difficulty in assimilation.

100 responses in favour of including more courses in Applied Mathematics, creating varied specialisation in the field of mathematics and reserving every course since mathematics is a universal language and relevant show total acceptance by all lecturers and calls for students' positive attitude towards mathematics.

Research Question Two:

To what extent are the curricula of different universities uniform?

Tables 3a and 3b give information about the uniformity and variations (if any) of the curricula.

Furthermore in appendix III, 69.6% of ABSU undergraduates respond that non availability of specialist lecturers may cause a so called variation while very high percentage of lecturers 62.5% and 100%, 83.3% from U.N.N. and ABSU respectively blame the variation on preference of some universities in adopting the basic N.U.C. standards in mathematics while others operate above the N.U.C. standards, and disruption of the academic calendar (which may lead to inability to complete the programme) and lecturers' preference.

Research Question Three:

To what extent do future prospects of Mathematics affect high students' enrolment in mathematics programmes?

Responses to items 4(a), 4(b), 9(a) (i), (ii) (iii), on the questionnaire gave rise to Appendix IV which shows that a very high percentage agree that aversion of students from the study of Mathematics traced to other reasons instead of no future prospects for graduates of mathematics.

Over 50% agree that there are many areas of relevance of mathematics. Over 50% blamed the slow pace of the country's technological advancement on inadequate attention being given to mathematics programmes, undergraduates, graduates and their lecturers.

100% respondents feel that mathematics lecturers, undergraduates et cetera need full government support for complete dedication to the achievement of the aims and objectives of mathematics to be given. 83%, 33% feel that government has interfered much in almost all aspects of life in Nigeria and so should allow creative minds, which mathematics produces to work independently.

Research Question Five:

How effectively does the qualified mathematics graduate handle senior secondary mathematics?

This question was answered by computing the means standard deviations, and Pearson's Product Moment Correlation Coefficients for items 6 and 7 on the questionnaire.

Table 7: Mean scores, standard Deviations and Correlation Coefficients as a measure of poor teaching implying failure in mathematics

No of subject U.N.N. (X)	ABSU (Y)	STATEMENT	$\bar{x}$	$\bar{Y}$	$\bar{x}$	$\bar{Y}$	r
Lecturers (L) 16	6	See Appendix	3.2	1.2	4.96	3.12	0.76
Undergraduates (U) 27	23	VI item 6	5.4	4.6	7.1	5.7	0.52
		Average mean and standard Deviation.	4.3	2.9	6.03	4.41	

Table 8: Mean scores, standard Deviations, and correlation coefficients as a measure of qualification of lecturer implying effective teaching

No of subject U.N.N. (X)	ABSU (Y)	STATEMENT	$\bar{x}$	$\bar{Y}$	$\bar{x}$	$\bar{Y}$	r
Lecturers (L) 16	6	See Appendix	3.2	1.2	5.03	2.4	0.97
Undergraduates (U) 27	23	VI item 7	5.4	4.6	5.3	3.98	0.89

		Average mean and standard Deviation.	4.3	2.9	5.165	3.19	

Table 9: Interpretation of Means and Standard Deviations by Nwana (1982)

MEAN	STANDARD DEVIATION	INTERPRETATION
High e.g. 46	Low, e.g. 1.5	Objective realised
High e.g. 40	Average, e.g. 4.0	Objective realised
Average e.g. 28	Low, e.g. 2.0	Objective partly realised.
Average e.g. 20	Average, e.g. 5.0	Objective partly realised
Average e.g. 25	High e.g. 9.0	Objective partly realised
Low, e.g. 15	Average e.g. 6.0	Objective not realised
Low, e.g. 6	Low, e.g. 2.0	Objective not realised

Note: The high, average, or low referring to the class mean is relative to the maximum desirable performance of 50 marks.

By the table on interpretation of means and standard deviation Nwana (1982) Table (9), these results depict that the respondents highly agree that poor teaching implies failure in mathematics and that good qualification is a correlate of effective teaching.

To determine the probability that r_u and r_i obtained for each of the hypothesis did not result by chance and that such results are not significantly different at the 0.05 level of significance the r_u and r_1 were subjected to tests as shown in appendices VII to XI below.

Hypothesis One

There is no significant linkage between University Mathematics courses and senior secondary Mathematics.

Table 9a **Computation of the significance of the difference between the correlation coefficients r_u and r_1 for the University and Senior secondary mathematics linkage (see Appendix VII)**

Variables	Number (N)		Degree of Freedom (v)		r_{cal}		r_{cv}	Z_l	Z_u	$\sigma_{z_l - zu}$	Z
University Mathematics	N_u	N_l	v_u	v_l	r_{ucal}	r_{lcal}					
Vs.	50	22	47	19	0.79	0.6	1.96 -1.96	0.69	1.085	0.27	-1.79034
Senior Secondary mathematics											

To determine whether two correlation coefficient r_1 and r_2 drawn from samples of size N_1 and N_2 respectively , differ significantly from each other, Spiegel and Stephens (1999) affirm that we compute Z_1 and Z_2 corresponding to r_1 and r_2 ... We use the fact that the test statistics Z is normally distributed ... Using a two-tailed test of the normal distribution, we reject H_0 only if $Z > 1.96$ or $Z < -1.96$.

The result in the case of hypothesis one shows that $Z = -1.790347831 > -1.96$, therefore we cannot reject H_0. We then conclude that the results are not significantly different at 0.05 level.

Again, $r_u = 0.79$ and $r_1 = 0.6$ show a moderately high correlation.

Suggested areas of discontinuity are also given in response to item 1 (a) as shown in appendix VII.

Hypothesis Two:

There is no significant relationship between inability to conceptualise knowledge of a course and premature termination of a course.

Table 10 Computation of the significance of the difference between the correlation coefficient r_u and r_l for the inability to conceptualise knowledge of a course versus premature termination of a course (See Appendix VIII)

Variables	Number (N)		Degree of Freedom (v)		r_{cal}		r_{cv}	Z_1	Z_u	$\sigma_{z_l - z_u}$	Z
	N_u	N_l	v_u	v_l	r_{ucal}	r_{lcal}					
Inability to conceptualize Knowledge of a course Vs Premature termination of a course	50	22	47	19	0.65	0.6	1.96 or -1.96	0.69	0.78	0.272	-0.3024514

The Z value of Z = - 0.302184514 > - 1.96 implies that H_0 cannot be rejected. We then conclude that the results are not significantly different at 0.05 level.

Again r_u = 0.65 and r_l 0.6 show a moderately high correlation.

Over 40% of respondents identified some courses which terminate prematurely. While a reasonable percentage suggest extension of each of the indicated courses.

Hypothesis Three:

There is no significant relationship between failure in Mathematics and lack of subordinate knowledge in mathematics.

Table 11 **Computation of the significance of the difference between the correlation coefficients r_l and r_u for failure in mathematics versus lack of subordinate knowledge in Mathematics (see Appendix IX)**

Variables	Number (N)		Degree of Freedom (v)		r_{cal}		r_{cv}	Z_1	Z_u	$\sigma_{z_l - z_u}$	Z
Failure in Mathematics	N_u	N_l	v_u	v_l	r_{ucal}	$r_{l\,cal}$	1.96				
Vs.	50	22	47	19	0.52	0.66	or -1.96	0.79	0.58	0.272	0.783489834
Lack of subordinate knowledge.											

The result of this test statistic Z = 0.783489834 < 1.96, therefore we cannot reject H_o. We then conclude that the results are not significantly different at 0.05 level. Again r_u = 0.52 and r_1 = 0.66 show a moderately high correlation.

A reasonable percentage of respondents suggested reasons for students failure of the mathematics courses. More seriously, 100% of respondents attributed failure to:

i) Most students not wanting to think.

ii) Some lecturers not taking time to illustrate the mathematics concepts in every day language.

iii) Insufficient pre-requisite knowledge.

Hypothesis Four:

There is no significant relationship between positive attitude towards the study of mathematics and effectiveness of mathematics curricula.

Table 12: Computation of the significance of the difference between the correlation coefficients r_l and r_u for positive attitude towards the study of mathematics versus effectiveness of the mathematics curricula (see Appendix X)

Variables	Number (N)		Degree of Freedom (v)		r_{cal}		r_{cv}	Z_1	Z_u	$\sigma_{z_l - z_u}$	Z
Positive attitude towards mathematics	N_u	N_l	v_u	v_l	r_{ucal}	rl_{cal}	1.96 or				
Vs	50	22	47	19	0.8	0.5	-1.96	0.54931	1.099	0.271861	-2.0206
Effectivenes s of the Mathematics Curricula											

The result of this test Statistic Z = -2.0206 < 1.96 implies that we reject H_o and conclude that the results are significantly different at 0.05 level. Thus there is significant relationship between positive attitude towards the study of mathematics and effectiveness of mathematics curricula.

Hypothesis five has been taken care of by research question 3, therefore the same results and conclusion apply here.

Hypothesis Six

There is no significant relationship between good teaching of Senior Secondary Mathematics and qualification of the teacher.

Table 13 **Computation of the significance of the difference between the correlation coefficient r_u and r_l for good teaching of Senior Secondary Mathematics versus qualification of the teacher**

Variables	Number (N)		Degree of Freedom (v)		r_{cal}		r_{cv}	Z_1	Z_u	$\sigma_{Z_1 - Z_u}$	Z
	N_u	N_l	v_u	v_l	r_{ucal}	r_{lcal}					
Good teaching Vs. Qualification	50	22	47	19	0.89	0.97	1.96 or -1.96	2.09231	1.422	0.272	2.434

The result of this test Statistic Z = 2.434 > 1.96H_o is rejected and we conclude that the results are significantly different at 0.05 level. Thus there is significant relationship between good teaching of Senior Secondary Mathematics and qualification of the teacher.

