SECONDARY SCHOOL MATHEMATICS TEACHERS' PERCEPTION OF THE JUNIOR SECONDARY SCHOOL MATHEMATICS CURRICULUM (JSSMC) IN GONGOLA STATE

BY

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DECLARATION

I, hereby declare that this thesis has been written by me and that it is a record of my own research work. All published and unpublished sources of information have been appropriately acknowledge. Direct quotations are indicated by quotation marks or indentations.

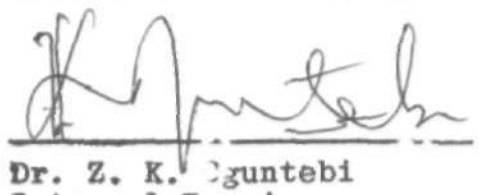
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CERTIFICATION

This research report has been read and approved as meeting the requirements of the Department of Education, Faculty of Education, Ahmadu Bello University Zaria in partial fulfilment of the requirements for the degree of Master of Education.

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Research work, especially to a novice is a lonely business. The experience with this research has not been any different. But there are those who, in one way or the other have helped to make it less of the wholesome lonliness that it would have been.

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ABSTRACTS

This study was aimed at assessing the secondary school mathematics Teachers[1] perception of the Junior Secondary School Mathematics Curriculum (JSSMC) based on their experience with it in the classroom so far in Gongola state. The study had also sought to establish the extent (if any) of relationships between; (a) perception of teachers of the JSSMC and their general attitude towards mathematics as a school subject, and (b) perception of teachers of the JSSMC and teachers knowledge of the curriculum.

The study involved an extensive review of the theoretical models and strategies of curriculum innovation and a statistical analysis of data obtained on a fifty-five item questionnaire administered on teachers. The review of the innovation models focused attention on what needs to be done by curriculum innovators to ensure the installation of an innovation, and the expected role of teachers in the process.

The questionnaire for the statistical study was meant to measure (a) perception of teachers based on their .responses on five curricular scales (relevance of content of the curriculum, relevance of instructional objectives, adequacy and balance of content, reasonableness of the organisational structure of content, and the feasibility and applicability of the prescribed teaching learning strategies), (b) attitude

of teachers towards mathematics and mathematics teaching; and (c) knowledge of the curriculum in terms of familiarity with the content and development of the JSSMC.

One hundred and fifteen (115) secondary school mathematics teachers were involved in the study. The teachers were grouped into three based on their academic and professional training. The three groups are graduate professionals, the Non-graduate professionals and others, i.e. teacher engaged in teaching mathematics at the secondary school level but with no training in mathematics.

Findings from the study showed that all the categories of teachers studied do not view the JSSMC as a document differently. But they do have differences of opinions on the five curricular issues raised on the JSSMC. Also, a significant relationship was found between the perception of teachers of the JSSMC and their general attitude towards mathematics. However, no such relationship was found between the perception and knowledge variables in the study.

Conclusions and recommendations focus mainly on more familiarization activities for teachers involved in the implementation of the JSSMC, and more genrally the 6-3-3-4, and need for further research on this issue especially in the light of the findings of this research.

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ACRONYMS

A C E - Associate Certificate in Education

CESAC - Comparative Education Study and Adaptation Centre.

DME - Diploma in Mathematics Education.

FME - Federal Ministry of Education.

HDME - Higher Diploma in Mathematics Education.

H S C - Higher School Certificate.

IJMB - Interim Joint Matriculation Board.

JSSMC - Junior Secondary School Mathematics Curriculum.

M A N - Mathematical Association of Nigeria.

MCEQ - Mathematics Curriculum Evaluation Questionnaire.

N C E - Nigeria Certificate in Education.

NERC - Nigeria Educational Research Council.

PEMC - Primary Education Mathematics Curriculum.

S M B - Schools Management Board.

SSSMC - Senior Secondary School Mathematics Curriculum.

TEMC - Teacher Education Mathematics Curriculum.

DEDICATION

This work is dedicated to my parents:
Mr. Musa Wajigirda Ndurhong, and Mrs
Regina Tazhidari Musa Ndurhong; and
my uncle Mallam Umoru Ndurhong.

CHAPTER ONE

THE PROBLEM

1.1 INTRODUCTION.

As an immediate consequence of the dramatic abolition of Modern Mathematics as a compulsory school subject at the now historic Benin Conference of 1977 in Nigeria, the Nigerian Educational Research Council (NERC) was assigned the responsibility of preparing syllabuses for a six-year primary education and a five-year teacher training programme. The Comparative Education Study and Adaptation Centre (CESAC) based at the University of Lagos was also asked to continue with its effort in preparing secondary school syllabuses for both the junior and senior levels, which it had earlier started. The syllabuses were produced and presented at a National Critique Workshop at which State governments, Educational institutions, and professional associations were represented in Onitsha in March 1978. The syllabuses were finally approved by the Federal Ministry of Education exactly a year later, in March 1979.

The syllabuses dropped much of the modern mathematics contents. At the junior secondary school level, 'set theory' has been entirely eliminated. "Logic' in the abstract formulation of modern mathematics has been excluded, though "proof of some theorems to inculcate ideas of logical thinking in pupils is retained"

(Federal Ministry of Education, 1979, JSSMC, P.1).

The implementation of the Junior Secondary School Mathematics Curriculum (JSSMC) was scheduled to take off with the first graduates of the Universal Primary Education (UPE) pupils beginning in the 1982/83 school year. However the implementation of the 6 - 3 - 3 - 4 education system was greatly politicised during the Second Republic, and this led some states to refuse to implement the policy, with most giving lack of money, equipment and teachers as excuses.

With another military intervention in the governance of Nigeria in 1983, a uniform implementation of the 6 - 3 - 3 - 4 system in all the states started. However, six states (Borno, Kaduna (old), Anambra, Bauchi, Cross River (old), Kano and Sokoto) and the Federal Government Colleges had by then started the programme.

There was very little classroom teacher participation in the development of the syllabuses right from the beginning contrary to the suggestions of many curriculum specialists (e.g., Hawes 1979, Shipman 1976, Ogunniyi 1985). Apart from a few teachers on the critique panel, most of those involved in the development of the syllabuses were either curriculum specialists

from CESAC and NERC or University lecturers (PSMC 1978). Though seminars, workshops and conferences were organised to prepare teachers towards the introduction of the new curricula in secondary schools, these reached only a very small number of teachers vis-a-vis the total number of teachers that would use the curricula in the classroom (Shirley, 1980).

This model of curriculum decision-making is a prominent feature of a 'centrally dominated curriculum system' (Skilbeck 1973, in Badmus 1985). While the strengths of the model include clear goal setting, clear role definition, and equitable distribution of resources, "its greatest weakness is that teachers merely act as functionaries in a bureaucratic system and play a very limited part in the curriculum development activities" (Badmus 1985, p. 40).

Wisemen and Pidgeon (1970) point out that a country which has a central control of school curricula like Nigeria "must make clear to teachers (and the public) the principles on which the curriculum is based, and the considerations which led to the inclusion of this and exclusion of that ..... to gain the teachers acceptance and co-operation" in the implementation of the curriculum (Page 10). Research evidence (Jones et al, 1986; NERC, 1977) also show that the

placing of new curricular materials in the hands of teachers who, though may be dedicated, do not perceive or understand the underlying philosophy, assumptions, design, and purpose of these materials, often result in teachers' resistance to curricular change. And "if mathematics teachers do not have a clear idea about the role of mathematics in the curriculum, it is likely that students will have confusion as well. "(Jones et al 1986, P. 277). This confusion may lead students to question why they should study mathematics at all as they will fail to appreciate its signicance.

Since the success of any new programme to be implemented in schools ultimately depends on the teachers (Ogunniyi, 1984; Hawes, 1979), there arises the question of the ultimate attainment of the objectives of the JSSMC considering the apparent non-involvement of classroom teachers in its development and implementation processes. This may have been the concern which led the Federal Ministry of Education to run a four-week teacher orientation course on the JSSMC in twenty centres, one for each state plus Abuja during the 1986 summer break. The essence of the course according to the Ministry, was

to enable the teachers update their knowledge, and improve their instructional methodology, in order to enhance their subject mastery and competence. Mathematics lecturers/teachers to handle the courses were requested to teach in such a way that participating teachers can imbibe the philosophy and spirit of the new mathematics curricula for the JSS and SSS currently being operated (Curriculum Development Unit, 1986).

This issue of teachers understanding the curriculum is stressed by Maclure (1967) who asserts that, the teacher's understanding of a curriculum is more important than any technique which may be packaged and handed to him for use.

1.2 The Problem

Teachers' participation in the development of new curricula have been stressed by many curriculum specialists (e.g. Hawes, 1979; Shipman, 1974). Such participation enhances their understanding and innovative role in the installation of the curriculum. This is more so since the installation of an innovation in a system is not a mechanical process, but a developmental one in which both the innovation and the accepting systems are altered (Atwood, 1973).

The implementation of new curricula by teachers

who may have no knowledge of its philosophical and psychological foundations may result in the distortion (or even rejection) of the curricula at varying levels in the classroom depending on how each teacher perceives it (Howson, 1978). Rejection may occur basically because of sheer ignorance, lack of willingness or because of direct experience with the curriculum (Miles, 1964). The JSSMC is in its fourth year of use in Gongola State. What is the mathematics teachers' perception of the curriculum and how does this perception relate to their attitude towards methematics as a school subject and their knowledge of the curriculum (as assessed by their familiarity with the development and content of the JSSMC).

1.3 Purpose of the Study

This study is therefore to assess secondary school mathematics teachers' perception of the Junior Secondary School Mathematics Curriculum (JSSMC) based on their 'first hand' experience with it so far in Gongola State. The study will also seek to establish what relationships there are between; (a) perception of teachers of the JSSMC and their general attitude towards mathematics and mathematics teaching and (b) perception of teachers of the JSSMC and teachers'

knowledge of the curriculum.

A major area of interest is the comparative responses of trained and untrained teachers. Hence teahhers will be grouped into three based on their academic and professional training (see Population, Chapter 3).

Teachers' percention will be studied in terms of five inter-related curricular issues; (adapted from Badmus 1985). The curricular issues include: (1) the relevance of the instructional objectives as they relate to the aim of teaching mathematics at the JSS, (2) the relevance of the content of the curriculum to current thinking in mathematics education, instructional objectives, psychological principles of learning, needs and interest of the learners, (3) the adequacy of balance of content, (4) the reasonableness (logical and psychological) of organisational structure of content of instruction, and (5) the feasibility and applicability of the prescribed teaching learning strategies.

1.4 Research Questions

This research will attempt to provide answers to the following questions: (a) Are the perceptions of the three groups of teachers on the JSSMC the same across the five curricular issues? (b) Are teachers' perceptions of the JSSMC different on the five curricular

issues? (c) Is there a significant relationship between teacher perceptions of the JSSMC and teachers' general attitude towards mathematics? (d) Is there a significant relationship between teacher perceptions of the JSSMC and their knowledge of the curriculum?

1.5 Hypotheses

The hypotheses, stated in null-form, that will be under consideration in this study are :

1. Teachers' perception of the JSSMC is independent of their qualifications.
2. Teachers perception of the JSSMC is not different on the five curricular issues raised on the JSSMC.
3. There is no significant relationship between teachers' perception of the JSSMC and their general attitude towards mathematics.
4. There is no significant relationship between teachers' perception of the JSSMC and their knowledge of the curriculum.

1.6 Significance of the Study

Designing a curriculum is one thing, having it accepted in the classroom and taught in a meaningful ungarbled way is another. Many constructive changes

never take place within an organisation, not because they lack merit but because they meet with covert as well as overt resistance from members of the organisation (Anderson et al 1976). The defensive reactions precipitated by threat of disequilibrium which accompanies change brings subversive acts that can cause a proposed change to die before its merits have been tested, especially if methods of implementing the change do not consider the impact of the change on the existing systems. This study will serve as a base for a transactional evaluation (i.e. evaluation of the implementation process) of the JSSMC which will minimize the threat and subsequent defensiveness felt by teachers.

The effective implementation of any new programme is considered an important step towards the success of that programme. Along with influence of available instructional texts and other materials, good teachers' perception forms an important bedrock for successful implementation of a new curricula, (Ogunniyi, 1984). A study like this to identify how the teachers perceive the JSSMC will help in the planning of teacher improvement programmes. It would also provide a basis for us to know whether implementation strategies needs to be changed or improved upon.

The perception of teachers in the groupings may also be an asset to teacher trainers at the various levels in designing appropriate curricula for training preservice teachers, especially in the area of familiarising them with the JSSMC.

The teacher's role in the education process is crucial for effective learning. He is the catalyst that determines and chooses the appropriate tool to achieve the set goals and objectives of the curricula. He directs the course of action, diagnoses and decides, and infact stands between the pupils and what they learn (Onwuka, 1983). The importance of teachers understanding changes in the education process has been highlighted by many writers (e.g. Schwab, 1983; Bloom et al, 1971); This study has in a way reminded the teachers that have been involved in it to be alive to their responsibilities in the implementation of the JSSMC.

Several curriculum specialists have called for research on the current school mathematics curricula in Nigeria, (e.g. Shirley, 1984 & 1987; Ogunniyi, 1984).

Shirley calls for 'research to seek teachers opinions and comments about the curriculum based on their first hand knowledge from dealing with it on a day-to-day basis" (1987 Page 8) in the classroom,

arguing that teachers' responses and suggestions on changes, and their familiarization and training for new curricular will determine the ultimate success or otherwise of the curricula change. Ogunniyi on his part advocates research to find answers to questions (based on what has been implemented so far) on among other things "the objectives of the new programme, the relationships that exist between the objectives and the actual learning outcomes, the quality of the content of the programmes, the relevance of the programme to the needs of the learner now and in the future ....." (Ogunniyi, 1985 P. 84)

Also, the Research Advisory Committee of the National Council of Teachers of Mathematics (NCTM) indentified teachers' understanding of school mathematics as one of the important areas of research in the field of mathematics reducation (NCTM, 1985).

The establishment of a research evidence on the relationship between teachers' general attitude towards mathematics and mathematics teaching, teacher familiarity with a curriculum, and perception of a curriculum is of great benefit to curriculum specialists in future development and implementation of curriculum.

Teachers' perception of curricula have a profound effect on the way they teach as well as on student learning in the classroom. This is also linked to their knowledge of the content and the willingness and the extent to which they implement curricula as intended by the developers (Carpenter and Fennema, 1986). Teachers' positive views of curricula is therefore an indispensable factor in the success of the new programmes. This calls for research to identify the status quo vis-a-vis the JSSMC.

1.7 Delimitations

This study is restricted to secondary school mathematics teachers in Gongola State. It focuses attention on teachers' perception of the Junior Secondary School Mathematics Curricula (JSSMC) as issued by the Federal Ministry of Education and published in 1979. The perception of teachers is being studied in terms of five curricular issues (see Purpose of the Study). Any attempt to generalize the findings of this study must take account of the sample used and the situation obtained in the state at the time of the study.

The general attitude of teachers towards mathematics and mathematics teaching, and teachers' factual

knowledge
/ of the historical development and the content of the curriculum is also being studied. No attempt is being made to empirically find the reasons for what-
attitude teachers may have apart from
ever perception or/to attempt to establish relationships between teacher perceptions and their general attitude, and knowledge of the historical development and content of the curriculum.

The basis for the assessment of the issues being studied is limited to the items on the questionaire, which is the instrument of the study.