Summary of Major Findings

The following major findings emerge from the analyses of data:

ii) There is significant linkage between some S.S. Mathematics Courses and University Mathematics Courses. However, General Mathematics 3 comprising Limits, Continuity, Differentiation and Integration has no link with any S.S. 3 Mathematics topic.

iii) Some discontinuity that may lead to distorted learning occur in the arrangement of courses like Probability, introduced only in S.S. 2 Mathematics Curriculum, 100 level University Mathematics Programme and terminates at 200 level.

iv) a) Computer Science/Programming is introduced at the 100 level and

b) Introduction to Mathematical modelling is studied only at the 300 level.

c) Optimisation Theory and Introduction to Operations Research studied only at the 300 level, cannot give enough opportunity for thorough acquisition of knowledge. Thus there is significant relationship between premature termination of a course and inability to conceptualise knowledge of that course.

iv) There is a significant linear relationship between effective methematics curricule and high students' enrolment into mathematics programmes.

v) Creation of varied specialisations in the field of mathematics is strongly recommended.

vi) Creative minds which mathematics helps; to develop are grossly being subdued by governments' interference. Government should pay full attention and give full support to mathematics programmes, undergraduates, graduates and lecturers in so much that the recipients of the knowledge will appreciate the fact that the effort put into knowing/using mathematics is thereafter matched with adequate remuneration. Thus there is significant relationship between high enrolment in mathematics programme and incentives derived from the study.

vii) There is a significant linear relationship between good qualification and effective teaching.

viii) There is a statistical significant relationship between the correlation coefficients of all the variables studied.

ix) There is a linear significant relationship between failure of a course and lack of subordinate knowledge of the course.

x) There is significant uniformity between curricula of different universities.

Chapter Five

DISCUSSION OF RESULTS

In this chapter, the results and findings emanating from the analysis of data are discussed.

The discussion is presented as specified under the following headings:

1. The profession of respondents.
2. Mathematics curricula of senior secondary schools and universities - Relevance, scope and continuity.
3. Mathematics graduates and implementation of the contents of the mathematics curriculum.
4. Implications on students' attitude towards the study of mathematics.
5. Conclusion
6. Educational implication of the study.
7. Recommendations.
8. Limitation of the study
9. Suggestions for further studies.

The profession of respondents shows that 16 lecturers and 27 undergraduates from U.N.N. (X) as well as 6 lecturers and 23 undergraduates from ABSU (Y) were involved in the study (X represents U.N.N. while Y represents A.B.S.U.).

Profession of Respondents

The Engineers, Scientists and Mathematicians featured more in providing information about the importance of mathematics in human and materials development. Mathematics curricula for senior secondary schools and universities - relevance, scope and continuity: the results as presented in tables 2, 3a, 3b and table iv indicate as follows:

Relevance:

A large percentage respondents agree to a large extent that the mathematics curricula are still relevant to the needs and objectives of the Nigerian society.

Some example of areas of relevance are given as specified below:

i) Industries and companies.
ii) Mathematical physics.
iii) Engineering and Computer firms
iv) Technology and Development
v) Statistics
vi) Economics
vii) Business.

Some, especially the undergraduates decry that the nature of some topics in mathematics makes them difficult to be applied to everyday needs and so their relevance is not seen immediately. All respondents stressed that mathematics provides basis for science and technology as well as the pedagogical needs of the Nigerian society (see Appendix IV (9b)).

Scope:

Majority of respondents agree to a large extent as follows:

i) Though the curricula span almost every aspect of knowledge, more courses in applied mathematics should be included.
ii) In order to achieve the purpose of evolving a mathematics curriculum for self-actualisation and self-reliance, varied specialisations in the field of mathematics such as:

a) Engineering mathematics,
b) Medical Mathematics,
c) Business mathematics
d) Agricultural Mathematics
e) Legal mathematics
f) Social Mathematics

g) Recreational Mathematics

h) Industrial Mathematics

i) Actuarial Mathematics
et cetera should be created (Appendix II (5b)).

iii) Early inclusion of operations research is also advised.

iv) The study of further mathematics curriculum should apply to every S.S. 3 students so that they can understand general mathematics 3.

Continuity:

The results shows that some university mathematics topics have no link with the senior secondary school mathematics topics.

Some areas of discontinuity as indicated by respondents include the following:

i) Functional Analysis

ii) Metric Space Topology and Partial Differential Equations.

iii) Abstract Algebra and Numerical Analysis

iv) Real Analysis.

However above 50% of the lecturers indicated that the Senior Secondary Mathematics serves to develop the computational and analytical skills of students so that they can cope with the University Mathematics. Others feel that students do not need to have idea of every thing done in the University Mathematics Curriculum at the secondary school level.

On intra-uniformity of Universities' Curricula:

Most lecturers strongly agree to a large extent that the curricula of different Universities are uniform. On the other hand, the Pearson Correlation Coefficient, r = 0.04 (see Appendix 3 (8a)), indicating no relationship shows that there is no agreement in the responses of the undergraduates on the uniformity of the curricula. Some reasons for this disparity in responses are given as follows:

i) Lecturers are very familiar with the different curricula which have their basis on the NUC. Standards.

ii) Undergraduates from a particular University are ignorant of the contents of the curriculum of another university and so have divergent views about the uniformity of their curricula.

iii) Some Universities may prefer to adopt the basic N.U.C. standards in Mathematics while others may prefer to operate above the N.U.C. minimum standard.

iv) Lecturers' preferences.

v) Disruption of the academic calendar.

Within each curriculum, continuity is preserved in some areas while some courses terminate prematurely. These courses which terminate prematurely include the following:

i) Functional Analysis,

ii) Mathematical Modelling,

iii) Operations Research,

iv) Most courses at the 100 - and 200 - levels that are basic in the application of mathematics especially Calculus and Differential Equations (See Table 5a and 5b).

Extension of these Courses

Most respondents suggested extension of the following courses to The 500 level.

i) Optimisation theory

ii) Mathematical modelling,

iii) Functional analysis,

iv) Operations research.

Courses suggested to be extended to the 300 level include:

i) Calculus

ii) Differential Equations I and II.

These analysis reveal that most of these courses which terminate prematurely are also difficult for students to conceptualise. There is therefore need for their extension to the higher levels.

Need for Continuity

There is need for students to realise that to run through any programme, it is not just a matter of passing the final examination, but that of acquiring the pre-requisite knowledge at each level that will aid the acquisition of the knowledge of courses of greater complexity, in scope and depth in the next level.

These results agree with Bruner's theory of learning mathematics - the process orientation. The result in Appendix 2 also shows a high correlation of the effectiveness of the mathematics curriculum versus high students' enrolment in mathematics programmes. If this effectiveness of the curriculum implies curriculum for self-actualisation and self-reliance, then such curriculum will enhance students' positive attitude towards the study of mathematics and hence increase in enrolment into mathematics programmes.

Mathematics Graduates and Implementation of the Contents of the Mathematics Curriculum

A high percentage of respondents agree that mathematics graduates can implement the contents of the mathematics curriculum if they undergo training in methodology of teaching and learning.

The results of Table 7 and 8 depict that respondents agree that good qualification is a correlate of effective teaching.

However, some attribute failure in mathematics by undergraduates and students to:

i) Poor teaching methods,

ii) Laxity on the part of the students,

iii) Lack of understanding of the courses, et cetera.

Implications on Students' Attitude Towards the Study of Mathematics

The results of Table 1 show that there has been aversion of students from the study of mathematics since 1993. Respondents have traced this aversion to reasons as found in Appendix IV. An urgent address of this situation becomes absolutely necessary so as to avoid a final dearth of mathematics students in our higher institutions in later years.

With a good curriculum having wide scope, very relevant to the needs and objectives of the country and preserving continuity, other variables which can help to enhance students' positive attitude towards the study of mathematics may include the following:

i) Governments' full attention to the mathematics programme, undergraduates, graduates and lecturers.

ii) Good methodology being used by lecturers.

iii) Awareness of the future prospects of mathematics by students.

iv) Hard work by students.

Conclusion

This study has shown that the present mathematics curricula have a wide scope. However, the study of the further mathematics curriculum by every S.S. 3 student can help them understand some 100 level university mathematics.

Again more courses in applied mathematics if introduced and varied specialisations as indicated, under the heading, scope above, if created, can enhance students positive attitude towards the study of mathematics.

The study has also shown that the curricula are relevant to the needs and objectives of government. If full attention is paid to the programme by creating public awareness on the importance of mathematics through seminars, students will begin to develop interest in mathematics.

The continuity inherent in the curricula makes for smooth movement from a lower level, to a higher level mathematics were discontinuity occurs, the study has suggested a link up.

The study also shows that all university mathematics curriculum are based on the NUC. Provisions, hence students of mathematics have been advised to feel comfortable with their curriculum and develop creative minds.

If students are aware of the future prospects of the mathematics they study, they will react more positively to the study of mathematics and more students will opt to study mathematics. Presently the aversion from the study of mathematics is due to low interest.

Educational Implication of the Study:

The findings of the study have the following implications: Good mathematics curricula

i) Will aid organisation of work in mathematics textbooks by authors.

ii) This implies that pre-requisite knowledge are discussed before the latter ones.

iii) Easy acquisition of initial knowledge before the introduction of a new course.

Lecturers of mathematics should follow strictly the course outline while teaching to ensure that sequence is preserved and logical thinking enhance.

Areas of relevance of mathematics in the society should be emphasised while delivering lectures on the different courses at all levels.

Approaching mathematics as it relates to life experiences of learners should be emphasised in schools. Mkpa (1987:139) opined: "... The multidisciplinary nature of mathematics could be explored by schools in order to arouse students interest in mathematics. This could be achieved by the integration of similar or related areas of different disciplines into a coherent thought".

Thus the mathematical aspects of different disciplines could be integrated into one coherent thought. This can act as an interest generator if taught as a course in university mathematics.

Varied specialisations in the area of mathematics should be created. Universities should endeavour not to disrupt the academic calendar for this could disturb the completion of the total course work for the students.

Recommendations:

On the basis of this study, the following recommendations are made:

1. Students should begin to develop interests in mathematics by devoting more time to its study.

2. Mathematics should be taught properly right from the primary and secondary levels by teachers. Teachers should make mathematics interesting by bringing it down to earth.

3. Government should:
   i) employ qualified and seasoned lecturers,

   ii) Organise seminars on the importance of and careers in mathematics for a cross section of the population.

   iii) Provide a good collection of mathematics books, journals, magazines, et cetera for use by students and lecturers.

   iv) Provide incentives to both lecturers and students at all levels of their study of mathematics.

   v) Employ sufficient number of faculty members with advanced degrees to offer basic advanced courses in pure and applied mathematics as they relate to the different professions.

   vi) Organise special compulsory programmes for mathematics students prior to their final year after which each can graduate in special fields of mathematics.