The influence of the issues under study on teachers' performance, or teaching ability or some other extra curricular activities is not also the subject of this study.

1.8 Limitations

This study is one that involves the assessment of teachers' perception based on data gathered by questionnaire This presumes that the questionnaire is adequate enough to gather such data and that all teachers do understand and honestly respond to the items on the questionnaire. The findings of this study therefore holds only to the extent that there are no serious violations of these conditions.

The stratified random sampling methods which Sax (1979) recommends to reduce error variance with either group or individual assignment of scores is being employed. This sampling technique increases precision. But it may have robbed this study of complete randomization and straightforward statistical analysis.

1.9 Assumption.

The following assumption is being made for this study: That all the categories of mathematics teachers that will respond to the instrument of this research (questionnaire) have taught or are currently teaching the Junior Secondary School Mathematics Curriculum (JSSMC).

1.10. Definition and Discussion of Important Terms.

In order to provide a proper direction and for a meaningful discourse for this study, it is necessary to define and explain some of the key terms which will most often be used and which may slightly differ in meaning from their usual usage.

1.10.1 Curriculum.

Curriculum as an educational term has had varying definitions at different times, especially during the

first half of this century. As yet, there is no consensus among educators on "the" definition of this term. However, Hirst and Peter's definition given in Wain (1978, p. 112) fits the horizon of this study and shall therefore apply here. They see curriculum as "the label for a programme or course of activities which is explicitly organised as means whereby pupil may attain the desired objectives, whatever these may be".

Mathematics curriculum will refer to the 1979 Junior Secondary School Mathematics Curriculum (JSSMC) as published by the Federal Ministry of Education, Lagos, unless otherwise stated or implied by the context of usage. Also curriculum and syllabus will be used inter- changeably.

The '1979 curricula' refers to the Junior Secondary School Mathematics Curriculum (JSSMC), the Senior Secondary School Mathematics Curriculum (SSSMC), the Teacher Education Mathematics Curriculum (TEMC) and the Primary Education Mathematics Curriculum (PEMC), all Published in 1979 by the Federal Ministry of Education, Lagos.

1.10.2 Teacher

Unless otherwise implied by the context, the term 'Teacher' will refer to all categories of secondary school mathematics teachers.

1.10.3 Trained Teachers

This refers to secondary school mathematics teachers who have received training in mathematics and education.

[The education courses (usually) incorporate Philosophy of Education, Psychology of Education, Sociology of Education, and Principles and Practice of Education]

Such training should have been from an Advanced Teachers College, a College of Education, a Polytechnic, a University or such other institutions of equivalent status.

1.10.4 Attitude

Attitude is one of the variables measured in this study. Attitude as opposed to opinions are organized and strongly held views of salient issues. Attitudes are usually stable and are often the basis of specific behaviours. Attitude here will refer to teachers' feelings about mathematics as a school subject and his disposition towards teaching the subject. Attitude,

within the context of teacher's attitude toward mathematics curriculum development or mathematics curricula innovation is not being measured. Area of interest is strictly the teachers frame of mind about mathematics as a school subject.

1.10.5 Knowledge

Knowledge used in the context "knowledge of the curriculum" refers to teacher familiarity with and awareness of the development and content of the JSSMC. Information on the content measured is restricted to the topics and general direction of emphasis of the curriculum. The resultant activities of the abolition of modern mathematics and the subsequent development and approval of the 1979 mathematics curricula with special reference to the JSSMC are the issues considered under the 'development' aspect of the knowledge of the syllabus. 'Knowledge' used otherwise in this study (i.e. not refering to the variable 'knowledge of curriculum') will carry the usual meaning.

1.10.6 Junior Secondary School (JSS)

'Junior Secondary School' refers to those schools that provide the first three years of secondary education in the 6 - 3 - 3 - 4 education system as

provided for in the National Policy on Education (1977, 1981, 1985). These are the schools which receive the primary school products. Such schools are comprehensive in nature and have both prevocational and academic subjects. (Mathematics is one of the core subjects at this level of schooling). Evaluation and certification at the end of the JSS are based on continuous assessment method and an end-of-course examination conducted by the appropriate state Ministry of Education leading to the award of the Junior School Certificate (J.S.C.).

Students passing out from the JSS may proceed to the Senior Secondary School (SSS), the Technical Colleges or Teachers College or may move to an apprenticeship system or some other scheme for an out-of- School vocational training.

1.10.7 Perception

Perhaps the major variate being measured in this study is perception. Within this context, it refers to teachers' understanding of the JSSMC based on five curricular issues: instructional objective, content of curriculum, balance of content, organisational structure, and applicability of suggested teaching-learning strategies. Emphasis is not on the

direct cognitive understanding of the curriculum, but on a global, philosophical, and psychological viewpoint.

1.10.8 Change

Change as used here will imply the alteration in the goals, structure, content, or processes of the educational system.

1.10.9 Innovation

Innovation will mean "a deliberate, novel specific change, which is thought to be more efficacious in accomplishing the goal of a system" (Miles, 1864, p. 14). Innovation is not a haphazard change, but a willed and planned- for change.

CHAPTER TWO.

REVIEW OF LITERATURE

This chapter takes a look at what is obtained in literature on the major variates being studied. The first section is a review of curriculum innovation theories which is meant to provide a framework for a proper discourse of how the JSSMC has been implemented. The section also provides a theoretical base for a comparative analysis of the extent of teacher-participation in the development and implementation process of the JSSMC vis-a-vis the dictum of available theories and models.

In the second section, the views of curriculum specialists on the expected role of teachers in curriculum innovation is considered and discussed. The rest of the chapter deals with the development and implementation of the 1979 syllabuses (PEMC, JSSMC, SSSMC and TEMC) with special emphasis on the JSSMC; and recent research report on teachers in curriculum innovation, and perception and attitude of teachers.

2.1 Curriculum Innovation

Since education by its very nature cannot remain static, curriculum change is needed to meet the requirements of man in an ever increasingly complex

society. The task of curriculum innovation and change which involves changing people and institutions is a difficult process because of the several forces (economic, political, social, etc.) that operate on the educational enterprise. It becomes even more difficult and complex if one considers the different groups of people and types of institutions that need to be changed - teachers, pupils, educational administrators, subject content, teaching materials and methods, time-tables, evaluation methods, etc. Most curriculum problems usually emanate from these difficulties of curriculum innovation which may end in "failure to achieve the desired conversion to the new aims, new content; and new approaches" (MacDonald & Walker, 1976, page 5). Is there a single most effective way of achieving a successful curriculum change?

The traditional ways by which educational innovation were diffused long before the formalization of the school system were by means of books and personal contact. Diffusion stemmed from an individual through his teaching, travel and writings. The modification of the curriculum necessitated by demand on schools from Universitiees and growth of public examinations led to a situation in which this mode of disseminating innovation became inadequate. (Howson, 1978). Several

models and theories of dissemination of new ideas which are vital in educational innovation have been e volved.

MacDonald and Walker (1976) have reviewed three major theories of how new ideas and practices of a planned change spread from their point of origin and gain widespread adoption. These include Havelock's (1971), Schon's (1971) and Houses' (1974) models.

2.1.1.Havelock's Model

After a massive survey of four thousand studies, Havelock offers three perspectives of a model based on how the dissemination and utilisation process were viewed by the authors of the studies. These are the Research, Development and Dissemination (R, D & D) perspective, the Problem-Solving (P-S) perspective and the Social Interaction (S-I) perspective.

The R, D & D perspective begins with a definition of a problem on the basis of the presumed need of the receiver. The initiative in the identification of the problem is by the curriculum developer and not the receiver. Focus is on the activity-phases of the developer as he designs and develops a potential solution. The process of change is viewed as an

orderly sequence which begins with the identification of the problem, then activities which are directed towards finding a solution to this problem and ends with diffusion of this solution. Most large curriculum change projects adopt this model.

In the Problem-Solving (P-S) perspective, the receiver identifies a problem or an area of concern. He then undertakes to alter the situation either through his own effort or with outside assistance. The advantage of this model is that, the receiver becomes actively involved in finding solution to his own problem.

The Social Interactions (S-I) perspective is usually obtained in local settings. A problem is discovered and solutions are immediately found and implemented. The most effective means of spreading information about an innovation in this model is through personal contact.

The R, D & D perspective is what can be said to be the closest to the development and implementation of the JSSMC since its development was done by outsiders (a committee), people external to the group of ultimate users.

Becher and Maclure (1978) note that the R, D & D model embodies highly technocratic assumptions, like the

existence of some central expertise not available to the average teacher. It also assumes that knowledge is something that could be delivered in packages, and independent of the personal interaction between the teacher and the pupil. As stated elsewhere in this study (section 1.1), these assumptions seem to run counter to the view of most curriculum specialists that classroom teachers be more involved in the business of curriculum development by having them develop their own goals and strategies. The R, D & D only leads to the production of a tightly structured packages geared to pre-determined objectives and as such does not give the classroom teacher much independence.

The Social Interaction (S-I) perspective is flawed by the false assumption that every teacher has the time, the talent, and the motivation to take an active part in developing new teaching approaches and the classroom materials that go with them. But it is known that few teachers will want to be actively involved in the work of curriculum development even if other barriers can be surmonted (Becher and Maclure, 1978).

Perhaps it is the Problem Solving (P-S) approach that provides a way of meeting the difficulties associated with the other models. Since the approach allows teachers to adopt materials without presupposing that he is willing to do all the work of curriculum development himself. It also encourages teachers' participation in decision making by way of identifying problems. However, the model still demands that the teacher has the proper academic and professional training to be able to intelligently question certain practices and subsequently seek meaningful solutions.

2.1.2 Schon's Model

Schon (1971) considered the necessary conditions that make certain social systems to be institutionalized. He found that the diffusion of innovation is a dominant factor for the transformation of society. The means by which ideas are communicated outward from one or more centres is of utmost importance. Based on this premise, he identifies three models; Centre-Periphery, Many Centres, and Shifting Centres models.

In the Centre-Periphery model, an innovation has already been developed and the task is for a central agency to spread the new ideas out to points

on the periphery. The model is based on three assumptions: (i) that an innovation in a form of a 'package' exists before its diffusion (e.g. the JSSMC); (ii) that diffusion is the movement of an innovation from a centre out to its ultimate users; and (iii) that the process of diffusion is directed and centrally controlled including the availability of resource and incentives. Effectiveness of the model depends on among other things the level of resources at the centre, the number of points to be reached and the 'length' of the channel of diffusion. Critics (e.g. Shipman, 1976) of this model say that ideas may be changed or distorted before it reaches many of the points on the periphery especially if untrained staff are involved in the dissemination process and if the 'length' of the channels of diffusion become too long. Schon himself warns that the Centre-Periphery system inspite of its simplicity is prone to failure through resource exhaustion, overload of the 'channel's, and mismanagement. Such failures could take the form of ineffectiveness in diffusion, distortion of the message or disintegration of the system as a whole. (MacDonald & Walker, 1976).

In addition to the basic Centre-Peripery structure of the model above, Schon's second category, the Many-Centres model has zonal centres. Here, the zonal centres engage in

in the diffusion of innovations while the headquarters support and manage the zonal centres. This set-up is supposed to have a multiplier effect in the diffusion process. The problems that are likely to be encountered in the use of this model include communication and control problems from the headquarters and heavier expenses in the running of the zonal centres.

The last of Schon's model is the Shifting-Centres model. This is obtained when approximately the same idea emanages from different centres but with no formal organisation linking them together and therefore no clearly established headquarters.

The implementation of the JSSMC may be fitted into two of Schon's models depending on one's perspective. The Many-Centres model seem to apply if one considers the national implementation of the curriculum, with the state capitals being the zonal centres. Looking at it from the perspective of individual state implementation, the Centre-Periphery model fits better. Here the state headquarters become the centres while the various secondary schools become the points to be reached on the periphery.

In the systematic use of these models, the periphery may have a variety of different peculiar needs and may not be able to adequately provide for these needs. If the centres attempt in any standardized way (like in the

R, D & D model) to meet these peculiarities, it is likely to get out of touch with the realities of individual classroom and may therefore alienate or confuse many of its potential users. If the periphery decides to go it alone the resulting imovations may be poor in quality. Infact such moves are liable to be dependent on the enthusiasm of individual teachers and therefore may lack staying power.

To solve this problem, Becher and Maclure (1978) recommend that the centre develop a variety of solutions to common problems, which allow the periphery to make the final choice, but with ample room for local adaptation. Would allowing the differents states (teachers) to adapt the JSSMC to the needs of their peculiar situations (classrooms) make a difference in the ultimate attainment of the goals of the JSSMC? And what demand would be made on teachers if such a move is to be accomplished?

2.1.3 Houses' Model

The most recent of models reviewed by MacDonald and Walker is that by House (1974). The model is an update from studies of innovation in rural societies. He contrasts diffusion in rural areas where population is homogeneous and urban areas where population is heterogenous. In the rural settings, diffusion of ideas

is done by one person talking to the other, while in spite of heavier population density in urban areas, social status barrier impedes such a mode of diffusion of information. Instead innovations leap from one concentration of population to the next largest in size, independent of distance.

In order to enhance innovation diffusion, House suggests that effort should be towards helping teachers establish personal contacts that out across levels of the educational hierachy. He criticizes Havelock's R, D & D model on the grounds that it restricts the flow of innovation and also increases the likelihood of teacher alteration in actual classroom practice to conform to the teachers' peer group norms. He says contemporary diffusion systems are instruments of control which suppress the innovative spirit and the legitimate expression of diversity. An effective approach to educational change would have to take account of the urban hierarchy with a view at promoting rapid adoption of innovation in the large centres and to provide incentives to increase the number of participants in the change process. The aim of innovation diffusion, he says, should be to reduce social and organisational barriers for teachers in establishing contact with the outside world. This calls for the involvement of profe-

ssional associations, notably the Mathematical Association of Nigeria (MAN) and the Nigerian Union of Teachers (NUT) in the Implementation of the JSSMC.

MacDonald and Walker hold the view that Schon's and Houses' models seem to be much closer to contemporary realities of the social system than earlier theorists. Their interest are more with structures in a period of change and speed of response becomes a key concern.

2.1.4 Chin's Strategies of Change

Hoyle (1972) also reviews Chin's strategies of planned organizational change. The three strategies identified by Chin are : (a) Power-Coercive, (b) Normative re-educative and (c) Empirical rational approach strategies.

Power-coercive strategy is the direct intervention to alter existing condition by authorities using power. This is usually done by limiting alternatives or a straight directive on how certain things should be performed. Hoyle points out that this strategy runs counter to educational aim arguing that, educational ends by their nature cannot be achieved without the commitment of the participants in it. But this is what apparently has been done in Gongola State. The Ministry of Education in Yola just sent out copies of the JSSMC to schools with a directive that this is 'the ' new syllabus for the junior secondary schools, without taking steps to convince the teachers that it should

really be 'the' syllabus.

The Normative-re-educative strategy involves activating forces within a system in order to alter the system based on the theory of change. The theory should appeal directly to the behaviour of an individual or small groups. It is an attitude change through a study of one's contagious behaviour pattern.

The Emprical-rational approach is an intellectual appeal through the demonstration of greater effectiveness of some new idea or practice over existing ones. This involves linking innovative processes with research and development.

Hoyle (1971) himself suggests that there are four stages in curriculum innovation; invention, development, diffusion and adoption. Jenkins (1976) says this model is similar to the R, D & D by Havelock when used in an educational system at large and is also compatible to the problem solving model when used in the individual school curriculum innovation.

2.1.5 Rogers' Model

After studying how ideas spread among doctors, businessmen, farmers and teachers, Rogers (1962) developed a five-step theory of innovation. He suggests that acceptance of innovation along a time scale has a definite

pattern. The steps of this pattern are Awareness, Interest, Evaluation, Trial and Adoption. The Awareness stage is when a prospective receiver of the innovation comes to know about the existence of the innovation; the Interest stage is when he shows willingness to learn more about the innovation, the Evaluation is when he decides whether the innovation is worthy of further action; Trial stage is when there is a temperary acceptance of the innovation and Adoption stage is when he wholly accepts the innovation on a somewhat permanent basis. This model has a great resemblance with Hoyle's model cited above.

Perhaps only the stages at the two end points, Awareness and Adoption, have come into focus in the implementation of the JSSMC in Gongola State. Teachers have not been provided with the opportunity to learn more about the curriculum after they were posted out to them, nor have they been afforded the chance to decide whether to try the curriculum before adoption at all.

Rogers (1962) says the target population of curriculum innovation could be fitted into a normal curve with time being on the horizontal axis as in figure 2.0

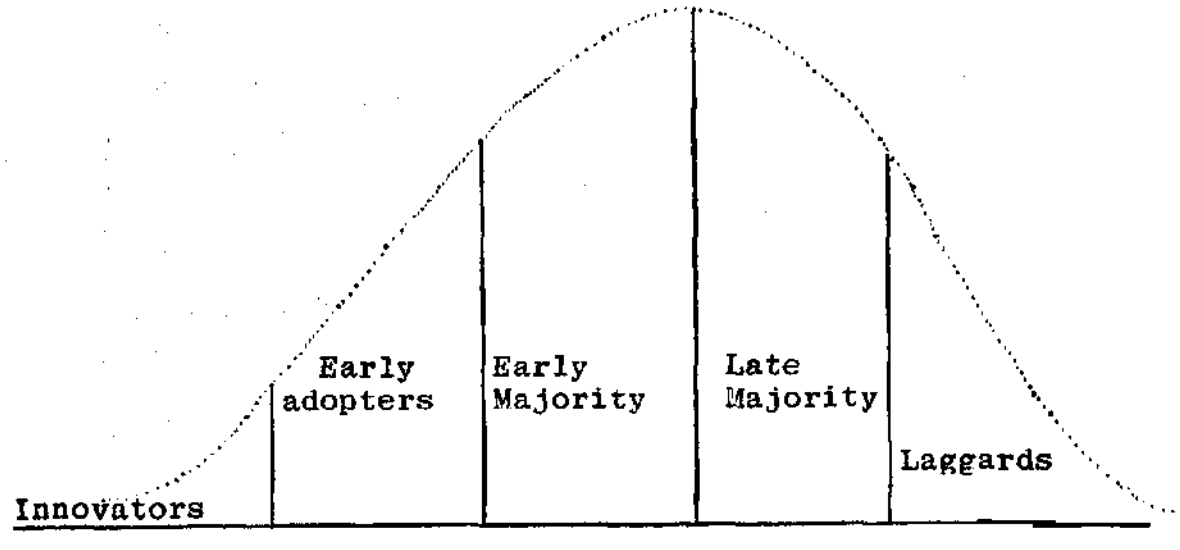


Fig. 1. : Acceptors of Innovation Along a Time Scale.

The 'Innovators' are the first to accept innovation, usually direct from researchers. The 'Early Adopters' are respected opinion leaders who learn about the innovation from change agents. The 'Early Majority' also learn from change agents but they take longer, waiting for results from their peers. The 'Late Majority' learn from their peers with some pressure. The 'Laggards' are the traditionalists who may learn just a little of the innovation from their peers after a very long time and may never change at all.

Rogers (1962) is of the view that emphasis should be in identifying the Early Adopters and Early Majority as they are these who respond to the curriculum innovation process. Diffusion activities should be directed towards these groups.

2.1.6 The Kurt Lewin Model

Blanchard & Zigarmi (1981) reviewed the Lewin model for understanding the process of change. The model identifies three basic phases to a change process.

The first phase is unfreezing, which prepares people through motivation to be ready for change. This is done by a critical examination of the status quo with a view to pointing out the disadvantages of existing practices and thus preparing people to accept new alternatives.

The next phase is the actual changing process which takes place after people are ready to change. This is accomplished through what they call 'identification' and 'internalization! Identification takes place when one or more models are provided from whom individuals can learn new behaviour patterns by indentifying with them and to try to be like them. Something akin to the emp irical-rational approach of Chin's model. Internalization takes place when nuw behaviours patterns are demanded from individuals as a result of the situation where they find themselves. They warn that the two must take place for effective change to be realised.

The final phase is the refreezing process. This is the process by which the newly acquired behaviour is institu-

tionalized.

Blanchard and Zigarmi note that these three phases must take place if a change in any school is to be effective. The problem with most change efforts in schools is that, the unfreezing and the refreezing processes never take place. New programmes are merely thrust on schools without preparing anybody to be ready for it. This is how the research views the way the JSSMC has been implemented in Gongola State.

They suggest that persons responsible for curriculum innovations should first determine what they have in support of the change (driving forces) and what will work against the change (restraining forces) before embarking on an innovation. Lewin refers to this concept as the force field analysis. That failure of innovation may be inevitable if this analysis is not done before starting the innovation.

2.1.7 Rowan and Morgan

An example of a strategy of how an externally developed programme can be adopted at the school level (and which could be extnded to cover a state like Gongola) is that given by Rowan and Morgan (1987). The strategy consists of five stages (see Figure 2.).

In Stage 1 the need for a change is identified by teachers. This corresponds to the undreezing phase of the Kurt Lewin Model discussed above. Here, teachers

are made to be aware of the need for change by pointing out the inadequacies of existing systems.

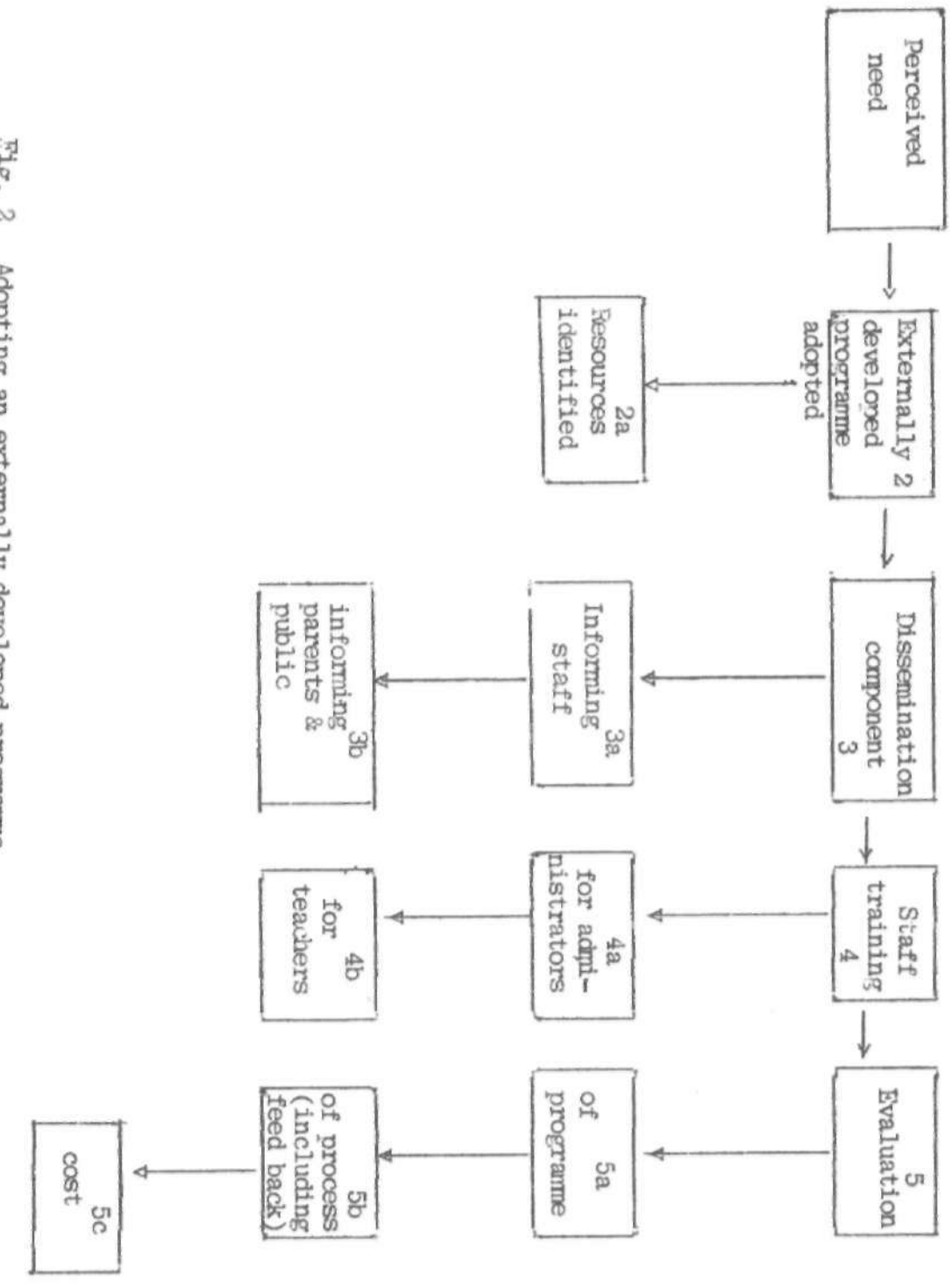


Fig. 2 Adopting an externally developed programme.
Redrawn from Rowan & Morgan (1981 (P. 107).

At the second stage (Stage 2) the review and adoption of the external programme together with research evidence that support the effectiveness of the programme is carried out. This is further followed by the indentification of the resources available, both human and materials (2a).

At Stage 3, dissemination to, first, the staff to be involved in the programme and later to parents and the public occurs. This stage is crucial and should employ a variety of public relations possibilities using newspapers, PTA meetings, newsletters and journals, classroom demonstrations and research evidence. Each activity is to be well planned especially with regards to timing and sequencing.

Staff training (Stage 4), which they argue is the key to success in the change process, should receive adequate attention in planning and execution. The training should first be extended to the administrators so that they would support the subsequent in-service programmes and other kinds of training for teachers. They suggest that training of teachers should be at several levels and stages so as to involve as many teachers that would be using the programme as possible.

Evaluation, which they say is also vital, comes at the

fifth stage. That evaluation is necessary to ensure that the goals and processes as defined are understood by the users (5a). It also helps in the documentation of the programmes' procedure of implementation, its successes and problems (5b), and the cost of the innovation (5c). This will be a rich source of information for researchers, the sponsors of the innovation and other persons that may need such information.

It is pertinent to point out here that none of these models and strategies of curriculum implementation reviewed seem to explain in toto, the basic guiding principles in the implementation of the JSSMC in Gongola State. This may not be surprising since most of these models and strategies were developed based on research and curriculum implementation experiences in America and Europe, who (in the opinion of the researcher) have different cultural and social forces exerting themselves on their educational systems.

Let us now by way of contrasting these models and strategies summarize this discussion so far. According to Rowan and Morgan, (1981) Models and strategies are often associated with efficiency because they enable one to see and pursue the steps suggested by their developers, usually with some assurance that they have been tried before. They

also suggest some activities that might be overlooked in the innovation process. It is therefore important that the intricasies, consequences and area of emphasis of each of these models be well understood.

Hoyle's four stages of invention, development, diffusion, and adoption provides a good base for a contrast. (See figure 3). The focus of comparison shall be the area of emphasis of each of the models and strategies along these four stages. This is intended only as a hypothetical sketch; such distinctions may not exist in most cases. In reality, these stages overlap. One can scarsely find a point in time for instance, when diffusion ends and adoption starts, or the point that separates the invention and development stages.

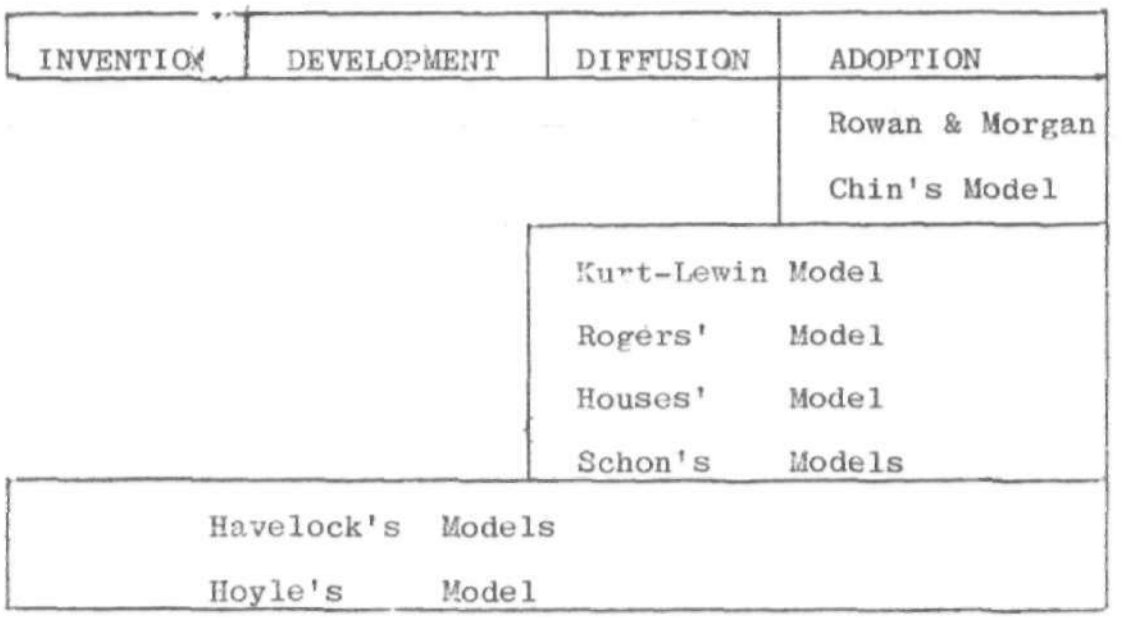


Fig. 3. Stages of Emphasis of the change Models and strategies.

Beginning with the all- comprehensive models; those given by Havelock's and Hoyle both assume that curriculum innovation should start right from when the idea of change is first mooted, and subsequently pass through all the four stages. The teacher (receiver) is viewed as a passive object and emphasis is on the intellectual basis for invention through research, field festing, diffusion through something akin to a sales drive or advertising campaign and culminating into adoption. An exception to this may be the Social Interaction (S-I) perspective of Havelock's model which may assume the existence of an already invented and developed package. Variations among Havelocks three models infact lie in the degree of freedom allowed the receiver and level of control of the outsiders.

The innovator is concerned mainly with preparing and disseminating packaged solutions in the R, D & D model, which therefore makes it a highly depersonalized model, reducing teachers to passive, 'Zombre-like' receivers in an innovation. In the Social-Interaction Model, the innovator concentrates on strengthening communication channels and promoting the exchange of ideas. He acts as a resource consultant working in a non-directive relationship with his clients (teachers) in the problem-solving (P-S) model.