4. Curriculum planners should introduce attractive combined honours courses one of which must be mathematics.

5. Seminars and conferences in mathematics should be an annual event in universities to enhance awareness of recent developments.

Limitations:

A notable limitation of this study is that it was difficult to reach the engineers and scientists who were expected to respond to the items of the questionnaire. Again, some of the items in the questionnaires were not responded to by the subjects in the universities. Thus there may be some flaws in the final results.

Suggestions for Further Studies

The following are suggested for further studies:

1. Further study should be carried out on the need for including in the university mathematics curriculum the methods, materials, analogues and teaching strategies in addition to the subject matter.

2. Identifying the methods of sustaining secondary school students' interest in the subject mathematics.

3. Investigation of the multidisciplinary nature of mathematics as a means of arousing students' interest in mathematics.

4. Further research should be investigated on identification and remediation of process errors in mathematics at the secondary school level and university level.

5. The need for interest generators in mathematics: The level of efforts made by the mathematics teacher.

6. The need for a student-centred-activity based method of teaching and learning in our higher mathematics lessons.

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APPENDIX I

Faculty of Education,
University of Nigeria, Nsukka (UNN)

27th November, 1996.

Dear Respondent,

I am a post graduate student conducting a scientific research that deals on the present mathematics curricula and their implications on the attitude of students towards the study of mathematics. To ensure a reliable result, please respond objectively and honestly to this instrument. Please read the instruction very well and attend to the preliminary "professional levels" before responding to the items.

All responses will be treated as highly confidential.

Yours sincerely,

The Researcher.

Please respond honestly to these items by ticking good (√) in the option that best describes your professional level.

Professional level:

Engineer	[ ]
Scientist	[ ]
Mathematician	[ ]
Mathematics Lecturer	[ ]
Mathematics Undergraduate	[ ]

Part A

This part measured the level of agreement of the relevance, continuity, sequence and scope of the mathematics curricula.

	Strongly Agree (SA)	Agree (A)	Disagree (DA)	Strongly disagree (SDA)	Uncertain (U)
1a) Some University Mathematics courses have no link with senior secondary mathematics topics.					
2a) Some University Mathematics courses topics are difficult to conceptualise due to poor background knowledge of the course.					
3a) Premature examination of some Mathematics courses/topics affects acquisition of the knowledge of higher level related topics.					
4a) There is an aversion of students from the study of mathematics in the Universities because there are no future prospects in the study of mathematics.					
5a) A mathematics curriculum for self-actualisation and self-reliance will enhance students positive attitude towards the study of mathematics.					
6) Poor teachings causes failure in Mathematics.					
7) Good Mathematics teaching is a correlate of qualification of the teacher.					

	Very Large Extent (VLE)	Large Extent (LE)	Small Extent (SE)	Very Small Extent (USE)	No Extent (NE)
8a) To what extent are the mathematics curricula uniform in all universities ?					
9a) To what extent are the present mathematics curricula still relevant to the needs and objectives of the Nigerian society?					

Part B

This part measures the closeness of opinions on the implications of the curricula on students attitude towards the study of Mathematics.

1bi) Indicate the areas of discontinuity between Senior Secondary and University mathematics:

i) ....

ii) ....

iii) ....

iv) ....

v) ....

1bii) Suggest a link up

i) ....

ii) ....

iii) ....

iv) ....

v) ....

2bi) Indicate those Mathematics Courses/topics which are difficult to conceptualise:

i) ....

ii) ....

iii) ....

iv) ....

v) ....

2bii) Give reasons why you think that students find these courses/topics difficult:

i) ....

ii) ....

iii) ....

iv) ....

v) ....

3bi) Give examples of Mathematics Courses/topics which terminate prematurely:

i) ....

i) ....

ii) ....

iii) ....

iv) ....

COURSE DESCRIPTION	500L	400L	300L	200L	100L
3Bii) To what level will you prefer the extension of these courses?					
i)					
ii)					
iii)					
iv)					
v)					

4bi) Suggest reasons for the aversion of students from the study of Mathematics:

i) ....

i) ....

ii) ....

iii) ....

iv) ....

4bii) Suggest ways of correcting such negative attitude towards the study Mathematics.

i) ....

ii) ....

iii) ....

iv) ....

v) ....

4biii) What has been the enrolment in your Mathematics class in past seven years? Indicate the number:

1993 1994 1995 1996 1997 1998 1999 2000

5b) Suggest some topics/courses that can be included or deleted from the present Mathematics curriculum to achieve this purpose:

i) ....

i) ....

ii) ....

iii) ....

iv) ....

8b) Give reasons for any variation in the content of Mathematics curricula of different Universities:

i) ....

ii) ....

iii) ....

iv) ....

v) ....

9bi) Give examples of areas of relevance (or no relevance) of the present Mathematics curricula to the needs and objectives of the Nigerian society.

i) ....

i) ....

ii) ....

iii) ....

iv) ....

9bii) Considering the slow pace of the country's technological advancement, and Mathematics being the bed rock of technology, what in your opinion is the reason for this drag?

i) ....

i) ....

ii) ....

iii) ....

iv) ....

9biii) What are your view about the products of the present Mathematics curricula being independent of governments' support?

i) ....

i) ....

ii) ....

iii) ....

iv) ....

APPENDIX II

Research Question 1:

To what extent dose effectiveness of the Mathematics curricula effect high student enrolment in Mathematics programme? This was answered using response to items' 5a and 5b on the questionnaire. Item 5a1 - A Mathematics curriculum for self-actualization and self-reliance will enhance students positive attitude towards the study of Mathematics.

Computation of r_l and r_u in answer to research question (1).

Undergraduates

	UNN (X)	ABSU(Y)	XY
SA.	17	13	221
A	10	10	100
D.A.	0	0	0
S.D.A.	0	0	0
U	0	0	0
	$\sum(x) = 27$	$\sum(y) = 23$	$\sum(xy) = 321$

$$\bar{x} = \frac{27}{5} = 5.4 \qquad \bar{y} = \frac{23}{9} = 4.6$$

X	$x - \bar{x}$	$(x - \bar{x})^2$	Y	$y - \bar{y}$	$(y - \bar{y})^2$
17	11.6	134.56	13	4.8	70.56
10	4.6	21.16	10	5.4	29.16
0	-5.4	29.16	0	-4.6	21.16
0	-5.4	29,16	0	-4.6	21.16
0	-5.4	29.16	0	-4.6	21.16
		$\Sigma(x - \bar{x}) = 243.20$		$\Sigma(y - \bar{y}) = 163.20$	

$$\sigma_x = \sqrt{\frac{\Sigma(x - x)^2}{n}} \qquad \sigma_y = \sqrt{\frac{\Sigma(y - y)^2}{n}}$$

$$= \sqrt{\frac{243.2}{5}} \qquad = \sqrt{\frac{163.2}{5}}$$

$$= \sqrt{48.64} \qquad = \sqrt{32.64}$$

$$= 6.97423831 \qquad = 5.713142743$$

Therefore $r_u = \dfrac{\Sigma(xy) - n\bar{x}\bar{y}}{n\sigma_x\sigma_y}$

$$r_u = \frac{321 - 5(5.4)(4.6)}{5(6.97423831)(5.713142743)}$$

$$r_u = \frac{321 - 124.2}{199.2240949}$$

$$r_u = \frac{196.8}{199.2240949}$$

$$r_u = 0.9878232 \approx 0.99$$

Lecturers:

	UNN (x)	ABSU (y)	xy
S.A.	10	2	20
A.	6	4	24
D.A.	0	0	0
S.D.A.	0	0	0
U	0	0	0
	$\in (x) = 16$	$\in (y) = 6$	$\in (xy) = 44$

$$\bar{x} = \frac{16}{5} = 3.2 \qquad \bar{y} = \frac{6}{5} = 1.2$$

X	$x - \bar{x}$	$(x - \bar{x})^2$	y	$y - \bar{y}$	$(y - \bar{y})^2$
10	6.8	46.24	2	0.8	0.64
6	2.8	7.84	4	2.8	7.84
0	-3.2	10.24	0	-1.2	1.44
0	-3.2	10.24	0	-1.2	1.44
0	-3.2	10.24	0	-1.2	1.44
		$\sum (x-\bar{x})^2$			$\Sigma(y=\bar{y})^2=12.80$

$$\sigma_x = \sqrt{\frac{\sum (x-\bar{x})^2}{n}} \qquad \sigma_y = \sqrt{\sum (y-\bar{y})^2}$$

$$\sigma_x = \sqrt{\frac{84.8}{5}} \qquad \sigma_y = \sqrt{\frac{12.8}{5}}$$

$$\sigma_x = \sqrt{16.96} \qquad \sigma_y = \sqrt{2.56}$$

$$\sigma_x = 4.118252056 \qquad \sigma_y = 1.6$$

$$\text{Therefore } r_l = \frac{\sum(xy) - n\overline{xy})}{n\sigma_x \sigma y}$$

$$r_l = \frac{44 - 5\,(3.2)(1.2))}{5(4.118252056)\,(1.6)}$$

$$r_l = \frac{44 - 19.2}{32.94601645}$$

$$r_l = \frac{24.8}{32.94601645} \qquad r_l = 0.75$$

(5b)

Suggested topics/courses to be included or deleted from the present Mathematics curriculum to make it more effective so as to affect high student enrolment into Mathematics programmes and analysed in percentages include:

	UNDERGRADUATES	UNN(x)	ABSU (y)
i	Delete Lebesque measure	24=88.9%	
ii	Delete Abstract Algebra	24=88.9%	
iii	Include Operations Research		12=52.2%
	LECTURERS:		
iv	Include more courses in Applied Mathematics	16=100%	6 = 100%
v	Mathematics is a universal language and every bit of what we teach is relevant, so none should be deleted.		6=100%
vi	Create varied specialisations in the field of Mathematics. For example, Medical, Engineering, Business - Mathematics, et cetera.	16 = 100%	6 100%

APPENDIX III

Research Question 2

To what extent are the curricula of different Universities uniform? This was answered using responses to items 8a and 8b on the questionnaire as well as Tables 3a and 3b.

Item 8a - To what extent are the Mathematics curricula uniform in all universities?