The next four models, Schon's, Houses, Rogers' and Kurt Lewin all focus on the diffusion and adoption stages of innovation. Schon's and Houses' models however slightly differ from that of Rogers and Kurt Lewin. Schon & House are concerned with structures that will lead to the acceptance of innovation by teachers. House talks about extending the contact network of teachers to break down the barriers that prevent the formation of personal contacts that cut across levels of educational hierarchy. Schon emphasizes the provision of enough resources and strengthening of communication channels from the centre to the peripheries.

Rogers and Kurt Lewin on the other hand considers the receiver central in the diffusion and adoption processes. Activities should be directed to him and his response to such activities counts in deciding whether to continue with the innovation strategy. Rogers' five point pattern: Awareness, Interest, Evaluation, Trial and Adoption are directed to the receiver. He classifies the target audience of an innovation based on their responses to diffusion activities. Because Roger's primary audience seem to be the receivers, the influence of certain social and psychological factors which affect innovation research and which inturn will affect the installation of the research result is neglected. Kurt Lewin's unfreezing, change

processes (identification and internalization); and refreezing stages are also directed to the receiver.

Two things seem to make this group distinct. They do assume the existence of a packaged innovation, (unlike Havelock's and Hoyle's models) and their diffusion activities adopt a kind of "sales drive" approach (unlike the next two models, Chin's & Rowan and Morgan).

Chin's models, and the Rowan-Morgan strategy of change both have the diffusion and adoption stages merged together. Both assume that the decision for adoption of an innovation has already been taken, either by an outsider or even the receivers themselves. Because of this assumption, adoption activities are not towards 'selling' the innovation to the receivers (teachers) but designed toward making the teachers use the innovation. A kind of prescriptive commands.

The implication of this contrast is that, a combination of these models can be used in a single curriculum innovation process. The dissemination component in Havelock's R, D & D for instance could adopt Rogers Model of diffusion and adoption, or Schon's models, or even the curriculum adoption strategy by Rowan and Morgan.

However, this perspective of contrast is only one of many possible ways of condensing these models together. Congruence could for instance be established between Havelock's R, D & D model with Schon's *centre-periphery* if the 'centre' is also charged with the production of materials for an innovation. The responsibilities ascribed by each model to the receiver and the role of the innovator can also be a basic for a comparative analysis.

In any case, the extent of the scope of the influence of each of the models discussed above can only be seen if the level of installation (National? State? Local? or School level?) of an innovation is well defined. With the JSSMC, we have seen its invention and development (perhaps with little research) between 1977 and 1979, with no accompanying classroom materials produced by the innovating agencies (NERC/FME), little diffusion activity and a directive for adoption (power-coervice kind of).

Would this model (if it can be referred to as such) used in the implementation of the JSSMC ensure a positive teachers' perception of the curricula which is vital for its institutionalization?

2.2 Teachers and Curriculum Innovation

The nature of demands which an innovation makes on a teacher is quite enormous; from the acquisition of new knowledge and attitude towards learning, which often makes some teachers uncomfortable; to involvement in the management of the innovation process itself.

All of the curriculum innovation theories and models examined above place the teacher in a central position in innovation. They all appeal to teacher's participation in curriculum development, competence in respective subject areas and above all, his understanding and willingness to carry out the innovation. As those teachers are expected not only to play key roles in the responsible for teaching pupils on a day-to-day basis, actual development of curriculum materials, but also determine how these materials are used in the classroom.

Teacher's skills, abilities and personalities cast an important role in classroom interaction. Whatever curriculum specialists may lay down in form of a 'packaged' materials as proposals for change, and no matter how specific these proposals may be, the teacher is the final determiner of what and how of the 'packaged' material gets to the pupils. The teacher is expected to use new books, new timetable, and new evaluation methods; to attend workshops or in-service courses and seek the support of the school authority and other teachers to co-operate

towards achieving the intended innovation (Shipman, 1974).

Apart from the teachers' personal concern, there is also anxiety about standards, a fear that the intended proposals of the innovation may not give pupils enough learning experiences in order to learn the essential skills of the subject. As Owen (1973) observes, teachers' loyalty, when a change is mooted, is to the principles of professionalism rather than ideals of better learning. It is for these and the fact that teachers invest so much time in the process of learning and teaching of a subject that they often defend the status quo.

Shipman (1974) reports that of the eight schools that had teachers who seemed to have been pressed into the 'Keele Project' between 1969 and 1971, five completed the trial. Three of these five experienced the lowest amount of curriculum change. This may be attributed to their 'forceful' involvement in the project, although he warns that, this may not be the sole reason.

Also, teachers involved in curriculum innovation do not function with a blank background (Onwuka, 1985). They have their personal values, notions and biases about what their subject curriculum should look like. These values, notions and biases can hamper their proper understanding of the dominant social values and ideals which

curricular planners seek to promote through their selected curricular experiences. It is because of this danger of mis-understanding of the central curricular intentions that curriculum specialists (e.g. Schwaz (1983), Shirley (1984) and others) call for the inclusion of the teacher at all points of the curriculum development process before the actual classroom use. Teachers should be involved in the debate, deliberation and decision about what to teach and how to teach what. This, they argue, will afford the teachers to be familiar with the general and specific demands which they are to meet in the classroom and also be willing to use it. Schwab further asserts that, teachers do not in most cases resort to open hostilities even if they are excluded from the process of curricula formulations because as he puts it :

> 'The are a thousand ingenious ways in which commands on what and how to teach can, will, and must be modified or circumvented in actual moments of teaching. Teachers practice an art, moments of choice of what to do, how to do it, with whom and at what pace, arise hundreds of times a school-day, and arise differently every day and with every group of students. No command or instruction can be so formulated as to control that kind of artistic judgement and behaviour with its demands for frequent, instant, choices of ways to meet an ever varying situation! (Page 245).

Also "to the average teacher in the average school the official curriculum plan is unattainable" (Hawes, 1979, p. 114).

Because teachers are the interpreters of the objectives and content of the curricula, and the planners and managers of the learning situations through which intention is transformed into actual practice in the classroom, Hawes (179) suggests that 'teacher training' should be the first essential for curriculum implementation. Such a training should include short courses especially at the initial stage of implementation, in-service courses, and pre-service courses. The teacher's understanding and competency of language of instruction, his knowledge, skills and understanding in relation to demands of the curriculum and the local and national needs and goals for development should well be noted. Miles, (1964) too, emphasizes this point. He says teachers' discontinuation in the use of new curriculum is caused much more by his inability to use it than sabotage. Thus, he advises change agents to try to distinguish between teachers' early questions, doubts, and hesitancies from teachers' resistance to the change. This calls for extensive familiarization activities for teachers on the JSSMC before engaging them in its implementation.

The teacher's interests, aspirations and how he can advance these interests, his attitude to current curriculum

and his relationship with the school and the community should be examined properly and redressed where necessary *before engaging them in curriculum innovation.* According to Hawes, teachers must know why changes have been made, what the changes are, and how to bring the changes about if they are to make the desired impact in the process of curriculum innovation.

Gould (1960) advocates three necessary relationships that should exist between the teacher and the curriculum at the implementation stage. Firstly, the teacher should holad an attitude of 'irreverence, complete and unequivocal' (page 350). He needs to recognise that the curriculum 'package' is not sacred, that he should be free to adapt to a reasonable limit as the occasion demands. He asserts that curriculum that makes the teacher timid and keeps him and his students marching in straight and single unbroken ranks with everyone perfectly in step and constant harmony of unchallenged agreement, is either bad in construction or in the philosophy on which it is founded. Secondly, he should be aware of the values of the "unplanned-for by- products" and extensions of the curriculum. Thirdly, the teacher should have wisdom. The curriculum should be enriched by this and his personal values and experiences regardless of the subject matter. He views the teacher

as the greatest of the three attributes of education- teacher, student and curriculum.

Another call for early involvement of teachers in the change process comes from Rowan and Morgan (1981). Teachers, they say, tend to be skeptical of ideas proposed by "experts" outside their schools. They argue that the more role teachers have in planning a change, the higher the likelihood of success for that change. Therefore the key to successful implementation of the classroom is to involve teachers at the planning stage, to develop what they call 'ownership of change! They are also of the view that teachers should have the facts and figures about the present situation before embarking on change. Blanchard and Zigarmi, (1981) also make the same point in their 'unfreezing' stage in the installation of an innovation.

On how an individual teacher or groups of teachers in an innovation could be more effective, Miller (1981) suggests that teachers should identify themselves with the desired change and with other persons who share their views on this change in order to harmonise their efforts in bringing the change about; and see interested parents and other outsiders as allies and not intruders into the system. It is therefore important for teachers to be open

to those with either negative or positive attitudes towards a planned innovation. Listening to only one p point of view may do a long term harm to a programme. Teachers should also design activities that will win more support for a change from those groups that mattter, especially if the change will require a lot of resource allocation. Miller warns against conflict in innovations. He says conflicts leave scars, and scars, heal slowly. Miller advises that, controversial issues in innovations be resolved through negotiations rather than direct confrontation.

In the 'RAND STudy of Federal Programs Supporting Educational Change' to determine what needed to be done for successful change to occur in the U.S.A., Berman and McLaughlin (1975, in Blanchard & Zigarmi, 1981) identified teacher characteristics together with institutional motivation, implementation strategy and institutional leadership as the broad factors influencing the successful implementation and continuation of change efforts in schools. The Rand study found that intrinsic motivators are more effective than extrinsic motivators in securing teachers' actual involvement in an innovative project, and stressed the need for staff support activites in-terms of in-classroom assistance. It also supported the notion

that teachers with a high degree of confidence were most able to implement change successfully. This underlines the need for teacher training with a view to having the teachers convince themselves of the worth of a new curricula. The training should be skill specific. The teacher is most likely to maintain a change in behaviour if he receives an in- classroom assistance from credible resource people; had an opportunity in the decision and if there is regular staff meeting to solve problems.

The diagnostic tool for assessing the teachers attitude towards new mathematics curriculum and their readiness for change, developed by researchers at the Research and Development Centre for Teacher Education at the University of Texas at Austin, identifies three aspects of teacher concern in curriculum change. These include stages of concern, levels of use and innovation configuration. The model assumes that change is a process and not an event, i.e. it takes time. Also educational change is a personal experience and teachers perceive a given innovation differently according to their personalities and past experiences (Blanchard & Zigarmi, 1981).

Lieberman and Miller (1981) on their part give guidelines which school improvers should follow if they hope to make a reasonable change. The guidelines include

approaching teachers as the real 'experts' on teaching and learning, rewarding teachers when they try something new, and to encourage dialogue among teachers. They point out that 'too often efforts at reform have failed because they have viewed schools too simplistically and too mechanistically; they have been based on a view of schools and teachers as empty slates" (Page 52). They suggest that innovations should assume from the outset that it is teachers who make change happend and make it endure.

After a review of three major studies conducted in the 1970s on process of school improvement in a variety of settings over time (the Concerns Based Adoption Model (CBAM) studies of individual teacher development, the Rand Change Agent Study of federal improvement project and the I/D/E/A study of school improvements in the individual schools over a five years period) Lieberman and Miller (1981) found that (a) teachers adapt to change developmentally, (b) teachers are motivated by a sense of personal competence and (c) teachers want and need training in new ideas and techniques that not only is rich in information but also provides support for trying out the new techniques in their classrooms.

Hence they advise that efforts for improvement in schools must begin with the concerns and needs of individual teachers. It is important for teachers to be actively involved in the improvement process from the outset. Also teachers should be acknowledged if they show commitment to improvement programmes.

Stenhouse (1986) makes reference to several curriculum specialists' view on the importance of teachers in the innovation process, especially that of Hoyle who asserts that the individual teacher is important in the innovation among his colleagues; and ultimately it is he who puts the innovation into practice at the classroom level. This is a view also shared by Shipman (1976).

According to Stenhouse, teachers should critically study themselves for a meaningful participation in the innovation process. This, he says, is because all well-founded curriculum research and development is based on the study of the classrooms. Whether it is that for a single teacher, a school, a group working within the co-ordinating framework of a national project, the curriculum is based on the work of teachers since it is the teacher that interacts in the classroom.

The teacher in a school is required to give knowledge, train students in some basic skills as stipulated in the

curricula, provide guidance for effective learning activities in the class, help in administration and provide a conducive emotional climate which will facilitate learning in the classroom. But resistance can develop among teachers who are positively oriented to carrying out these when an innovation is being implemented in a school system. This may be due to frustrations they may face in their attempts to overcome the problems of the implementation process. This usually comes as a result of 'barriers! The 'barriers' could be lack of clarity about the new role model, lack of skills and knowledge to carry out the innovation, unavailability of required material and equipment, set of organisational arrangement existing prior to and during the introduction of the innovation that are incompatible with the innovation and several other factors (Stenhouse, 1986).

The difficulty in overcoming barriers may lead to the rejection of the innovation, which consequently may lead to the rejection of the ideas which the innovation represents (e.g., the scrapping of "modern maths" in Nigeria in 1977). Kerr (1972) notes that resistance to change is natural response and any attempt to force change upon unwilling teachers could be counter productive in education. Planned change should itself be regarded as an educational enterprise which is essentially a dialogue.

The discomfort which genuine innovation brings on teachers in the form of deskilling them is usually resolved either by reversion to previous practice or the acquisition of new knowledge and skills. The aim of all innovatios is to achieve the latter. Ideally, curricular specifications should feed a teacher's personal research and development programme through which he progressively increases the understanding of his own works to better his teaching.

Several of the points raised here seem not to have been borne in mind in the development of the JSSMC, vis-a-vis teacher involvement. There was no 'unfreezing' from the onset of the change, few classroom teachers were involved right from the planning stage up to the development of the curriculum, trial testing of the curricular specifications was not done, infact no classroom teaching packages (in terms of texts) were produced by the innovators, and very little teacher familiarization activities was carried out. Will these affect teachers' perception of the curricula?

2.3. Development and Implementation of the JSSMC

In january 1977, the Federal Ministry of Education, so worried with the state of mathematics education in our schools then, invited experts to a conference in Benin. In his opening address at the conference, the then Federal

Commissioner of Education informed delegates that Government had decided to abolish "Modern Maths" as a compulsory school subject with effect from the next academic session (1977/78). Many at the conference were shocked at this announcement, for it had clearly been stated in their letters of invitation that, the Ministry wished to be guided by experts in order to give appropriate advise to the government on the content and methodology of school mathematics. But here they were, being told that the Government had already decided that "Modern M Mathematics" had come to its end.

Curriculum change, ideally, should be well planned and should take place when there are changes in the objectives of education emanating from change in the social values, beliefs, and traditions of a society. Curriculum change could also occur when there is change in the nature of knowledge or content of education or when what is known about learning process changes, when an educational system changes and when feedback from curriculum evaluation necessitates a change (Shirley,1980, Onwuka, 1985). The singular move by government as announced at Benin in 1977 brought a lot of reactions.

Firstly the experts reacted strongly. They issued a fourteen-page report challenging the Commissioner's assertions and pointing out what appeared to be his or the government's misunderstanding of the nature of contemporary mathematics. They, in particular criticised the way the action was taken without making the necessary consultations with the relevant professional bodies. The report ended with a list of objectives and recommendations for curriculum development, smooth implementation, and teacher training (Shirley, 1980).

Secondly, Principals and State Ministries of Education were caught by surprise at the announcement. Principals and teachers had to 'dig' into their stores to find earlier abandoned textbooks for use without defined aims and objectives apart from that of preparing students for the West African School Certificate examinations.

Thirdly, and more positively too, the announcement spurred the NERC Task Force on mathematics syllabuses, which had been formed in the previous year, into action. The Task Force which could not meet throughout 1976 was pushed by the announcement at the Benin conference to meet in February 1977 in Ibadan. The Task Force studied the problems facing mathematics-education in Nigeria and

made positive recommendations towards the solution of these problems. Problems highlighted included those associated with curricula, pupils, language of instruction, teachers, evaluation of achievement, school management and societal attitudes towards mathematics (NERC, 1977). It made detailed recommendations that were later to influence to a very great extent, the production and form of the Junior Secondary School Mathematics Curriculum (JSSMC) and the Senior Secondary School Mathematics Curriculum (SSSMC). The Task Force emphasized a point raised by the experts at Benin, that mathematics and not just arithmetic should be taught at all levels.

Meanshile the Comparative Education Study and Adaptation Centre (CESAC) based at the University of Lagos was independently working on problems of the secondary school mathematics curricula. It started as early as August 1976 with a series of conferences and workshops aimed at developing a new syllabus for secondary school mathematics and organising a carefully planned timetable of text-writing, and teacher training.

The National Council of Education met in October 1977 to discuss these various efforts in mathematics curricula development. The NERC was assigned the responsibility of

preparing primary and teachers college syllabuses while CESAC was to continue its work on secondary school syllabus. The works of these two bodies were presented at a National Critique Workshop held in Onitsha in March 1978. The meeting at Onitsha adopted the NERC primary school syllabus with few minor modifications. At the secondary level, the committee noted the new structure described in the National Policy on Education which called for a three-year junior secondary school followed by a three-year senior secondary school. The secondary school syllabus was therefore to be similarly divided.

The junior secondary school syllabus was to be a general one having a dual function; catering for those who would continue their education in both arts and science areas. Consequently, two syllabuses were worked out; one for the junior and the other for senior levels of secondary education, drawing ideas from both the CESAC plan and the NERC recommendations.

The new syllabuses were approved by the Federal Ministry of Education in March 1979. The JSSMC is formulated under five headings, namely, Topic, Objectives, Content, Activities/Materials, and Remark. The topics include Number & Numeration; Algebraic processes; Geometry &

Mensuration; and Everyday Statistics. The objectives are stated in terms of what the teacher hopes the students will be able to accomplish after each topic. The contents can be said to represent something of a compromise between the "traditional" and "modern" positions (if, indeed there was a real dichotomy). Much of the "modern" content and terminology is dropped. Set theory has been removed from the Junior Secondary School level. The abstract logical proofs as obtained under modern mathematics have also been excluded at this level.

Some of the "modern" ideas however remain. Geometry is included throughout the primary programme and remains intutive geometry in the junior secondary school syllabus. Gaining support from both modern adherents and those who want practical utility in mathematics, the topic of statistics receives much coverage throughout the syllabuses. Computation skills remain important but are modified by discussions of estimation, approximation, and deciding if answers are reasonable.

Following the approval of the syllabuses in 1979, attention shifted to the onerous task of implementation; the problem which had earlier bedevilled the "Modern Mathematics" syllabus and which eventually led to its scrapping (NERC, 1977).

Because of the large number of teachers to be trained at the primary school level, the State Ministries of Education were asked to take up the responsibility of organising familiarization workshops for teachers. The NERC with aid from UNICEF also held several primary text-book-writing workshops and by 1982 had a full six-year series published. Some commercial publishers also have produced texts or have modified old ones to match the new syllabus.

A noteworthy point here is the apparent little classroom-teachers' participation in the development of the 1979 curricula. This runs counter to the suggestion of most curriculum specialists (e.g. Hawes, 1979 Shipman 1976, and others)

The implementation of the JSSMC which was planned to take off in the 1982/83 school year was not to be possible due mainly to political bickering and lack of facilities. At the time NERC was busy producing texts on the PEMC, the Federal Ministry of Education organised some week-long workshops in parts of the country to explain the JSSMC and SSSMC to secondary school teachers. But these workshops, though well organised, reached only a fraction of the total number of teachers that would use the syllabuses (Shirley, 1980). Even as late as 1981/82 session,

many teachers were found to be unaware of the existence of a new mathematics syllabus (Shirley, 1984).

Public and private efforts are being made to produce textbooks based on the JSSMC. The Mathematical Association of Nigeria (MAN) in association with the University Press Limited (UPL) is producing a complete series based on each point of the content and objectives of the JSSMC (books one and two have so far been published). Also MacMillan, Evans, Africana FEP, and Longman, each have a full three-year set of junior secondary school texts.

In Gongola State, the JSSMC and SSSMC were received and sent to schools in 1982 as "the" new mathematics syllabuses with no suggestions on how the syllabuses should be implemented or how teachers are expected to learn the new skills that the syllabuses demand. The JSSMC was brought into full use in 1984, when the State started the implementation of the two-tier secondary school setup of the 6 - 3 - 3 - 4 system.

Such curriculum decision-making is a major characteristics of a centralized curriculum system (Skillbeck, 1973, in Badmus 1984). Although the system has its advantages especially in setting a clear direction (like the R, D & D model), teachers are not allowed to play their expected roles in curriculum development. And

teachers who find themselves in an innovation in such systems may resist the changes that the innovation may entail even if they are dedicated teachers (NERC, 1977); Jones et al, 1986).

2.4 Research on the 1979 Curricula

There have been few empirical studies so far on the 1979 curricula. Perhaps this is due to the fact that the full impact of the curricula especially at the secondary school level is yet to be felt. Happily however, the few available deal with the mathematics teachers role in the implementation process.

Shirley (1984) examined the effects of early participation of classroom teachers in the familiarization of teachers with new mathematics curricula, on the teachers attitude toward the introduction of new curricula, and more generally on the successful implementation of the new mathematics programmes. The research was a case study of mathematics teachers in the post-primary teachers colleges of Benue, Kaduna (old) and Sokoto States.

The instrumen t of study was a 50-item questionnaire to measure (a) attitude towards accepting a new curriculum, (b) amount of previous participation in curriculum development and their knowledge of the new programme. He also

found that many teachers were not aware of the new programme. Shirley also noted the importance of and the need for more, early teacher participation in mathematics curriculum development, use of familiarization workshops, establishment of more teacher centres, and generally, better communication between classroom teachers and methematics curriculum developers.

This current study is a product of one of the recommendations of that research, which was also echoed at the March 1987 International Conference/Workshop on Mathematics and Applications (Shirley, 1987). He recommended among other things, research to seek teachers' opinions and comments on the new curricula based on their experiences in dealing with it in the classroom; and better teaching approaches.

There are also other similarities. The instrument for measuring factual knowledge of the development and content used in this study is an adaptation from the one used by Shirley. However, while Shirley examined the Teachers Education Mathematics Curriculum (TEMC) and therefore dealt with teachers in the teacher training colleges, this study concentrates on the JSSMC and its handlers.

A similar study to that of Shirley (1984) was done by Miri (1986) on the Primary Education Mathematics Curriculum (PEMC). Miri sought to find out the knowledge of facts expected to be acquired by the primary school teachers about the 1979 primary mathematics curriculum and the factual knowledge of the teacher, teaching methodology, and to relate the factors to teachers attitudes towards the 1979 primary mathematics curriculum and the implementation of the programme.

The statistical analysis was based on a forty-item questionnaire answered by primary school teachers in six local government areas in Plateau State. Some of his findings justifies the need for this study. He found positive correlations between teachers' knowledge of the new curricula and their attitude towards understanding its contents; and between teachers' knowledge of the new programmes. This according to him indicates the importance of teacher factor in the implementation of new programmes in mathematics. He asserts firmly:

> "In general the results imply that those school teathers who are familiar with new mathematics syllabus and those teachers who can apply the right type of teaching methods to different contents of the school curriculum tended to have better attitudes towards accepting and implementing new programmes" (Page 71).

This 'implication' subtly links knowledge of the content and methodology of the curriculum to attitudes towards accepting and implementing new programmes. The current study is based on the firm belief that, a better perception by teachers preceeds a "better attitude towards accepting and implementing new programmes". This study will therefore extend the frontiers of Miri's study by filling in the gaps in establishing statistical relationships between attitude towards mathematics as a school subject, knowledge of the development and content of the curriculum and teacher perceptions of the curriculum.

Badmus (1985) in a pre-implementation study of the JSSMC sought to assess the worth of the curricula through the perception of one hundred and twenty six teachers, selected from five states. The teachers belonged to three groups of academic and professional training (graduate-professionals, non-graduate professionals, and graduate non-professionals) and were teaching three different types of mathematics programmes (teacher training mathematics, commercial/Technical mathematics, and general mathematics in grammar schools). The distribution of teachers into these various grouping was made in sch a way as to produce an orthogonal design.

Teacher-perceptions were assessed on six curricular

issues, the general objectives of teaching mathematics at the JSS, relevance of instructional objectives, relevance of content of instructions, balance and scope of content of instruction, reasonableness of organisational structure of content of instruction, and feasibility and applicability of teaching-learning strategies.

He found that the overall perception of teachers on the JSSMC with respect to: (a) general objectives of teaching mathematics at the JSS was significantly better than their perception on either relevance of content, organisational structure of the content or the prescribed teaching learning strategies. (b) Balance and scope of content was significantly better than their perception of the prescribed teaching learning stragegies. (c) Instructional objectives was significantly better than their perception of the prescribed teaching-learning strategies.

He also found that, the graduate professionals were characterized by high scores on instructional objectives scale, high scores on organisational structure of content scale and high score on teach ing-learning scale. The non-graduate professionals had high scores on instructional objective, teaching-learning strategies, and general objectives of teaching mathematics scales. He attributes

the high score on the general objectives of teaching mathematics by this group to either over-rating or over simplifying the objectives of teaching mathematics. The graduate non-professionals were characterized by low scores on: general objectives of teaching mathematics, organisational structure of content and teaching-learning strategy scales. He says the pattern of perception scores in the three qualification groups is independent of the programme that teachers teach.

On the type of programme factor, he found that TC II mathematics teachers were characterized with high scores on general objectives of teaching mathematics, relevance of content and teaching-learning strategies scales. The teachers of commercial/tech nical mathematics had low scores on general objectives of teaching mathematics, relevance of content and teaching-learning strategies scales. The teachers of general mathematics were characterized by low scores on general objectives of teaching mathematics and organisational structure of the content, but high score on teaching-learning strategies scale.

Badmus (1985) notes the need to educate all categories of teachers on the rationale for the selection of the content of the JSSMC to avoid the arbitrary deletion or addition of topics of th eir choice from/to the curriculum which teachers may resort to as a result of his findings.

He also suggests the need for intensive in-service training and re-training for teachers (particularly the non-professionals) on the teaching- learning strategies to convince them of its feasibility and practicability.

This current research has a lot in common with the Badmus (1985) study especially in the areas of instrument and design. However, the bases for the study are distinctively different. While Badmus was concerned with pre-implementation perception of teachers and even involved teachers from teachers colleges and commercials/technical colleges who were not likely to use the syllabus, the present study is to assess teachers perception based on their daily use of it in the classroom. Also Gongola State falls outside the area covered by Badmus (1985). His findings will however provide a good base for comparison with the result this study.

Another study that made use of the JSSMC was one carried out by Jahun (1986). The study was to standardize test items for use in Kano State for the purpose of implementing continuous assessment programme recommended by the new education policy. The test items were drawn from the algebra section of the JSSMC form three and was administered in Kano State.

The study showed a poor performance by students on the items and this made the standardization of test difficult. The primary concern which this result brings to mind is the cause of this poor performance. Among other questions that needs to be answered first is whether teachers have a good perception of the JSSMC in order to carry out their expected roles in the classroom well. This is what this study tries to find out.

In this chapter, curriculum innovation theories have been reviewed and discussed with a view at providing a theoritical framework on which the implementation of the JSSMC was based. The role of teachers in curriculum innovation as suggested by curriculum experts have also been discussed. All the experts say the teacher is very important in the innovation process and as such should be involved in it at the appropriate stages. Only then would teachers be better prepared to carry out the desired aims of an innovation. Also, the development and implementation (particularly in Gongola State) of the JSSMC has been examined. These do not seem to have followed the suggestions of the innovation experts especially with regards to teacher involvement. The rest of the chapter dealt with the recent empirical studies on the 1979 curricula.

CHAPTER THREE

PROCEDURE AND DESIGN

This study is bei ng undertaken in an attempt to assess the perception of three groups of secondary school mathematics teachers of the worth of the 1979 Junior Secondary School Mathematics Curriculum (JSSMC) in Gongola State. Attempt will also be made to find what relationships there is b etween: (a) perception of teachers and their general attitude towards mathematics and (b) perception of teachers and their knowledge of the JSSMC.

3.1 Population

The population of this study are the secondary school mathematics teachers in Gongola State who have had the experience of using the JSSMC in the classroom. Gongola State came into existence as a result of the splitting into three of the defunct North Eastern State in 1976 by the Murtala regi me . I t is the second largest in Nigeria in terms of area. The State with a 1987 projected population of 4.766 million has one hundred and twenty three (123) secondary schools with a total enrolment of 89,283 students. As at June 1986, there were 287 secondary

school mathematics teachers in the State. These teachers are heteregenous in many respects: sex, academic and professional q ualifications, and nationality.

But, since th e JSSMC is being used by all teachers of mathematics at JSS level of education, male or female, qualified or unqualified, Nigerian or expatriate, no group will be excluded from this study for any of these reasons. Hence teachers handling the JSSMC in the State have been grouped into three.

The first group , A, includes trained mathematics teachers with a minimum of a first degree. Such teachers should normally have a B.Sc.(Ed.), B. Ed., M. Ed. or a B.Sc/B.A. and PGDE, with subject specializations in Mathematics.

Group B comprises of trained mathematics teachers at the intermediate level. This includes holders of DME, NCE, HDME, ACE of equivalent certificates.

Group C includes all those other teachers teaching mathematics at the JSS level with training or specialization in subjects other than mathematics.

Table 3.1 Teacher groupings.

GROUP	QUALIFICATIONS
A	B.Sc./B.A. (Ed)., B.Ed., M.Ed., B.Sc./B.A. & PGDS
B	DME, NCE, HDME, ACE or equivalents
C	OTHERS.

These grouping have been used because a major underlying reason for this study is to make a comparative analysis of trained teachers' disposi tion to accepting curricula innovation, as shown by their perception, in which they have had little input as compared to the untrained teacher. The further breaking of trained teachers into two groups (A and B) is for a deeper understanding of how professional teachers view curricular specifications vis-a-vis their expected role in formulating these specifications.

3.2 SAMPLE.

Working on the assumption of obtaining three mathematics teachers per school, a total of seventy (70) secondary schools were randomly selected from the one hundred and twenty three (123) secondary schools in the state. The plan was to get a total of one hundred and twenty (120)

& SSS under 'one roof' and those operating JSS alone.

A deliberate effort was therefore made to ensure that at least one of each type of school was represented in each Local Government Area. Non randomness of random numbers when the sampling is small is an acknowledged disadvantage of the random numbers table (Jonson, 1977).

3.3 Instrument

This study is being undertaken using a questionnaire as the instrument for the collection of data. The questionnaire is a five-page, closed 5-point Likert type consisting of fifty-five items. It is an adaptation from three different sources.