Undergraduates

	UNN(x)	**ABSU (y)**	**xy**
V.L.E.	0	0	0
L.E.	19	7	133
S.E.	0	16	0
V.S.E.	0	0	0
N.E.	8	0	0
	$\sum(x) = 27$	$\sum(y) = 23$	$\sum(xy) = 133$

$\bar{x} = \frac{27}{5}$ $\quad\quad \bar{y} = \frac{23}{5}$

$= 5.4$ $\quad\quad = 4.6$

x	$x - \bar{x}$	$(x - \bar{x})^2$	y	$y - \bar{y}$	$(y - \bar{y})^2$
0	-5.4	29.16	0	-4.6	21.16
19	13.6	184.96	7	2.4	5.75
0	-5.4	29.16	16	11.4	129.96
0	-5.4	29.16	0	-4.6	21.16
8	2.6	6.76	0	-4.6	21.16
	$\sum(x-\bar{x})^2 = 279.2$			$\sum(y-\bar{y})^2 = 199.20$	

$$\sigma_x = \sqrt{\frac{\sum(x - \bar{x})^2}{n}} \qquad \sigma_y = \sqrt{\frac{\sum(y - \bar{y})^2}{n}}$$

$$\sigma_x = \sqrt{\frac{279.2}{5}} \qquad \sigma_y = \sqrt{\frac{199.2}{5}}$$

$$\sigma_x = \sqrt{55.84} \qquad \sigma_y = \sqrt{39.84}$$

$$\sigma_x = 7.472616677 \qquad \sigma_y = 6.311893535$$

$$r_u = \frac{\sum(xy) - n\bar{x}\bar{y})}{n\sigma_x \ \sigma_y}$$

$$r_u = \frac{133 - 5(5.4)(4.6)}{5(7.472616677)(6.311893535)}$$

$$r_u = \frac{133 - 124.2}{235.8318045}$$

$$r_u = \frac{88}{235.8318045}$$

$$r_u = 0.037314729 \approx 0.04$$

Lecturers

	UNN(x)	**ABSU (y)**	**xy**
V.L.E.	4	1	4
L.E.	12	5	60
S.E.	0	0	0
V.S.E.	0	0	0
N.E.	0	0	0
	$\sum(x) = 16$	$\sum(y) = 60$	$\sum(xy) = 64$

$$\bar{x} = \frac{16}{5} \qquad \bar{y} = \frac{6}{5}$$

$$\bar{x} = 3.2 \qquad = 1.2$$

x	x - x̄	(x - x̄)²	y	y - ȳ	(y - ȳ)²
4	0.8	0.64	1	-0.2	0.04
12	8.8	77.44	5	3.8	14.44
0	-3.2	10.24	0	-1.2	1.44
0	-3.2	10.24	0	-1.2	1.44
0	-3.2	10.24	0	-1.2	1.44
	$\sum (x-\bar{x})^2 = 108.8$			$\sum (y-\bar{y})^2 = 18.80$	

$$\sigma_x = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} \qquad \sigma_y = \sqrt{\frac{\sum (y - \bar{y})^2}{n}}$$

$$\sigma_x = \sqrt{\frac{108.8}{5}} \qquad \sigma_y = \sqrt{\frac{18.80}{5}}$$

$$\sigma_x = \sqrt{21.76} \qquad \sigma_y = \sqrt{3.76}$$

$$\sigma_x = 4.664761516 \qquad \sigma_y = 1.939071943$$

$$r_l = \frac{\sum (xy) - n\bar{x}\bar{y})}{n\sigma\ x\ \sigma y}$$

$$r_l = \frac{64 - 5(3.4)(1.2)}{5(4.66476156)(1.939071943)} = \frac{44.8}{45.22654088}$$

$$r_l = \frac{133 - 124.2}{235.8318045}$$

$$r_l = \frac{88}{235.83189405}$$

$$r_l = 0.990568792$$

Suggested reasons for variations in the content of mathematics curricula of different universities and analysed using percentages include:

	Undergraduates	UNN (x)	ABSU (y)
I	Non-availability of specialist lecturers.		16 = 69.6%
	Lecturers		
ii	Preference of some universities in adopting the basic N.U.C. standards in mathematics, while others operate above the N.U.C. standards.	10 = 62.5%	6 = 100%
iii	Though they are uniform, there may be variation due to (a) Lecturer's preference (b) Disruption of academic calendar		5 = 83.3%

Tables 3 (a) and (b) give further information about the uniformity and variations (if any) of the curricula.

APPENDIX IV

Research Question (3)

To what extent do future prospects of Mathematics affect high student enrolment in mathematics programmes?

This was answered using responses to items 4(a), 4(b), 9(b) (i), ii, iii on the questionnaire. Item 4(a) - There is aversion of students from the study of mathematics.

The enrolment data into mathematics programmes for 1993 to 2001 (Table 1) of the two sample universities show that there is aversion of student from the study of mathematics.

Respondents however, strongly disagree that aversion of students from the study of mathematics is due to no future prospect for graduates of mathematics, instead such aversion has been traced to other reasons in responses to item 4(b) i as follows:

	Undergraduates	**UNN (x)**	**ABSU (y)**
i	There is a phobia amongst students that mathematics is difficult	14 = 51.9%	
ii	Lack of good foundation for students from the primary school level is an inhibition to interest development in the disciplines.	13 = 48.15%	
iii	The abstract nature of mathematics makes students run away from it.		23= 100%
iv	Non-professional nature of the course makes students feel it is not job oriented.		23 = 100%
v	Attitude of employers to graduates of mathematics is not so encouraging as to attract students to the discipline.		23 = 100%
vi	The society lacks orientation on the importance of mathematics in every facet of life.		23 = 100%

vii	Those who study mathematics cannot be employed elsewhere except in the teaching profession.	16 = 100%	6 = 100%
viii	They think that mathematics is just a cushion for other professional courses.	16 = 100%	
ix	They think that there is no good reward for doing mathematics as a course.		6 = 100%

Item 9(a) - To what extent are the present mathematics curricula still relevant to the needs and objectives of the Nigerian society?

Undergraduates	UNN (x)	ABSU (x)	xy
V.L.E. L.E. S.E. V.S.E. N.E.	16 8 3 0 0	9 7 7 0 0	144 56 21 0 0
	$\sum(X) = 27$	$\sum(y) = 23$	$\sum(xy) = 221$

$\bar{x} = \frac{27}{5}$ $\qquad \bar{y} = \frac{23}{5}$

$= 5.4$ $\qquad = 4.6$

x	$x - \bar{x}$	$(x - \bar{x})^2$	y	$y - \bar{y}$	$(y - \bar{y})^2$
16	10.6	112.36	9	4.4	19.36
8	2.6	6.76	7	2.4	5.76
3	-2.4	5.76	7	2.4	5.76
0	-5.4	29.16	0	-4.6	21.16
0	-5.4	29.16	0	-4.6	21.16
	$\sum(x-\bar{x})^2 = 183.2$			$\sum(y-\bar{y})^2 = 73.2$	

$$\sigma_x = \sqrt{\frac{\sum(x-\bar{x})^2}{n}} \qquad \sigma_y = \sqrt{\frac{\sum(y-\bar{y})^2}{n}}$$

$$\sigma_x = \sqrt{\frac{183.2}{5}} \qquad \sigma_y = \sqrt{\frac{73.2}{5}}$$

$$\sigma_x = \sqrt{36.54} \qquad \sigma_y = \sqrt{14.64}$$

$$\sigma_x = 6.05309838 \qquad \sigma_y = 3.826225294$$

$$r_u = \frac{\sum(xy) - n\overline{xy})}{n^{\sigma_x}\ \sigma_y}$$

$$r_u = \frac{221 - 5(5.4)(4.6)}{5(6.05309838)(3.826225294)}$$

$$r_u = \frac{221 - 124.2}{115.8025906}$$

$$r_u = \frac{96.8}{115.8025906}$$

$$r_u = 0.835905306 \approx 0.8$$

Lecturers	**UNN (x)**	**ABU (y)**	**xy**
V.L.E L.E. S.E. V.S.E. N.E.	7 9 0 0 0	6 0 0 0 0	42 0 0 0 0
	$\sum$ (X) = 16	$\sum$ (y) = 6	$\sum$ (xy) = 42

$\bar{x} = \frac{16}{5}$ $\qquad$ $\bar{y} = \frac{6}{5}$

= 3.2 $\qquad$ =1.2

x	x - x̄	(x - x̄)²	y	y - ȳ	(y - ȳ)²
7	3.8	14.44	6	4.8	23.04
9	5.8	33.64	0	-1.2	1.44
0	-3.2	10.24	0	-1.2	1.44
0	-3.2	10.24	0	-1.2	1.44
0	-3.2	10.24	0	-1.2	1.44
	$\sum (x-\bar{x})^2 = 78.8$			$\sum (y-\bar{y})^2 = 28.8$	

$$\sigma_x = \sqrt{\frac{\sum (x-x)^2}{n}} \qquad \sigma_y = \sqrt{\frac{\sum (y-y)^2}{n}}$$

$$\sigma_x = \sqrt{\frac{78.8}{5}} \qquad \sigma_y = \sqrt{\frac{28.8}{5}}$$

$$\sigma_x = \sqrt{15.76} \qquad \sigma_y = \sqrt{5.76}$$

$$\sigma_x = 3.969886648 \qquad \sigma_y = 2.4$$

$$\textit{Therefore } r_l = \frac{\sum (xy) - n\overline{xy})}{n\,\sigma_x\,\sigma_y}$$

$$r_l = \frac{42 - 5(3.2)(1.2)}{5(3.969886648)(2.4)}$$

$$r_l = \frac{42 - 19.2}{47.63863978}$$

$$r_l = \frac{22.8}{47.63863978}$$

$$r_l = 0.478603085 \approx 0.5$$

Suggested Areas of relevance in response to item 9b (I) include:

	Undergraduates	UNN (x)	ABSU (y)
i	Industries and Companies	20 = 74%	
ii	Engineering/Computer Firms	22=81%	
iii	Technology/Development	25=92.59%	
iv	Mathematical physics	14 =51.85%	
	Lecturers		
v	Very relevant in Statistics Economics and business.	15 = 93.75%	6 = 100%
vi	Provides basis for science and technology		6 = 100%
vii	Provides pedagogical needs of the Nigerian society.		6 = 100%

Suggested reasons for the slow pace of the country's technological advancement in response to tem 9b (ii) include:

	Undergraduate	UNN (x)	ABSU (y)
i	Lack of encouragement to those who offer to study mathematics reduce their devotion to the discipline's challenges.	23=85.2%	23 = 100%
ii	No incentive for mathematics lecturers discourages them from using their full potentials.	20=74.1%	
iii	Lack of interest in Mathematics by growing youths has caused aversion from the discipline.	21=77.7%	
iv	Lack of public awareness of the importance of mathematics in technology		21=77.7%
v	Lack of awareness of the possible careers for the graduates of mathematics.		20 = 86.96%
	Lecturers		
vi	Dwindling interest of students in mathematics has caused poor enrolment in the discipline and hence low manpower for technological development	16=100%	16 = 10.0%
vii	Inadequate devotion by some mathematics lecturers leads to the production of half-baked graduates who cannot apply the true knowledge of mathematics to physical situations.	16=100%	6=100%

Suggested reasons for the slow pace of the country's technological advancement in response to tem 9b (ii) include:

	Undergraduate	**UNN (x)**	**ABSU (y)**
i	Lack of encouragement to those who offer to study mathematics reduce their devotion to the discipline's challenges.	23=85.2%	23 = 100%
ii	No incentive for mathematics lecturers discourages them from using their full potentials.	20=74.1%	
iii	Lack of interest in Mathematics by growing youths has caused aversion from the discipline.	21=77.7%	
iv	Lack of public awareness of the importance of mathematics in technology		21=77.7%
v	Lack of awareness of the possible careers for the graduates of mathematics.		20 = 86.96%
	Lecturers		
vi	Dwindling interest of students in mathematics has caused poor enrolment in the discipline and hence low manpower for technological development	16=100%	16 = 10.0%
vii	Inadequate devotion by some mathematics lecturers leads to the production of half-baked graduates who cannot apply the true knowledge of mathematics to physical situations.	16=100%	6=100%
viii	Insufficient encouragement by government to both teachers and students of mathematics affects devotion to work.	16=100%	6=100%
ix	Nigeria does not appreciate much of the manpower available to her in the area of mathematics and this results in negative response to the study of mathematics.	10=62.5%	6=100%
x	The country is still interested in the importation of foreign technology.		4=66.7%
	Undergraduate	**UNN (x)**	**ABSU (y)**
xi	Lack of interest in the discipline has caused aversion of students who otherwise would have applied their mathematical competence in technology after graduation.		6=100%
xii	Although Mathematics is a difficult subject requiring a lot of brain work, there is no adequate incentive by government to mathematicians and mathematics teachers so students feel it is not a lucrative career.		6=100%
xiii	Planners disregard the need to make numeracy a policy issue and this has had adverse affect on the technological advancement of the country.		6=100%

APPENDIX V

Research Question (5)

To what extent does effectiveness of the mathematics curricula affect positive attitude towards the study of mathematics?

This was also answered using responses to items 9 (a) and 9 (b) in the questionnaire. This means that once the mathematics curriculum is found to be highly effective in other areas of study, students will react positively to the study of mathematics and so will apply to study it in the University.

APPENDIX VI

Research Question (6)

How effectively does the qualified mathematics graduate handle Senior Secondary Mathematics?

This was answered using responses to items 6 and 7 n the questionnaires.

Item 6 - Poor teaching causes failure in Mathematics.

Undergraduates	**UNN (x)**	**ABSU (y)**	**xy**
S.A.	0	0	0
A	19	10	190
D.A.	5	0	0
S.D.A.	3	13	39
U.	0	0	0
	$\sum(x) = 27$	$\sum(x) = 23$	$\sum(xy) = 229$

$$\bar{x} = \frac{27}{5} \qquad \bar{y} = \frac{23}{5}$$

$$= 5.4 \qquad = 4.6$$

x	$x - \bar{x}$	$(x - \bar{x})^2$	y	$y - \bar{y}$	$(y - \bar{y})^2$
0	5.4	29.16	0	4.6	21.16
19	13.6	180.96	10	5.4	29.16
5	-0.4	0.16	0	-4.6	21.16
3	-2.4	5.76	13	8.4	70.56
0	-5.4	29.16	0	-4.6	21.16
	$\sum (x-\bar{x})^2 = 249.20$			$\sum(y-\bar{y})^2 = 163.20$	

$$\sigma_x = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} \qquad \sigma_y = \sqrt{\frac{\sum (y - \bar{y})^2}{n}}$$

$$\sigma_x = \sqrt{\frac{249.2}{5}} \qquad \sigma_y = \sqrt{\frac{163.2}{5}}$$

$$\sigma_x = \sqrt{49.84} \qquad \sigma_y = \sqrt{32.64}$$

$$\sigma_x = 7.059745038 \qquad \sigma_y = 5.713142743$$

$$r_u = \frac{\sum (xy) - n\overline{xy})}{n\sigma_x \ \sigma_y}$$

$$r_u = \frac{229 - 5(5.4)(4.6)}{5(7.059745038)(5.713142743)}$$

$$r_u = \frac{229 - 124.2}{201.6666557}$$

$$r_u = \frac{104.8}{201.6666557}$$

$$r_u = 0.519669449 \approx 0.52$$

$$\sigma_x = \sqrt{\frac{\sum(x - \bar{x})^2}{n}} \qquad \sigma_y = \sqrt{\frac{\sum(y - \bar{y})^2}{n}}$$

$$\sigma_x = \sqrt{\frac{249.2}{5}} \qquad \sigma_y = \sqrt{\frac{163.2}{5}}$$

$$\sigma_x = \sqrt{49.84} \qquad \sigma_y = \sqrt{32.64}$$

$$\sigma_x = 7.059745038 \qquad \sigma_y = 5.713142743$$

$$r_u = \frac{\sum(xy) - n\bar{x}\bar{y})}{n\sigma_x \ \sigma_y}$$

$$r_u = \frac{229 - 5(5.4)(4.6)}{5(7.059745038)(5.713142743)}$$

$$r_u = \frac{229 - 124.2}{201.6666557}$$

$$r_u = \frac{104.8}{201.6666557}$$

$$r_u = 0.519669449 \approx 0.52$$

Lecturers	UNN (x)	ABSU (y)	xy
S.A A D.A. S.D.A. U	0 13 1 2 0	0 6 0 0 0	0 78 0 0 0
	$\sum(x) = 16$	$\sum(y) = 6$	$\sum(xy) = 78$

$$x = \frac{16}{5} \qquad y = \frac{6}{5}$$

$$= 3.2 \qquad = 1.2$$

x	x - $\bar{x}$	$(x - \bar{x})^2$	y	y - $\bar{y}$	$(y - \bar{y})^2$
0	-3.2	10.24	0	-3.2	10.24
13	9.8	96.04	6	2.8	7.84
1	-2.2	4.84	0	-3.2	10.24
2	-1.2	1.44	0	-3.2	10.24
0	-3.2	10.24	0	-3.2	10.24
	$\sum (x-\bar{x})^2 = 122.8$			$\sum(y-\bar{y})^2 = 48.80$	

$$\sigma_x = \sqrt{\frac{\sum (x-\bar{x})^2}{n}} \qquad \sigma_y = \sqrt{\frac{\sum (y-\bar{y})^2}{n}}$$

$$\sigma_x = \sqrt{\frac{122.8}{5}} \qquad \sigma_y = \sqrt{\frac{48.8}{5}}$$

$$\sigma_x = \sqrt{24.56} \qquad \sigma_y = \sqrt{9.76}$$

$$\sigma_x = 4.955804677 \qquad \sigma_y = 3.12409987$$

$$r_l = \frac{\sum (xy) - n\overline{xy})}{n\sigma_x \sigma_y} = \frac{78 - 5(3.2)(1.2)}{5(4.955804677)(3.12409987}$$

$$r_l = \frac{78 - 19.2}{77.41214374} = \frac{58.8}{77.4124374} = 0.759570749$$

Item 7 - Good mathematics teaching is a correlate of qualification of the teacher.

Undergraduates	UNN (x)	ABSU (y)	xy
S.A	10	6	60
A	13	10	130
D.A	4	7	28
S.D.A.	0	0	0
U	0	0	0
	$\sum (x) = 27$	$\sum(y) = 23$	$\sum (xy) = 218$

$$\bar{x} = \frac{\sum(x)}{n} = \frac{27}{5} = 5.4 \qquad \bar{y} = \frac{23}{5} = 4.6$$

x	x - x̄	(x - x̄)²	y	y - ȳ	(y - ȳ)²
10	-4.6	21.16	6	1.4	1.96
13	7.6	57.76	10	5.4	16.16
4	-1.4	1.94	7	2.4	5.76
0	-5.4	29.16	0	-4.6	21.16
0	-5.4	29.16	0	-4.6	21.16
	$\sum(x-\bar{x})^2 = 139.2$			$\sum(y-\bar{y})^2 = 79.2$	

$$\sigma_x = \sqrt{\frac{\sum(x - \bar{x})^2}{n}} \qquad \sigma_y = \sqrt{\frac{\sum(y - \bar{y})^2}{n}}$$

$$\sigma_x = \sqrt{\frac{139.2}{5}} \qquad \sigma_y = \sqrt{\frac{79.2}{5}}$$

$$\sigma_x = \sqrt{27.84} \qquad \sigma_y = \sqrt{15.84}$$

$$\sigma_x = 5.276362383 \qquad \sigma_y = 3.979949748$$

$$r_u = \frac{\sum(xy) - n\bar{x}\bar{y})}{n\sigma_x \ \sigma_y}$$

$$r_u = \frac{218 \ - 124.2}{104.9982857}$$

$$r_u = \frac{93.8}{104.9982857}$$

$$r_u = 0.893347918$$

Lecturers	UNN (x)	ABSU (y)	(xy)
S.A A D.A. S.D.A. U	13 3 0 0 0	6 0 0 0 0	78 0 0 0 0
$\sum(x) = 16$		$\sum(y) = 6$	$\sum(xy) = 78$

$$\bar{x} = \frac{16}{5} = 3.2 \qquad \bar{y} = \frac{6}{5} = 1.2$$

x	$x - \bar{x}$	$(x - \bar{x})^2$	y	$y - \bar{y}$	$(y - \bar{y})^2$
13	9.8	96.04	6	-4.8	23.04
3	-0.2	0.04	0	-1.2	1.44
0	-3.2	10.24	0	-1.2	1.44
0	-3.2	10.24	0	-1.2	1.44
0	-3.2	10.24	0	-1.2	1.44
	$\sum(x-\bar{x})^2 = 126.80$			$\sum(y-\bar{y})^2 = 28.80$	

$$\sigma_x = \sqrt{\frac{126.9}{5}} \qquad \sigma_y = \sqrt{\frac{28.8}{5}}$$

$$\sigma_x = \sqrt{25.36} \qquad \sigma_y = \sqrt{5.76}$$

$$\sigma_x = 5.035871325 \qquad \sigma_y = 2.4$$

$$r_u = \frac{78 - 5(3.2)(1.2)}{5(5.035871325)(2.4)}$$

$$r_l = \frac{78 - 19.2}{60.4304559}$$

$$r_l = \frac{58.8}{60.4304559}$$

$$r_l = 0.973019301$$

APPENDIX VII

Hypothesis One

There is no significant linkage between University Mathematics courses and Senior Secondary Mathematics.