Section B, which comprises items for measuring perception of teachers is a part adoption of the 'Mathematics Curriculum Evaluation Questionnaire' (MCEQ) developed and validated by Badmus (1985). He reports that the validation was done with seventy-five secondary school mathematics teach ers. The correlation of each item with the scale to which it belongs ranges from 0.32 to 0.84. The overall reliability coefficient for the composite MCEQ was found to be 0.89, which is an estimate of its internal consistency.

Section C for measuring teachers general attitude towards mathematics is an adaptation from the 'Mathematics attitude Scale' developed and validated by Lassa (1976). He reports a reliability coefficient of 0.94.

The knowledge of the historical development and content of the JSSMC measuring instrument has been adapted from Shirley (1984). This has also been validated by him using many teachers who have had teaching experiences at the post-primary level of education.

The items on the questionnaire have been organised into four sections. The first section deals with demographic data meant to reveal the respondent's personal information on teaching experience, qualification and school type-JSS or both JSS and SSS.

The second section (Section B) is a thirty-five item section designed to evaluate teachers' perception of the JSSMC, with seven items on each of the five curricular issues. The curriculum issues being (1) the relevance of the content of the curricula to current thinking in mathematics education, in structional objectives, psychological principles of learning, needs and interests of the learners; (2) the relevance of the instructional objectives as they relate to the aim of teaching matheamtics

at the JSS; (3) the adequacy of balance of content; (4) the reasonableness (logical and psychological) of organisational structure of content of instruction, and (5) the feasibility and applicability of the prescribed teaching-learning strategies. Respondents are expected to respond to each item by ticking under one of five alternatives: Strongly Agree(SA), Agree (A), Undecided (U), Disagree (D), Strongly Disagree (SD).

The third section (Section C) is a ten-item section meant to assess teachers general attitude towards mathematics and mathematics teaching. Teachers are expected to respond to items here just like in Section B.

The fourth section is also a ten-item section meant to evaluate teachers factual knowledge of the historical development and content of the JSSMC. Respondents are requested to tick under one of the three headings : Yes (Y), Don't know (DK) and No. The "Don't know" point has been introduced here to discourage guessing by respondents.

The questionnaire is used as the instrument of research in this study because the sample for the study is too large and scattered, making it uneconomical for reasons of time and finance for personal contact for interview.

3.4 Pilot Study

A pilot study using teachers from ten secondary schools was carried out in Zaria Local Government area of Kaduna State in January, 1988. The pilot study was done to determine: (a) the feasibility of the study through a trial run, (b) the appropriateness of the instrument and the proposed statistical analysis, (c) the approximate time required for teachers to complete questionnaires and their co-operation, and (d) other administrative problems that are likely to hinder the successful completion of all the tasks in the main study.

Of the 45 questionnaires distributed, only 31 were fully completed and collected back, giving a return rate of about 70%. It took several days of visits to retrieve many of the 31 questionnaires.

Some few modifications were made as a result of the pilot study. This relates to the number of pages of the questionnaire and method of recovering them. Teachers seem to be reluctant in accepting to fill in the questionnaires because of sheer number of pages. The introductory letter to the teachers on the same page as Section A has been transfered to a separate sheet (See Appendix A). Section A itself was adjusted as to maximize the use of space (See Appendix B).

Perhaps, an area where the pilot study has been most useful is in identifying administrative problems that could arise during th e main study. For three days, a letter permitting the pilot study could not be got from the Zonal Headquarters of the Kaduna State Ministry of Education in Zaria, what the researcher had at first thought was not necessary.

The initial plan for getting questionnaires back from teachers in the main study had been by post or through the Gongola State Schools Management Board. But the experience of getting questionnaires from teachers during the pilot warranted a modification (See Section 3.5).

The pilot study has also helped in straightening out matters related to the design of analysis. Most teachers who completed the questionnaire said it took them between 20 to 30 minutes, although some said it took them all night.

3.5 COLLECTION OF DATA.

After obtaining permission from both the permanent secretary of the state's Ministry of Education and the executive secretary of the Gongola state schools Management

Board, parcels were despatched to each of the selected schools through the latter's agency in March 1988. The parcels contained :

1. A letter from the permanent secretary to the school principals directing them to cooperate with the researcher by carrying out what he (the research er) was requesting them to do. (See Appendix D).

2. A letter from the researcher to the Principals requesting them to administer the questionnaire on their teachers who have had the experience of using the JSSMC (Appendix E).

3. A letter to each teacher explaining the context of the research. The letter in particular emphasized the need for teachers to draw from their classroom experiences in filling out the questionnaires. It also stressed on matters of confidentiality of responses and anonymity of teachers in order to obtain valid responses.

4. The research questionnaires to be administered to teachers. This varied in number, depending on the size of each school.

5. A stamped, self-addressed envelope measuring about

20 cm x 25 cm.

Owing to the researcher's experiences in the collection of questionnaires from schools during the pilot study (see section 3.4), a two-pronged questionnaire-retrieval method was planned. First, the research had requested the Principals to return the questionnaires by post within two weeks of receipt. Second, (the contingency plan), the researcher and some research assistants were to go round some of the schools to collect the questionnaires.

In the end, both methods had to be employed. Suffice it to add that, more questionnaires were received through post than by personal contact, Perhaps this was due to the Easter break which made most teachers to stay away from school during the time of the collection of the questionnaires. Infact, many teachers were not on their seats in most of the schools the researcher visited around that time. The collection of the questionnaires which the researcher had hoped would be completed in April therefore extended into May, 1988.

The returned questionnaires were reviewed for completeness of pagination and responses. Some of the questionnaires were found to be unusable because of one reason or the other. Several others were also returned

uncompleted, mostly from schools that have fewer mathematics teachers than the number of questionnaires sent to them; a point many of the principals took time to make it known to the researcher either through accompanying letters or as notes on the uncompleted questionnaires.

A total of two hundred and seventeen (217) questionnaires were sent out. One hundred and fifteen (115) dully completed ones were recovered. A concise summary of the distribution of the number of schools involved, the number of questionnaires sent out, and the number of the duly completed questionnaires that were returned, according L.G.A's of the state is shown in table 2 :

Table 2. Distribution of Schools and Questionnaires

	L.G.A.	No. of Schools selected	No. of Questionnaires sent out	No. of Questionnaires returned
1.	Bali	3	9	6
2	Fufore	3	9	2
3	Ganye	4	12	2
4	Gombi	6	17	10
5	Guyuk	3	9	3
6	Jalingo	3	9	5
7	Karim Lamido	4	12	3
8	Mayo Bewa	3	7	2
9	Michika	5	16	5
10	Mubi	5	18	16

Table 2 Distribution of Schools and Questionnaires. (Contd.

	L.G.A.	No. of Schools selected	No. of Questionnares sent out	No. of Questionnaires returned.
11	Numan	6	19	10
12	Sardauna	4	12	2
13	Song	3	9	6
14	Takum	7	24	17
15	Wukari	5	16	9
16	Yola	4	15	14
17	Zing	2	4	4
	TOTAL	70	217	115

Responses of the selected teachers on each of the 55 items were scored. For each positive item in sections B and C, a score of + 1 was assigned to the 'Strongly Agree' (SA) or Agree' responses, O to the 'Undecided' (U) and -1 to the 'Disagree' (D) or 'Strongly Disagree' (SD). This scoring pattern was reversed for negative items.

In section B, the scores for all items were summed up on each of the five curricular issues. Thus each respondent (teacher) had five totals with a maximum and minimum of each total being + 7 and - 7 respectively. Row totals for each teacher across the five curricular

issues were also calculated. In section C, the total for all the items was summed up for each respondent, giving a maximum possible score of + 10 and a minimum possible score of - 10.

In section D, the scoring pattern has been + 1 for a 'Yes' response, O for 'Don't Know', and - 1 for a 'No', for positive items. This also, has been reversed for negative items. As in section C, each respondent has a single total with a possible maximum of + 10 and possible minimum of - 10.

The dully completed questionnaires received from the selected schools were grouped in to the three categories of teachers being studied. Group A_1, i.e. graduate teachers in mathematics and education numbered 20, Group A_2 comprising of trained teachers at the intermediate level (NCE or equivalents) numbered 75 and Group A_3 which includes those other teachers teaching mathematics at the Junior Secondary School level but with no training in mathematics. This data is shown in table 3.2

Table 3.2 Classification of Teachers (Respondents)

Group	Number
A_1	20
A_2	75
A_3	20

3.6 DESIGNS

A variety of statistical designs have been used in this study. For the first two hypothesis which deal with the perception variable, a 3 x 5 two-way Fixed Effects ANOVA with repeated measures on one of the factors was used for their analysis. The method of computation was based on the unweighted-means solution which is one of the methods used when there are unequal cell frequencies in a multifactor experiments having repeated measures. Winer (1962) points out that, the method of the unweighted-means solution is the more appropriate if the original plan for an experiment calls for equal group, but because of conditions unrelated to the treatments, the completed experiment does not have equal group sizes.

The method in essence considers each cell in the experiment as if it contains the same number of observations

as all other cells (at least with regard to the computation of main effects and interaction effects).

Two other main features identify this design, and which also make it unique. The standard error of the mean in this type of design is not proportional to the number of observations in each group as is normally obtained, but rather to its reciprocal. Because of this, the harmonic mean of the observations is used in the computation of the main and interaction effects. Also because both factors A (teacher groupings) and B (curriculum issues) in this study are fixed factors, the mean sum of squares for within the cell variations is the proper denominator for all tests. (Winer, 1962 p. 243).

The Pearson's Product Moment Correlation technique was used to calculate the correlation coefficients between the variables; Perception and Attitude; and Perception and Knowledge. Thus based on these, the t-statistic was used to test hypothesis 3 and 4. All four hypothesis of this study were tested at the 5% level of significance.

Scatter diagrams and Regression analysis were also employed for further graphic and indepth study of the correlated variables.

CHAPTER FOUR

ANALYSIS OF DATA

4.1 INTRODUCTION.

This study was designed to answer questions on secondary school mathematics teachers' perception on the Junior Secondary School Mathematics Curriculum (JSSMC) currently being used in Nigeria. The study also deals with attitude of teachers towards mathematics as a school subject and their knowledge of the content of the curriculum.

In the first section of this chapter, the means and standard deviations of scores obtained on the instrument of the study is presented. The nature of the distribution of the scores is also examined. Next, an analysis of Hypotheses I and 2 are made using an ANOVA technique. The analysis involves only the responses of teachers on the perception scales.

The second section deals with the analysis of the relationships among the three main variates in this study - using correlational analysis.

The emphasis in this chapter is on data presentation and statistical significance. The interpretation and practical significance of the results in relation to the problem being investigated is dealt with in the next chapter.

4.2 SCORES

Following the methods of scoring described in section 3.5, the teachers responses on the five curricular scales, and ten items each of the Attitude and Knowledge scales were scored. Teachers' composite score on the five curricular scales was summed up to give each teacher a single score on perception. Thus each teacher had one score each on the Perception, Attitude, and Knowledge variables. 'Perception' scores of teachers ranged from - 22 to 35, for Attitude' from 1 to 10, and for 'Knowledge' from - 5 to 7. The mean and standard deviation for all the teachers on the three variables is shown in table 4.6 below.

Table 4.1. Mean and Standard deviation of Teachers' responses.

	N	$\bar{X}$	S
Perception	115	15.4087	12.0982
Attitude	115	9.0609	1.6925
Knowledge	115	0.1217	2.4926

A careful observation of table 4.1 shows that the mean on the Attitude scale appears to be very high, and yet with a low standard deviation. This could have occured for two reasons. First, it is expected that those who teach or have studied mathematics beyond the secondary school level must have done so because of their positive attitude towards the subject. Also, one needs a minimum of credit level score at the ordinary level in order to go in for teacher training at the tertiary level, and since it is an acknowledged fact that achievement and positive attitude towards mathematics especially amongst teachers correlate highly, (Lassa 1975), it may be safe to assume that the high scores on the attitude scale in this study is a true reflection of the feelings of the teachers involved.

Second, it is not unusual when dealing with questionnaires to find respondents who respond to certain category of questions based on an assumed expectations of the researcher. Thus, there may have been the tendency on the part of some teachers to respond to the items on the Attitude scale based on what is expected of them as mathematics teachers or what the 'authorities' would expect of them. This may be true most especially with the untrained teachers. It was in anticipation of this problem that

the letter accompanying the questionnaires addressed to each teacher stressed on the need for them to "respond as accurately and honestly as possible (see Appendix B). In any case mathematics is a school subject which many people have never hidden their hatred for. So it is assumed that their scores are valid.

The low mean value on the Knowledge variable on the other hand may have been due to the time lapse between the time [illegible] of the heated debates on the modern mathematics curriculum in the 1970s which led to its scrapping and the development of the JSSMC; and the time of this study. Many of the teachers who participated in this study may not have been in service by then, or even placed in a position to follow the trend of discussions and decisions at that time.

However, it is expected that teachers who may have participated in the development of the goals, content, and approach of the JSSMC would not have forgotten the items measured on the Knowledge variable of this study. So the low mean value of this variable could be viewed from a different perspective as an index of the degree of involvement of teachers from the state in the development of the JSSMC Shirley (1984), found that there is a positive correlation between participation in curriculum development and Knowledge of that curriculum.

4.3 ANOVA

The computation for the Analysis of Variance (ANOVA) table in the unweighted means solution uses the means of the various group under study. The means for each group of teachers on the five scales of the perception variable were therefore computed. The scales being on content relevance (B_1), Instructional objectives (B_2), Balance and Score of content (B_3), Organisational structure of content (B_4), and the suggested Teaching/Learning strategies (B_5). These are presented in table 4.2

Table 4.2 Group Means of Teachers on the five Curricular Scales.

Groups of Teachers (Factor A)	Curriculum Issues (Factor B)				
	B_1	B_2	B_3	B_4	B_5
A_1	3.8	4.8	4.45	4.1	1.45
A_2	3.47	3.49	3.64	3.6	-0.35
A_3	4.15	4.45	4.35	4.05	1.05

As already mentioned elsewhere (section 3.6), because both factors is this study are fixed factors, the mean sum of squares for within cell is used as a denominator for all tests. Following this method, the Analysis of Variance table was computed as presented in table 4.3. This table was used for the tests of hypotheses 1 and 2.

Table 4.3 ANOVA table for a 3 x 5, Fixed Effects two-way repeated measures ANOVA having unequal group size- the unweighted-means solution.

Source	SS	df	MS	F
Between Teachers (A)	71.47	2	35.74	0.68
Between Curr. Issues (B)	706.75	4	176.69	3.38*
AB	0.78	8	0.097	
Within Cell	5230.91	100	52.31	

*$F_{0.95}(4,100) = 2.86$

4.3.1 Hypothesis 1

The first hypothesis of this study stated in null form, is :

Teachers' perception of the Junior Secondary School Mathematics Curriculum is independent of their qualifications.

This stated statistically is :

$H_o : \alpha_i = 0$

$H_1 : \alpha_i \neq 0$

$i = 1 \ldots 3$

A comparison of the observed F in table 4.3 with the critical F ($F_{0.95}(2,100) = 3.80$) shows that the observed F

is less than the critical F. Hence the null hypothesis that the α_{is} = O cannot be rejected at the 5% level of significance. The data collected on the perception scales in this study therefore support the contention that teachers' perception of the JSSMC is independent of their qualifications.

4.3.2 Hypothesis 2

The second hypothesis to be tested using table 4.3 is :

Teachers' perception of the JSSMC is not different on the five curricular issues raised on the JSSMC.

Translated statistically, it is ;

$H_o : \beta_j = 0$

$H_2 : \beta_j \neq 0 \quad j = 1 \quad ....5.$

Again the observed $F = 3.38$ (table 4.3) is compared with the critical $F_{0.95}(4,100) = 2.86$. Since the observed F is greater than the critical F, the null hypothesis that the the β_{js} are all zero is rejected. Hence we conclude that teachers' perception of the JSSMC is different on the five curricular issues raised on the JSSMC.

This conclusion leads to a question; are the perceptions of the ~~different on all of the perceptions~~ teachers of the different on all of the curricular issues or on some of them only? What needs to be done to answer this question is a posteriori or post hoc pairwise comparison of the levels of the curricular factor.

Winer (1962) and Glass and Stanley (1970), recommend the Tukey test (T-method) for general use in making a posteriori test, Scheffe's multiple comparison method as given in Yamane (1973, p . 859) is being used here. Although Scheffe's approach gives fewer significant results in such comparisons as this, it has a very important property; the type I error is at most α for any of the possible comparisons. Also assumptions of equality of observations which the T-method makes is not necessary. It is because of this general applicability and its greater sensitivity when complex combinations of the sample means are being estimated that mathematicians regard Scheffe's method as superior to the T-method. (Glass & Stanley, 1970 p. 595)

Schaffe's test given by

$\sqrt{2m_i \, MS_{error} \, F}$ yields a critical value of

29.96 (see Appendix F)

Table 4.4 Differences Among Curriculum Scale Means.

	B_1	B_2	B_3	B_4	B_5
	11.42	12.74	12.44	11.75	2.15
B_1	-				
B_2	1.32	-			
B_3	1.02	0.3	-		
B_4	0.33	0.99	0.69	-	
B_5	9.27	10.59	10.29	9.6	-

Comparing the critical value for Scheffe's test of 29.96 with the pairwise comparisons in table 4.4, it is seen that none of the entries is significant at the 5% level. Thus, based on the confidence afforded by the S-method, there is no evidence to suggest that teachers perception on any one of the curriculum scales differ significantly from the others. It should be noted that Scheffe's test is a conservative test and therefore; less powerful. Other powerful test such as the tukey's test (Honestly significant difference) cannot be applied here because the data collected do not meet the assumptions of these tests.

However an inspection of table 4.2 shows that the perception of teachers on the suggested teaching-learning strategies (B_5) has a 'marked' difference from their perception on the other scales.. This may be potraying the lack of consensus of teachers on this factor.

4.4 Correlation Results

(For a detailed discussion of the statistical methods used in this section, see Horowitz 1974, p. 319-364).

In determining the relationship between the perception of teachers and teachers' attitude towards mathematics; and perception of teachers and their knowledge of the curriculum, the Pearson's Product Moment Correlation Coefficient (r) were calculated in both cases. This r value is an estimate of ρ (rho), the population value, which is also the mean of the sampling distribution of the rs. It is given by the formula ;

$$r = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{N\sum X^2 - (\sum X)^2}\ \sqrt{N\sum Y^2 - (\sum Y)^2}}$$

The correlation r between the scores on the perception scales (P) and Attitude scales (A) was calculated to be 0.38, while that between the perception scales (ρ) and Knowledge variable (K) was - 0.015.

4.4.1 Hypothesis 3

There is no significant relationship between teachers' perception (P) of the JSSMC and their general Attitude (A) towards mathematics.

Statistically stated ;

$H_o : \rho = 0$

$H_1 : \rho \neq 0$

$\alpha = 0.05$

The t statistic is given by,

$$\frac{r\sqrt{N-2}}{\sqrt{1-r^2}}$$

Where N - refers to the number of pairs of observation

r - sample correlation coefficient.

For P Vs A

N = 115

r = 0.38

∴ t calculated = 4.36.

$t_{0.05}(113) = 1980$

$t_{calculated} > t_{critical}$

Therefore the null hypothesis, H_o, is rejected at $\alpha = 0.05$. There is a significantly positive relationship between teachers' perception of the JSSMC and their general attitude (A) towards mathematics.

4.4.2 Hypothesis 4

There is no significant relationship between teachers' perception (P) of the JSSMC and their Knowledge (K) of the curriculum.

Stated Symbolically ;

$$H_o : \rho = 0$$

$$H_1 : \rho \neq 0$$

$$t = \frac{r\sqrt{N-2}}{\sqrt{1-r^2}}$$

P_{or} P Vs K

$N = 115$

$r = -0.0153$

$\therefore\ t_{calculated} = -0.1627$

$t_{0,05}(113) = 1.980$

$t_{calculated} < t_{0,05}(113)$

Therefore the null hypothesis, H_o, is retained; i.e. there is no significant relationship between teachers' perception of the JSSMC and their knowledge of it.

CHAPER FIVE

SUMMARY AND CONCLUTIONS.

5.1 INTRODUCTION

In this chapter, the research problem and questions are restated, followed by a brief review of the literature surveyed, the precedure adopted in the conduct of the study, the method of statistical analysis, and then a discussion of the findings relevant to each of the questions earlier raised. The problems associated with educational research of this kind (and this study in particular) is also briefly discussed. Suggestion and recommendations to teachers, curriculum innovators (especially those involved in the implementation of some aspects of the 6 - 3 - 3 - 4 system) and for further research in this aspect of curriculum implementation will also be made.

5.2 Restatement of the Problem.

Curriculum specialists suggest that classroom teachers be actively involved in the development of new curricula so as to enhance their understanding and to gain their support in the installation of the curriculum. Doing otherwise may result in the distortion

or even outright rejection of new curricula by teachers in the classroom. The development of the JSSMC had very little imput from classroom teachers. This study was therefore designed to find out secondary school mathematics teachers perception of the JSSMC in Gongola state based on their experience with the curriculum in the classroom so far. It also attempted to establish what relationship there are between; perception of teachers of the JSSMC and their attitude towards mathematics; and perception of teachers of the JSSMC and their knowledge of the curriculum.

The specific research questions this study attempted to answer are :

1. Are the perceptions of the three groups of teachers on the JSSMC the same across the five curricula issues?
2. Are teachers perceptions of the JSSMC different on the five curricula scales?
3. Is there a significant relationship between teacher perceptions of the JSSMC and teachers' general attitude towards mathematics?
4. Is there a significant relationship between teacher perceptions of the JSSMC and their knowledge of the curriculum?

For the purpose of empiricism, these questions were stated hypothetically and were to be retained or rejected in the light of statistical evidence based on the data collected at 5% level of significance.

5.3 SUMMARY

5.3.1 The Literature Survey.

In order to establish a firm base for a proper discussion and understanding of the process of curriculum implementation and the expected roles of teachers in the innovation process, several theories and models of curriculum innovation were reviewed. The theories reviewed include those by Havelock (1971), Schon (1971), House (1974), Hoyle (1972), Chin (in MacDonald and Walker, 1976), Rogers (1962) Kurt Lewin (in Blanchard & Zigarmi, 1981), and Rowan and Morgan (1981).

A concise summary of these models has been made based on the area of emphasis along Hoyle's four innovation stages; Invention, Development, Diffusion and Adoption. Hoyle's and Havelock's models (perhaps with the exception of the social interaction perspective of Havelock's model) assume that curriculum innovation should start right from the time the idea of the change is mooted. The teacher's

role in both models is passive, emphasis is on the intellectual basis for invention through research, field testing, diffusion and adoption.

The models by Schon, House, Rogers and Kurt-Lewin focus on the last two stages of Hoyle's four stages, the diffusion and adoption stages. The concern by Schon and House is on providing structures that will make teachers accept innovation. Rogers and Kurt-Lewin on the other hand make teachers central figures, and diffusion and adoption activities should be directed to them.

Chin's models, and the Rowan-Morgan strategy of change both assume that the decision for the adoption of an innovation has already been made by either a teacher, or other authorities. Adoption activities are therefore not towards 'selling' the innovation to the teachers but towards making them use it.

The literature survey also discussed the views of many curriculum specialists on teachers in curriculum innovation. Curriculum innovation makes enormous demand on teachers. The demand on teachers in innovation may be in a variety of ways. Some of which may include teacher's ;

(a) Participation in the development of the innovation

material itself.

(b) Acquisition of new knowledge & attitude towards learning.

(c) Involvement in the management of the innovation process.

(d) Understanding & willingness to carry out the innovation.

(e) Competence in respective subject areas.

(f) Attendance at workshops, use of new books and new evaluation methods.

It is because of these demands that the curriculum specialists suggest the inclussion of teachers at the very beginning of the curriculum innovation process. They pint out that teachers tend to be skeptical of ideas proposed by experts outside their schools. The more roles teachers have, the more likelihood of success of change.

The concerns and needs of teachers should also be borne in mind by curriculum innovators. Since teachers do not operate with blank minds, their personal values, notions and biases about their subject area; and their interests, aspirations and how these can be advanced

within the innovation process should be taken into consideration. In doing this, intrinsic motivators should take precedence over extrinsic ones as these are known to be more affective. Innovators must realise right from the on set that it is teachers who make change happen and make it endure. They must therefore know why changes have been made, what the changes are and how to bring these changes about. This is why the training of teachers involved in curriculum innovation is considered paramount. Failure to do this is likely to bring resistance from the teachers.

Resistance may also occur among teachers as a result of frustration due to implementation problems, lack of clarity about their new roles, lack of skills & knowledge on the innovation, unavailability of required materials and equipment; and any organisational arrangement that are incompatible with the innovation. These difficulties may even even lead to a rejection of the ideas of the innovation.

Curriculum specialists however warn that resistance to change is natural, and innovators should not try to force change upon unwilling teachers as this may be counter-productive. Instead appropriate diffusion activities should be lined up to enable teachers 'buy' or adopt

change voluntarily. Much of these activities suggested by the curriculum specialists seem not to have guided the implementation of the JSSMC in Gongola State.

Empirical studies on the 1979 curricula are few. Perhaps it is too early to expect much, since the full impact of all the curricula is yet to be felt at all levels of the educational system. Some of these reviewed include studies by Shirley (1984), Badmus (1985), and Miri (1986).

Some of the major findings of these studies include (a) a significant positive correlation between teachers' attitudes towards accepting curriculum change and previous involvement in developing the curriculum and their familiarity with the programme, (b) need for early teacher familiarization workshops in curriculum innovation, (Shirley 1984); (c) teachers who are familiar with new mathematics syllabus have better attitude towards the implementation of the new programme, (Miri, 1986); (d) a significantly better perception of teachers on, the general objectives of teaching mathematics at the JSS than on either relevance of content, organisational structure of the content or the prescribed teaching-learning strategies of the JSSMC; (e) a significantly better perception of teachers on the balance and scope of content and instructional objectives than on the prescribed teaching-learning

strategies of the JSSMC; (f) a marked differences in the responses of three groups of teachers (the graduate professionals (GP, the non-graduate professionals (NGP), and the graduate non-professionals (GNP) in the perception of the JSSMC, (Badmus, 1985).

5.3.2 Collection of data

The data for this study was collected through the use of a questionnaire. The questionnaire is a 55 - item Likert type with 35 items on the perception variable, 10 items each on the attitude and knowledge of curriculum variables.

The questionnaires were sent out to principals of schools through the Gongola State Schools Management Board, Yola. The Principals were requested to administer the questionnaires on teachers who have had the experience of teaching the JSSMC in their schools. A stamped self-addressed envelope was provided to each school by the reseacher for the return of the questionnaires. The researcher and some research assistants went round to some of the schools that didn't respond early enough to collect the questionnaires. A total of 115 teachers were involved.

5.3.3 Statistical Analysis and Findings.

Two major statistical designs were employed to analyze the data obtained on the questionnaires. The first design used was the unweighted-means solution of the multifactor repeated measures Analysis of variance (ANOVA) having unequal group sizes. This design was used to test hypotheses 1 and 2. For hypotheses 3 and 4, the Pearson's Product Moment correlation coefficient (r) were calculated for statistical test of significance. The hypotheses tested are restated here.

Hypothesis I :

Teachers' perception of the Junior secondary school Mathematics Curriculum is independent of their qualifications.

Hypothesis 2 :

Teachers' perception of the JSSMC is not different on the five curricular issues raised on the JSSMC.

Hypothesis 3:

There is no significant relationship between teachers' perception (P) of the JSSMC and their general Attitude (A) towards Mathematics.

Hypothesis 4 :

There is no significant relationship between teachers' perception (P) of the JSSMC and their knowledge (K) of the curriculum.

The results from the statistical analy ses of the data obtained indicated tne following :

Hypothesis 1 : Is retained, thus teachers perception of the Junior Secondary School Mathematics Curriculum is independent of their qualifications.

Hypothesis 2 : Is rejected, teachers perceptions of the JSSMC is different on the five curricular issues raised on the JSSMC.

Hypothesis 3 : Is rejected, there is a significant positive relationship between teachers' perception (P) of the JSSMC and their general Attitude (A) towards mathematics.

Hypothesis 4 ; Is retained, there is no significant relationship between teachers' perception (P) of the JSSMC and their knowledge (K) of the curriculum. These findings answer the research questions earlier raised, (Section 1.4).

A pairwise posteriori test using Scheffe's method on the statistical significance of hypothesis 2 was carried out, but this has failed to reveal any trend. However an inspection of table 4.2 shows a consistent marked difference on the feasibility and applicability of the prescribed teaching-learning strategies scale as compared with others. This may therefore imply that the teachers have a 'better' perception of the other curriculum issues than the suggested teaching-learning strategies.

5.4 Problems Encountered.

Although every effort was devoted to making this research as professional and scholarly as possible, a word of caution on the interpretation of the results of the study may be appropriate here. The following problems should be acknowledged in the consideration of these results.

This study had initially been designed for four groups of teachers. In the event of the study, no more than three teachers in one of the groups responded. Because of this, the group was excluded from this analysis. Also, equal number of teachers were to be sampled within each group. This became impossible because adequate number of teachers could not be traced according to their qualifications. The last list prepared by the Gongola State Schools Management Board was in 1986, and this was found to be greatly

inaccurate. However appropriate statistical designs have been employed to take care of this anomally. Also, the results of the analysis are limited to the responses of 115 teachers.

With questionnaires sent through mail, it may be difficult to motivate respondents to fill out questionnaires and to return them within a reasonable period. This limitation and the complex nature of human beings are usually the greatest threats towards getting precise measures of variables in educational research.

The results of this study should therefore be viewed in the light of these constraints.

5.5 Conclusions

The conclusions which follow are made on the basis of the literature reviewed in chapter two and the statistical analysis in chapter four.

The implication of not rejecting the first hypothesis of this study is that, qualifications does not seem to be a factor that affects teachers' perception of the JSSMC in Gongola State. Thus all the categories of the teachers studied seem to view the JSSMC in the some way. This result has far reaching consequences. That untrained teachers

should perceive a school curriculum in the same way as trained teachers is a violent violation of the assumption that teaching is a profession which requires expertise, obtained through professional training. And since this is true, it appears threrefore that, other factors may have worked to confound the differences that these groups of teachers may have in their perception of the JSSMC. Inspite of the homogeneity of the groupings of the teachers adopted in this study based on qualifications, other factors such as the number of years of teaching experience, type of programme (modern or traditional mathematics) each teacher went through, whether a teacher is also teaching the SSSMC or other curricula, sex of teacher, particular school attended by a teacher, etc may have helped in confounding the qualification effect as it relates to their perception of the JSSMC. Or, perhaps it may be as a result of the method of implementation of the JSSMC in the state. Further research that would control one or two of these factors at a time may possibly reveal a trend.