Tables 1a, 1b and 2 provide answers to Hypothesis one. Response to item 1a on the questionnaire also provide answers to hypothesis one.

Item 1a: Some University Mathematics courses have no link with Senior Secondary Mathematics topics.

Undergraduates	**UNN (x)**	**ABSU (y)**	**xy**
S.A.	4	6	24
A	7	5	35
D.A.	6	6	36
S.D.A.	10	6	60
U	0	0	0
$\sum (x) = 27$		$\sum (y) = 23$	$\sum (xy) = 155$

$$\bar{x} = \frac{27}{5} = 5.4 \qquad \bar{y} = \frac{23}{5} = 4.6$$

x	$x - \bar{x}$	$(x - \bar{x})^2$	y	$y - \bar{y}$	$(y - \bar{y})^2$
4	-1.4	1.96	6	1.4	1.96
7	1.6	2.56	5	0.4	0.16
6	0.6	0.36	6	1.4	1.96
10	4.6	21.16	6	1.4	1.96
0	-5.4	29.16	0	-4.6	21.16
	$\sum (x-\bar{x})^2 = 55.2$			$\sum(y-\bar{y})^2 = 27.2$	

$$\sigma_x = \sqrt{\frac{\sum(x-\bar{x})^2}{n}} \qquad \sigma_y = \sqrt{\frac{\sum(y-\bar{y})^2}{n}}$$

$$\sigma_x = \sqrt{\frac{55.2}{5}} \qquad \sigma_y = \sqrt{\frac{27.2}{5}}$$

$$\sigma_x = \sqrt{11.04} \qquad \sigma_y = \sqrt{5.44}$$

$$\sigma_x = 3.322649646 \qquad \sigma_y = 2.332380758$$

$$r_u = \frac{\sum(xy) - n\overline{xy})}{n\sigma_x \ \sigma_y}$$

$$r_u = \frac{155 - 5(5.4)(4.6)}{5(3.322649545)(2.33)}$$

$$r_u = \frac{155 - 124.2}{38.73831932}$$

$$r_u = \frac{30.8}{38.74841932}$$

$$r_u = 0.7944871133 \approx 0.79 = A \text{ mod}\textit{erately high correlation.}$$

Lecturers	UNN (x)	ABSU (y)	xy
S.A. A D. A. S.D.A. U	0 0 0 16 0	0 0 3 3 0	0 0 0 48 0
$\sum$ (x) = 16		$\sum$ (y) = 6	$\sum$ (xy) = 48

$$\bar{x} = \frac{16}{5} = 3.2 \qquad \bar{y} = \frac{6}{5} = 1.2$$

x	x - $\bar{x}$	$(x - \bar{x})^2$	y	y - $\bar{y}$	$(y - \bar{y})^2$
0	-3.2	10.24	0	-1.2	1.44
0	-3.2	10.24	0	-1.2	1.44
0	-3.2	10.24	3	1.8	3.24
16	12.8	163.84	3	1.8	3.24
0	-3.2	10.24	0	-1.2	1.44
	$\sum (x-\bar{x})^2 = 204.8$			$\sum(y-\bar{y})^2 = 10.80$	

$$\sigma_x = \sqrt{\frac{204.8}{5}} \qquad \sigma_y = \sqrt{\frac{10.80}{5}}$$

$$\sigma_x = \sqrt{40.96} \qquad \sigma_y = \sqrt{2.16}$$

$$\sigma_x = \qquad \sigma_y = 1.46969346$$

$$\textit{Therefore } r = \frac{\sum (xy) - n\overline{xy})}{n\sigma_x \ \sigma_y}$$

$$\frac{48 - 5(3.2)(1.2)}{5(6.4)(1.4969346)}$$

$$r_l = \frac{48 - 19.2}{47.03020307}$$

$$r_l = \frac{28.8}{47.03020307}$$

$r_l = 0.612372435 \approx 0.6$ *A Moderately high correlation.*

Suggested areas of discontinuity in response to item 1a include the following:

	Undergraduates	UNN(x)	ABSU(y)
i	Functional analysis	6=22.2%	0=0%
ii	Abstract Algebra and numerical analysis	0=0%	10=43.5%
iii	Metric Space topology and partial differential equation.	3=11.1%	10=43.5%
	Lecturers		
v	The senior secondary mathematics serves to develop the computational and analytical skills of students so that they can cope with the University mathematics.	8=50%	3=50%
vi	They do not need to have idea of everything done in the university mathematics curriculum at the secondary school level.	8=50%	3=50%

Computation of the Significance of the Difference Between the Correlation Coefficients r_u and r_l for the University and Secondary Mathematics Linkage

Let the correlation coefficient of Undergraduate response = r_u

and that of lecturers = r_1

Number of Undergraduates = N_u

Number of Lecturers = N_1

Z statistic for Undergraduates responses = Z_u

Z statistic for lecturers responses = Z_1

$$Z_1 = 1.1513 \log_{10} \frac{(1 + r_l)}{(1 - r_l)} = 1.1513 \log_{10} \left(\frac{1 + 0.6}{1 - 0.6}\right)$$

$$= 1.1513 \log_{10} \left(\frac{1.6}{0.4}\right) = 1.1513 \log_{10} 4$$

$$= 0.693151668 \quad » \quad 0.6932$$

$$Z_u = 1.1513 \log_{10} \left(\frac{1 + 0.794871133}{1 - 0.794871133}\right)$$

$$= 1.1513 \log_{10} \frac{1.794871133}{0.205126667}$$

$$= 1.1513 \log_{10} \ 8.749968541$$

$$= 1.084532074$$

$$\sigma_{z_i} - z_u = \sqrt{\frac{1}{N_1 - 3} + \frac{1}{N_u - 3}}$$

$$= \sqrt{\frac{1}{22 - 3} + \frac{1}{50 - 3}}$$

$$= \sqrt{\frac{1}{19} + \frac{1}{47}}$$

$$= \frac{47 + 19}{893}$$

$$= \sqrt{\frac{66}{893}}$$

$$= 0.271860579$$

We wish to decide between the hypothesis
Ho : $u_{z_1} = u_{z_u}$ *and* $H_1 : u_{z_1} \neq u_{z_u}$
Under hypothesis Ho

$$Z = \frac{z_1 - z_u - \left(u_{z_u} - u_{z_1}\right)}{\sigma^{-}{}_{z_1} - {}_{zu}}$$

$$Z = \frac{0.693151668 - 1.08453207 - 0}{0.271860579}$$

$$Z = \frac{-0.391380402}{2.271860529}$$

$$Z = -1.790347831 > -1.96$$

APPENDIX VIII

Hypothesis Two

There is no significant relationship between inability to conceptualise knowledge of a course and premature termination of a course.

Responses to items 3(a) and 3(b)i, ii on the questionnaire provide answers to hypothesis two:

Item 3(a): Premature termination of some mathematics courses/topic affects acquisition of knowledge of higher level related topics.

Undergraduates	UNN(x)	ABSU(y)	xy
S.A	14	23	32
A	13	0	0
D.A	0	0	0
S.DA.	0	0	0
U	0	0	0
	$\sum(x) = 27$	$\sum(y) = 23$	$\sum(xy) = 322$

$\bar{x} = \frac{27}{5}$ $\bar{y} = \frac{23}{5}$

$\bar{x} = 5.4$ $\bar{y} = 4.6$

x	x- $\bar{x}$	$(x-\bar{x})^2$	y	$y-\bar{y}$	$(y-\bar{y})^2$
14	8.6	73.96	23	18.4	338.56
13	7.6	57.6	0	-4.6	21.16
0	-5.4	29.16	0	-4.6	21.16
0	-5.4	29.16	0	-4.6	21.16
0	-5.4	29.16	0	-4.6	21.16
	$\sum(x-\bar{x})^2 = 219.2$				$\sum(y-\bar{y})^2 = 423.20$

$$\sigma_x = \sqrt{\frac{\Sigma\left(x-\bar{x}\right)^2}{n}} \qquad \sigma_y = \sqrt{\frac{\Sigma\left(y-\bar{y}\right)^2}{n}}$$

$$\sigma_x = \sqrt{\frac{219.20}{5}} \qquad \sigma_y = \sqrt{\frac{423.20}{5}}$$

$$\sigma_x = \sqrt{43.84} \qquad \sigma_y = \sqrt{84.64}$$

$$\sigma_x = 6.621178143 \qquad \sigma_y = 9.2$$

$$\sigma_x = 6.6 \qquad \sigma_y = 9.2$$

$$r_u = \frac{\Sigma\left(xy\right) - n\bar{x}\bar{y}}{n\sigma_x \sigma_y}$$

$$r_u = \frac{322 - 5(5.4)(4.6)}{5(6.621178143)(9.2)}$$

$$r_u = \frac{322 - 124.2}{304.5741946}$$

$$r_u = \frac{197.8}{304.5741946}$$

$$r_u = 0.64943125$$

$r_u \approx 0.65 = A$ *moderately high correlation*

Lecturer	**UNN(x)**	**ABSU(y)**	**xy**
S.A.	0	0	0
A	16	3	48
D.A.	0	3	0
S.D.A.	0	0	0
U.	0	0	0
	$\sum(x) = 16$	$\sum(y) = 6$	$\sum(xy) = 48$

$$\bar{x} = \frac{16}{5} \qquad \bar{y} = \frac{6}{5}$$

$$\bar{x} = 3.2 \qquad \bar{y} = 1.2$$

x	$x-\bar{x}$	$(x-\bar{x})^2$	y	$y-\bar{y}$	$(y-\bar{y})^2$
0	-3.2	10.24	0	-1.2	1.44
16	12.8	163.84	3	1.8	3.24
0	-3.2	10.24	3	1.8	3.24
0	-3.2	10.24	0	-1.2	1.44
0	-3.2	10.24	0	-1.2	1.44
		$\sum(x-\bar{x})^2 = 204.80$			$\sum(y-\bar{y})^2 = 10.80$

$$\sigma_x = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n}} \qquad \sigma_y = \sqrt{\frac{\Sigma(y-\bar{y})^2}{n}}$$

$$\sigma_x = \sqrt{\frac{204.8}{5}} \qquad \sigma_y = \sqrt{\frac{10.80}{5}}$$

$$\sigma_x = \sqrt{40.96} \qquad \sigma_y = \sqrt{2.16}$$

$$\sigma_x = 6.4 \qquad \sigma_y = 1.469693846$$

$$r = \frac{\Sigma(xy) - n\bar{x}\bar{y}}{n\sigma_x \sigma_y}$$

$$r_1 = \frac{48 - 5(3.2)(1.2)}{5(6.4)(1.469693846)}$$

$$r_1 = \frac{28.8}{47.03020307}$$

$r_1 = 0.612372435 \approx 0.6 \Rightarrow$ *A* mod*erately high correlation.*

Items 3b(i) Courses identified to terminate prematurely and so difficult to conceptualise include:

Undergraduates		**UNN(x)**	**ABSU(y)**
i.	Functional and Real Analysis	11=40.75%	0 = 0%
ii.	Optimisation Theory I and II		
iii.	Mathematical Modelling		
iv.	Operations research		
v.	Metric space/General Topology	11 = 40.74%	20 = 86.96%
vi.	Measure theory and Abstract Algebra	16 = 59.3%	20 = 86.69%
vii.	Lebesque Measure and Integration	16 = 59.3%	0 = 0%
viii.	Tensor Analysis	0 = 0%	13 = 13.04%
Lecturers			
ix.	Mathematical Modelling and Operations research	16 = 100%	3.50%
x.	Abstract Algebra, Functional and Real Analysis	0 = 0%	4 = 66.7%
xi.	Most courses at 100 and 200 levels that are basic in the application of mathematics especially calculus and differential equations.	0 = 0%	3 = 50%

Items 3b(ii) Suggested levels for extension of each of these courses

Undergraduates	**Functional Tens real Analysis**		**Optimization Theory & Topology**		**Mathematical Modelling & Measure theory**		**Operations Research & Abstract Algebra**		**Labasque Measure & Integration**	
	UNN (x)	**ABSU (y)**	**UNN (x)**	**ABSU (y)**	**UNN(x)**	**ABSU (y)**	**UNN (x)**	**ABSU (y)**	**UNN (x)**	**ABSU (y)**
	%	%	%	%	%	%	%	%	%	%
500L	0	0	5=18.5%	0	7=25.9%	0	0	0	0	0
400L	7=25.9	3=13	2=7.41	6=26	2=7.41	1=4.35	4=14.8	0	7=25.9	0
300L	0	0	0	0	0	0	0	0	0	0
200L	0	0	0	0	0	0	0	0	0	0
100L	0	0	0	0	0	0	0	0	0	0

Lecturers	Mathematical Modelling & Operations Research		Abstract Algebra, Functional and Real Analysis		Calculus		Differential Equations I &II	
	UNN (x)	ABSU (y)	UNN (x)	ABSU (y)	UNN (x)	ABSU (y)	UNN (x)	ABSU (y)
500L	10=62%	6=100%	6=37.25%	0=0%	0	0	0	0
400L	0	0	0	0	0	0	0	0
300L	0	0	0	0	8=50%	6=100%	0	3=50%
200L	0	0	0	0	0	0	0	0
100L	0	0	0	0	0	0	0	0

Computation of the significance of the difference between the Correlation coefficients r_u and r_l for the inability to conceptualise knowledge of a course versus premature termination of the course.

Referring to the notations used in computing Z for hypothesis one,

$$Z_1 = 1.513\log_{10}\left(\frac{1+r_1}{1-r_1}\right) = 1.513\log_{10}\left(\frac{1+0.6}{1+0.6}\right)$$

$$Z_1 = 1.513\log_{10}\left(\frac{1.6}{0.4}\right) = 1.513\log_4$$

$$= 0.693151668 \approx 0.69$$

$$Z_u = 1.1513\log_{10}\left(\frac{1+0.65}{1-0.65}\right) = 1.513\ \log_{10}\frac{1.65}{0.35}$$

$$= \ 1.1513\ \log_{10}\left(4.714285714 = 1.1513(0.673415899)\right)$$

$$= \ 0.775303725$$

$$s_{z_l} - z_u = \sqrt{\frac{1}{N_1 - 3} + \frac{1}{N_u - 3}} = \sqrt{\frac{1}{22-3} + \frac{1}{50-3}}$$

$$= \sqrt{\frac{1}{19} + \frac{1}{47}} \qquad = \sqrt{\frac{47+19}{893}}$$

$$s_{z_l} - z_u = \sqrt{\frac{66}{893}} \qquad = 0.271860579$$

$H_0 : U_{z_l} = U_{z_u}$ *and* $H_1 : u_{z_l} {}^{1} u_{z_u}$
Under H_o,

$$z = \frac{z_l - z_u - \left(u_{z_l} - u_{z_u}\right)}{0^{-}_{z_l} - z_u}$$

$$= \frac{0.693151668 - 0.775303725 - 0}{0.271860579}$$

$$z = \frac{-0.082152057}{0.271860579} = 0.302184514 > -1.96$$

APPENDIX IX

Hypothesis Three

There is no significant relationship between failure in Mathematics and lack of subordinate knowledge in mathematics.

Responses to items 2(a) and 2(b) ii on the questionnaire provide answers to hypothesis three.

Item 2(a): Some Mathematics courses/topics are difficult to conceptualise due to poor background knowledge of the courses.

Undergraduates	**UNN(x)**	**ABSU(y)**	**xy**
S.A.	0	0	0
A.	19	10	190
D.A.	3	13	39
S.D.A.	5	0	0
U.	0	0	0
	$\sum(x) = 27$	$\sum(y) = 23$	$\sum(xy) = 229$

$\bar{x} = \frac{27}{5}$ $\qquad$ $\bar{y} = \frac{23}{5}$

$= 5.4$ $\qquad$ $= 4.6$

x	$x-\bar{x}$	$(x-\bar{x})^2$	y	$y-\bar{y}$	$(y-\bar{y})^2$
0	-5.4	29.16	0	4.6	21.16
19	13.6	184.96	10	5.4	29.16
3	-2.4	5.76	13	8.4	70.56
5	-0.4	0.16	0	-4.6	21.16
0	-5.4	29.16	0	-4.6	21.16
			$\sum(x-\bar{x})^2 =$	249.20	$\sum(y-\bar{y})^2 = 163.20$

$$\sigma_x = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n}} \qquad \sigma_y = \sqrt{\frac{\Sigma(y-\bar{y})^2}{n}}$$

$$= \sqrt{\frac{249.2}{5}} \qquad \sqrt{\frac{163.2}{5}}$$

$$= \sqrt{49.84} \qquad \sqrt{32.64}$$

$$= 7.059745038 \quad = 5.713142743$$

$$r_u = \frac{229 - 5(5.4)(4.6)}{5(7.059745038)(5.713142743)}$$

$$= \frac{229 - 124.2}{201.6666557}$$

$$= \frac{104.8}{201.6666557}$$

$$= 0.519669449 \approx 0.52$$

$\Rightarrow$ A moderate correlation

Lecturers	**UNN (x)**	**ABSU (y)**	**xy**
S.A. A. D.A. S.D.A. U.	0 13 2 1 0	0 6 0 0 0	0 78 0 0 0
	$\sum(x) = 16$	$\sum(y) = 6$	$\sum(xy) = 78$

$\bar{x} = \frac{16}{5}$ $\qquad$ $\bar{y} = \frac{6}{5}$

$= 3.2$ $\qquad$ $= 1.2$

x	$x-\bar{x}$	$(x-\bar{x})^2$	y	$y-\bar{y}$	$(y-\bar{y})^2$
0 13 2 1 0	-3.2 9.8 -1.2 -2.2 -3.2	10.24 96.04 1.44 4.84 10.24	0 6 0 0 0	-3.2 4.8 -3.2 -3.2 -3.2	10.24 23.04 10.24 10.24 10.24
		$\sum(x-\bar{x})^2 = 122.8$			$\sum(y-\bar{y})^2 = 64.00$

$$\sigma_x = \sqrt{\frac{\Sigma\left(x-\bar{x}\right)^2}{n}} \qquad \sigma_y = \sqrt{\frac{\Sigma\left(y-\bar{y}\right)^2}{n}}$$

$$= \sqrt{\frac{122.8}{5}} \qquad = \sqrt{\frac{64}{5}}$$

$$= \sqrt{24.56} \qquad = \sqrt{12.8}$$

$$= 4.955804677 \qquad = 3.577708764$$

$$r = \frac{\Sigma\left(xy\right) - n\overline{xy}}{n\sigma_x \ \sigma_y}$$

$$r_1 = \frac{78 - 5(3.2)(1.2)}{5(4.955804677)(3.577708764)}$$

$$= \frac{78 - 19.2}{88.65212913}$$

$$r_l = \frac{58.8}{88.65212913} = 0.663266642$$

⇛ A moderately high correlation

Computation of the significance of the difference between the correlation coefficients r_1 and r_u for failure in mathematics versus lack of subordinate knowledge in Mathematics. Reference is also made to notations used for computing z for hypothesis one.

$$z_l = 1.1513\log_{10}\left(\frac{1+r_l}{1-r_l}\right) = 1.1513\log_{10}\left(\frac{1+0.66}{1-0.66}\right)$$

$$= 1.1513\log_{10}\frac{1.66}{0.34} = 1.1513\log_{10}(4.882352941)$$

$$= 1.1513(0.688629171)$$

$$= 0.792818764$$

$$z_1 \approx 0.793$$

$$z_u = 1.1513\ \log_{10}\frac{1+0.52}{1-0.52} = 1.1513\ \log_{10}\frac{1.52}{0.48}$$

$$\sigma_x = \sqrt{\frac{\Sigma\left(x - \bar{x}\right)^2}{n}} \qquad \sigma_y = \sqrt{\frac{\Sigma\left(y - \bar{y}\right)^2}{n}}$$

$$= \sqrt{\frac{122.8}{5}} \qquad = \sqrt{\frac{64}{5}}$$

$$= \sqrt{24.56} \qquad = \sqrt{12.8}$$

$$= 4.955804677 \qquad = 3.577708764$$

$$r = \frac{\Sigma\left(xy\right) - n\bar{x}\bar{y}}{n\sigma_x \ \sigma_y}$$

$$r_1 = \frac{78 - 5(3.2)(1.2)}{5(4.955804677)(3.577708764)}$$

$$= \frac{78 - 19.2}{88.65212913}$$

$$r_l = \frac{58.8}{88.65212913} = 0.663266642$$

⇛ A moderately high correlation

Computation of the significance of the difference between the correlation coefficients r_l and r_u for failure in mathematics versus lack of subordinate knowledge in Mathematics. Reference is also made to notations used for computing z for hypothesis one.

$$z_l = 1.1513\log_{10}\left(\frac{1 + r_l}{1 - r_l}\right) = 1.1513\log_{10}\left(\frac{1 + 0.66}{1 - 0.66}\right)$$

$$= 1.1513\log_{10}\frac{1.66}{0.34} = 1.1513\log_{10}(4.882352941)$$

$$= 1.1513(0.688629171)$$

$$= 0.792818764$$

$$z_1 \approx 0.793$$

$$z_u = 1.1513 \ \log_{10}\frac{1 + 0.52}{1 - 0.52} = 1.1513 \ \log_{10}\frac{1.52}{0.48}$$

$$= 1.1513\ \log_{10}(3.166666667) = 1.1513(0.50060235)$$

$$= 0.57634385 \approx 0.58$$

$$z_u \approx 0.58$$

$$\sigma_{z_l - z_u} = \sqrt{\frac{1}{N_1 - 3} + \frac{1}{N_u - 3}} = \sqrt{\frac{1}{22-3} + \frac{1}{50-3}}$$

$$= \sqrt{\frac{1}{19} + \frac{1}{47}} \qquad = \sqrt{\frac{47+19}{893}}$$

$$\sigma_{z_l - z_u} = \sqrt{\frac{66}{893}} \qquad = 0.271860579$$

$H_0 : U_{z_l} = U_{z_u}$ *and* $H_1 : u_{z_l} \neq u_{z_u}$
Under H_o,

$$z = \frac{z_l - z_u - \left(u_{z_l} - u_{z_u}\right)}{0_{\bar{z}_l} - z_u}$$

$$= \frac{0.793 - 0.58 - 0}{0.271860579}$$

$$z = \frac{0.213}{0.271860579} = 0.783489834 < 1.96$$

Suggested reasons for students' failure of these courses/topic in response to item 2b(ii)

Undergraduates	UNN (x)	ABSU (y)
i. Lack of knowledge of the concept of the course.	10 = 37.04%	12 = 52%
ii. Lack of good Textbooks on the course.	11 = 40.7%	11 = 47.8%
iii. Pre-conceived fear for the course.	8 = 29.63%	10 = 43.5%
iv. Inability for some lecturers to impart the knowledge	11 = 40.7%	3 = 13.04%
v. Poor background of most students in mathematics.	12 = 44.44%	16 = 69.6%
vi. Non specialist lecturers in the different courses handle courses poorly.	7 = 25.93%	12 = 52%
Lecturers		
vii Most students do not want to think	16 = 100%	6 = 100%
viii Some lecturers do not take time to illustrate those concepts in mathematics in everyday language.	16 = 100%	6 = 100%
ix. Insufficient prerequisite knowledge.	16 = 100%	6 = 100%
x. Students do not work hard to know these courses because the effort put into knowing them is thereafter not matched with adequate remuneration.	7 = 43.8%	3 = 50%
xi. Most lecturers do not want to be bothered after lectures because they give more time to other more rewarding ventures outside teaching.	6 = 37 .5%	3 = 50%

APPENDIX X

Hypothesis Four

Computation of the significance of the difference between the correlation coefficients r L and r U for positive attitude towards the study of Mathematics versus effectiveness of the Mathematics curricula.

Refer to notations used for computing z for hypothesis one.

z_l $=1.1513l \log_{10} \frac{(1+r_l)}{(1-r_l)} = 1.1513 \log_{10} \frac{(1+0.5)}{(1-0.5)}$

$=1.15131 \log_{10} \frac{(1+0.5)}{(0.5)} = 1.1513 \log_{10}(3)$

$=1.1513 \quad (0.477121254) = 0.5493097$

z_u $=1.1513 \log_{10} \frac{(1+0.8)}{(1-0.8)} = 1.1513 \log_{10} \frac{(1.8)}{(0.2)}$

$= 1.1513 \log_{10} \quad (9) \quad = 1.1513\ (0.954242509)$

$=1.09869140$

$$\sigma_{zl-zu} = \sqrt{\frac{1}{N_l - 3} + \frac{1}{N_u - 3}}$$

Ho: $U_{zl} = U_{zu}$ and $H_1 : U_{zl} = U_{zu}$

under Ho,

$$z = \frac{0.5493097 - 1.09861940}{0.271860579}$$

$= -0.54930970$

$z = -2.02055665 < -1.96$

APPENDIX XI

Hypothesis Six

There is no significant relationship between good teacher of Senior Secondary Mathematics and qualification of the teacher.

Responses to item (7) provide answers to hypothesis six.

Item (7): Good Mathematics teaching is a correlate of qualification of the teacher.

Undergraduates

Undergraduates	UNN(x)	ABSU(y)	xy
S.A. A D.A.. S.D.A U.	10 13 4 0 0	6 10 7 0 0	60 130 28 0 0
	$\sum$ (x) = 27	$\sum$(y) = 23	$\sum$ (xy) = 218

$\bar{x} = \frac{(x)}{n}$ $\bar{y} = \frac{(y)}{n}$

$\bar{x} = 5.4$ $\bar{y} = 4.6$

x	$(x-\bar{x}$	$(x-\bar{x})^2$ y	$y-\bar{y}$	$(y-\bar{y})^2$
10 13 4 0 0	4.6 7.6 -1.4 -5.4 -5.4	21.16 6 57.76 10 1.96 7 29.16 0 29.16 0`	1.4 4.5 2.4 -4.6 -4.6	1.96 29.16 5.76 21.16 21.16
		$\sum(X-\bar{X})^2 = 139.2$	$\sum(y-\bar{y})^2 = 79.2$	

$\sigma_x = \sqrt{\frac{\sum(X-\bar{x})^2}{n}}$ $\sigma_y = \sqrt{\frac{\sum(y-\bar{y})^2}{n}}$

$=\sqrt{\frac{139.2}{n}}$ $\quad = \sqrt{\frac{79.2}{5}}$

$=\sqrt{27.84}$ $\quad = \sqrt{15.84}$

=5.276362383 = 3.979949748

$$r = \frac{\sum(xy) - n\overline{xy}}{n\sigma_x \ \sigma_y}$$

$$r_u = \frac{218 - 124.2}{5\ (5.276362380)(3.979949748)}$$

$$= \frac{93.8}{104.9982857}$$

= 0.893347918 $\approx 0.89 \Rightarrow$ A high degree of correlation

Lecturers	UNN (x)	ABSU (y)	(xy)
S.A A D.A S. D. A. U..	13 3 0 0 0	6 0 0 0 0	78 0 0 0 0
	$\sum$ (x)=16	$\sum$ (y) = 6	$\sum$ (xy) =78

$\bar{x} = \frac{16}{5} = 3.2 \qquad \bar{y} = \frac{6}{5}$

$= 1.2$

x	x- $\bar{x}$	$(x-\bar{x})^2$	y	$y-\bar{y}$	$(y-\bar{y})^2$
13 3 0 0 0	9.8 0.2 -2.3 -3.2 3.2	96.04 0.04 10.24 10.24 10.24	6 0 0 0 0	4.8 -1.2 -1.2 -1.2 -1.2	23.04 1.44 1.44 1.44 1.44
	$\sum(x-\bar{x})^2 = 126.8$			$\sum(y-\bar{y})^2 = 28.8$	

$$\sigma_x = \sqrt{\frac{126.8}{5}} \qquad \sigma_y = \sqrt{\frac{28.8}{5}}$$

$=5.035871325 \qquad = \quad 2.4$

$$r_l = \frac{78 - 19.2}{5(5.035871325)(2.4)}$$

$$= \frac{58.8}{60.434559} \qquad = 0.973019301$$

$\Rightarrow$ A high degree of correlation.

Computation of the significance of the differences between the correlation coefficients r_u and r_l for good teaching of Senior Secondary Mathematics versus qualification of the teacher.

Refer to notation used for computing z for hypothesis one.

$$z_l = 1.1513 \log_{10}\left(\frac{1+0.97}{1-0.97}\right) = 1.1513 \log_{10}\left(\frac{1.97}{0.03}\right) .$$

$$z_l = 1.1513 \quad \log_{10} = \left(\frac{1+0.97}{1.-0.97}\right) = 1.1513 \log_{10}\left(\frac{1.97}{0.03}\right)$$

$= 1.1513 \log_{10} (65.66) \qquad = 1.1513 (1.81734497)$

$= 2.9023909266$

$$z_u = 1.1513 \log_{10}\left(\frac{1+089}{1-089}\right) = 1.1513 \log_{10}\left(\frac{1.89}{0.11}\right)$$

$= 1.1513 \log \quad (17.181818) = 1.1513 \log_{10} (1.235069115)$

$= 1.21935077$

$\sigma_{z_l} - z_u \;=\; 0.271860579$

$H_o: \; Uz_l = U_{z_u}$ *and* $H_1: U_{z_l} \; {}^1 \; U_{z_u}$

under Ho,

$$Z = \frac{Z_l - Z_u - (U_{z_l} - U_{z_u})}{\sigma_{z_l - z_u}}$$

$$= \frac{2.092309266 - 1.421935077 - 0}{0.271860579}$$

$$= \frac{0.670374189}{0.271860579}$$

$$z = 2.453601109 > 1.96$$