The contention that the perception of the selected teachers would vary from issue to issue on the five curricular issues was supported by the results of hypothesis 2. This result confirms the finding by Badmus (1985) in a pre-implementation study of the JSSMC. Although a posteriori test by

Scheffe's method failed to reveal any trend, an inspection of tables 4.2, (Group means of teachers on the five curricular scales) and table 4.5, (Differences. Among curricular scale means) show a marked difference of perception of teachers on the prescribed teaching-learning strategies scale. This suggests the need for familiarization activities for all the groups of teachers on the JSSMC, especially towards convincing them on the feasibility and practicability of the suggested teaching-learning strategies in the JSSMC. Otherwise the implementation of the JSSMC is likely to be done differently, at least in the classrooms, since the teachers do not see the five curricular issues in the same way. In particular, teachers are likely to ignore the suggestions on the teaching-learning strategies put forword by the developers of the curriculum. This will certainly affect the success of the curriculum in our schools.

The results of hypothesis 1 and 2 taken together appear perlexing, if not contradicting at first sight. In hypothesis 1, we find that the perception of teachers in the three groups of teacher are not different. In hypothesis 2, the opinion of the teachers are not the same on the five curricula issues, thus implying that the differences in opinions on the curricular issues is not related to the qualification of the teachers. Other factors),

different from from qualification effect is/are therefore responsible for the differences on the curriculum issues.

In the second part of the analysis, we find that, perception of the selected teachers has a significant relationship with their general attitude towards mathematics, but does not seem to relate to their knowledge of the curriculum. Thus teachers with positive attitude towards mathematics are likely to have better perception and hence be willing to implement the JSSMC successfully. This relationship between perception and attitude of teachers agrees with the findings of the studies by Shirley, (1984) and Miri (1986). Shirley and Miri found a positive correlation between teachers' knowledge of the new curricula and their attitude towords understanding its contents, and between teachers' knowledge of the new mathematics programmes.

However the absence of relationship between the perception of teachers and knowledge of the JSSMC in terms of their familiarity with the content and historical development of the curriculum in this study may be due to two reasons. First the genesis of the events that gave birth to the JSSMC, the scrapping of the modern mathematics syllabus as a result of the modern/traditional mathematics

controvercy in the 1970s must be fading from memory due to time lag. This is more so, since most of the respondents (teachers) involved in this study are recent graduates and who would not have been placed in positions to be conversant with the issues then.

Also, the teaching of secondary school mathematics to would-be teachers are recent innovations in some of the country's universities and colleges of education. Attention had in the past been more on the university level mathematics which was based on the premise that, this will lead to an automatic proficiency in the secondary level mathematics. This premise has been questioned by several experts in recent times. (A study on this is currently being conducted at A.B.U., Zaria). This issue (oversight) might have therefore contributed to the poor knowledge of the JSSMC exhibited by this teachers in this study.

Curriculum innovation problems usually emanate from the difficulties associated with changing any one or more of the determiners of the curriculum-teachers, students, subject matter, methods, materials & facilities, and time. There is no single 'divine' method of curriculum change that will guarantee success, because 'success' in innovation is by and large determined by several factors independent

of the innovation itself. However, most, if not all, curriculum experts agree that genuine innovation does not occur unless teachers become personally committed. Innovations must be complemented by ambitious efforts towards communicating the philosophy of such innovations to teachers, to show them how to put it into practice, and to help them modify it to fit their own classrooms.

The JSSMC as an innovation does not call upon the school system to provide a completely new service or teach a completely new subject which usually are more difficult to accomplish. The curriculum demands that teachers be knowledgeable with its new contents and be committed towards teaching it in the classroom.

5,6 Suggestions & Recommendations

The following suggestions and recommendations are offered in view of the literature reviewed, findings of this study and other informations gathered in the course of the study. The recommendations are addressed to a varied group of people; teachers, curricula innovators at both the state and national levels, teacher trainers and researchers. It is hoped that the recommendations will provide some assistance most especially to the Gongola state Government in the implementation of the JSSMC and

the 6 - 3 - 3 - 4 education system generally in the state.

1. There is a wide gap between the theory of curriculum innovation and the way the JSSMC was handled in Gongola State. This has been supported by one of the findings of this study that, teachers' perception of the five curricular issues (Content relevance, relevance of instructional objectives, adequacy of content, reasonableness and organisational structure of content, feasibility of prescribed teaching-learning strategies) differ significantly.

If curriculum developers would not want the potential beneficiaries of curriculum innovation (the pupils) to have a heavily watered down (or distorted) version of the JSSMC, attention should be given to working out an elaborate familiarization programmes for teachers. These will be to communicate the philosophical and psychological foundations to teachers, to show them how to put into practice in their classrooms, and to help them modify it to fit their own context.

2. Mathematics teachers handling the JSSMC and other similar programmes in Gongola state should on their own seek to learn more about the curricula and the psychological bases on which it has/been built. Only then would they appreciate the importance of the suggested teaching-learning strategies in the realization

of the overall objectives of the JSSMC.

3. The study of innovation process has shown that, wherever possible, the proposed change should be offered in a form of a package, that could be used directly by teachers either in a form of equipment, or a new set of textbooks. There is therefore an urgent need on the part of the implementing agencies of the JSSMC to produce textbooks and other resource materials which teachers could directly use in the classroom. Such materials would also serve as guidelines to private publishers. (The NERC has done this at the primary school level).

4. The Gongola state Government should map out a plan for improving on the quality of teachers in her secondary schools; at least by certification. It appears there are too few graduate teachers compared to NCE holders in her schools. Although the result of this study does not show a significant difference between the perception of these categories of teachers, it is a fundamental fact that graduates would command more confidence and more respect in the much needed discipline of mathematics education.

5. There is a need on the part of curriculum developers to involve classroom teachers in future curriculum development projects right from the starting point. This could be done in a variety of ways; by obtaining information on actual classroom

difficulties, asking teachers to make suggestions on the content and instructional methods of curriculum to be developed, using them as writers, and testing draft materials in their classrooms. This will bring about the much-talked-about 'ownership of change' by experts.

6. Most curriculum experts agree that the ways in which curriculum policies are implemented are shaped by teachers' convictions, and teachers' convictions are also shaped by the implementation policies. Thus what eventually gets instituionalized will differ from the intended curriculum. There is the need at this point in time for an empirical study to find the gap betwen the 'intended' and the 'realized' of the JSSMC.

7. The results of hypothesis 1 of this study calls for further investigation. Such a research should seek to control the variables discussed - years of teaching experience, involvement in other programmes, sex, type of programme teacher went through in his/her secondary school days etc.

8. Universities and colleges of education that are yet to incorporate the familiarization of pre-service teachers with the JSSMC (and infact the SSSMC) should as a matter of top priority design programmes for doing this. Teachers who may join the service after much of familiarization activities

on a new programme have been completed may fail to appreciate the philosophical and psychological foundations of the programme if he/she has not received adequate information on it while in training.

9. So much has been spent by government on importing equipment/materials for the 6 - 3 - 3 - 4 education system, with little attention being paid to teacher training which curriculum experts all agree is a first essential in curriculum innovation. Perhaps it is time the government takes a bold step in this area, not just by announcing her intention of doing such on the pages of newspapers as it is now the case, but taking practical steps towards getting both the quantity and quality of the teachers needed for the programme.

10. The Mathematical Association of Nigeria and the Nigeria Union of Teachers should actively be involved in the implementation of the JSSMC. This will reduce the social and organisational barriers for teachers in establishing contact with curriculum developers and some other opinion teachers in their profession. It will also afford teachers to discuss their in-classroom problems and seek assistance with/from credible resource persons. Teachers are more likely to maintain change if they receive such assistance.

11. A study similar to this present work be carried out in other states of Nigeria. Apart from using such studies for

comparative analysis on a state to state basis, it will also provide a base for a gigantic national curriculum review exercise.

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APPENDICES.

APPENDIX A

QUESTIONNAIRE FOR SECONDARY SCHOOL MATHEMATICS TEACHERS ON THE JUNIOR SECONDARY SCHOOL MATHEATICS CURRICULUM (JSSMC)

Dear Maths Teacher,

I am carrying out a study on 'Mathematics Teachers' Perception of the Junior Secondary School Mathematics Curriculum' (JSSMC) as part of a requirement for a masters' degree programme. This questionnaire is meant to measure your perception of the Junior Secondary School Mathematics Curriculum (JSSMC).

Your responses will strictly be treated as confidential and will not be used for any other purpose outside this study. So, please respond to the items on the questionnaire as accurately and honestly as possible.

Thank you for your cooperation.

Reymond Musa
M.Ed. (Maths. Educ.) II
Ahmadu Bello University,
Zaria.

SECTION A

This section is to enable the researcher classify the respondents to this questionnaire. Please tick in all the appropriate boxes.

1. QUALIFICATION :

- ☐ Diploma in Maths. Educ.
- ☐ Nigeria Certificate in Education
- ☐ Higher Diploma in Maths. Education
- ☐ B.Ed. (Maths. Education)
- ☐ B. Sc. (Ed.) Mathematics)
- ☐ B.Sc. Maths.
- ☐ M. Ed. (Mathematics Education)
- ☐ M.Sc. (Mathematics
- ☐ P. G. D. E.
- ☐ Others (Please specify)

2. TEACHING EXPERIENCE :

- ☐ Below 3 years
- ☐ 3 to 5 years
- ☐ 3 to 5 years
- ☐ Above 5 years

3. SCHOOL TYPE: ☐ JSS ONLY. ☐ JSS & SSS

SECTION B

This section is designed to measure your perception of the JSSMC. Please tick under the appropriate response. SA is strongly Agree, A - Agree, U - Undecided, D - Disagree and SD - Strongly Disagree.

	SA	A	U	D	SD
1. The contents are relevant to corresponding instructional objectives.					
2. The contents are irrelevant to current thinking in mathematics education at this level of education.					
3. The contents are relevant to the needs and interests of the learners					
4. Contents are psychological relevant because it conforms with the principles of learning and motivation					
5. The contents are relevant to learners' experience and environment.					
6. The contents are not suitable for the stage of mental development of the learners					
7. The contents are relevant more to the needs of bright learners (elitist) rather than the needs of most learners (non-elitist).					

	SA	A	U	D	SD
8. Instructional objectives are clearly stated.					
9 The instructional objectives are reasonably attainable by most of the learners now known to be in this level.					
10. The instructional objectives are not related to general objectives of teaching mathematics at this level.					
11. The instructional objectives are appropriate for the learners at this particular level of education and stage of mental development.					
12. Instructional objectives are not likely to contribute cumulatively to the general objectives of secondary school mathematics teaching.					
13. The instructional objectives are not important enough to encourage and improve learning in various applicable areas like scierce, technology, social science and vocational areas.					
14. The instructional objectives are not important enough to encourage further learning in mathematics at the next level of education.					
15. Emphasis on computational skills is inappropriate.					
16. Emphasis on concepts and principles are appropriate					

	SA	A	U	D	SD
17. Emphasis on suitable, precise mathematical language is appropriate					
18. Topics are sequenced from the known to unknown					
19. The strategies are not flexible enough to accommodate a variety of methods					
20. The strategies are feasible with respect to time generally alloted to mathematics in (Secondary) School					
21. The sequencing will not maximize learning.					
22. Topics are not inter-related					
23. Coverage of Number and Numeration is appropriate.					
24. Coverage of Geometry and Measuration is inappro-priate.					
25. Coverage of Everyday Sta-tistic is appropriate					
26. Topics are sequenced from the part to the whole					
27. Topics are not sequenced from the easy to the difficult;					
28. The suggested activi-ties will atract and motivate the learners					

	SA	A	U	D	SD
29. Majority of the serving teachers will require inservice training before they can efficiently and effectively use the strategies.					
30. Coverage of Algebraic processes is inappropriate.					
31. Sequencing is incongruent to the readiness and experience of the learners at this stage of development					
32. The activities are not suitable for general intellectual level of the learners.					
33. Vital links are established with other areas (like Physics, Chemistry, Economics etc.) where Mathematics serves as a tool.					
34. Adequate guides are not provided for teachers.					
35. Guided discovery approach will not be practicable for lack of teaching materials and/or time.					

SECTION C

This section is to assess your general attitude towards Mathematics as a school subject. Tick as in Section B above please.

		SA	A	U	D	SD
1.	Mathematics is very interesting to me and I enjoy teaching it.					
2.	I feel a sense of insecurity when attempting questions in mathematics					
3.	Mathematics makes me feel uncomfortable, restless, irritable and impatient.					
4.	Mathematics is fascinating and fun.					
5.	The word Mathematics scares me anytime it is mentioned.					
6.	I am happier teaching Mathematics than any other school subject.					
7.	I feel at ease with Mathematics and I like it very much.					
8.	It makes me nervous to even think about having to solve mathematics problems in class					
9.	I really (sincerely) like mathematics					
10.	I have never liked mathematics and I hate having to teach it.					

SECTION D

The questions in this section are to measure how well information about the Junior Secondary School curriculum have reached Mathematics teachers. Answer the questions by ticking under the appropriate response on your understanding of the facts of the SSSMC. Do not guess please.

The Junior Secondary School Mathematics Syllabus...	Yes	Don't know	No.
1. .... is mainly oriented towards teaching a deeper understanding of the Mathematics.			
2. ..... places the major emphasis on the fun of mathematics; games, puzzles and even maths. jokes.			
3. ..... was prepared by a committee under the Nigeria Educational Research Council.			
4. ..... treats geometry without formal proofs of theorems.			
5. ..... was written by group of textbook publishers and professional writers.			
6. .... assumes that students have a good background from their primary school mathematics.			
7. ..... was prepared with considerable advice from foreign educators.			
8. ..... was at first rejected by the Federal Ministry of Education			
9. ..... has much coverage of basic statistics.			
10. ..... was approved at a conference in Benin City.			

APPENDIX B

Department of Education,
Ahmadu Bello University
Zaria.

25th February, 1988.

Dear Maths. Teacher,

I am Raymond H. Musa. I am carrying out a study on "Mathematics Teachers' Perception of the Junior Secondary School Mathematics Curriculum in Gongola State" as part of a requirement for a Masters' degree programme. I am counting on your support to make this possible.

The attached questionnaire is meant to measure your perception of the Junior Secondary School Mathematics Curriculum. I would deeply appreciate it if you would take some few minutes of your time to complete this questionnaire straight-away, please. This will enable me make my submission within the stipulated time.

Your response should draw from your experience with the syllabus in the classroom situation so far. Be assured that your your response will be treated as strictly confidential and will not be used for any other purpose outside this study. So, please respond to the items on the questionnaire as accurately and honestly as you can.

I am thanking you in advance for your cooperation.

Raymond H. Musa
M. Ed./Maths. Educ.) student.

QUESTIONNAIRE FOR SECONDARY SCHOOL MATHEMATICS TEACHERS

JUNIOR SECONDARY SCHOOL MATHEMATICS CURRICULUM (JSSMC)

SECTION A

This section is to enable the research classify the respondents to this questionnaire. Please tick in all the appropriate boxes.

1. QUALIFICATION :

- ☐ Diploma in Mathematics Education
- ☐ Nigeria Certificate in Education
- ☐ Higher Dinloma in Maths. Education
- ☐ B. Ed. (Maths. Education)
- ☐ B.Sc. (Ed.) Mathematics)
- ☐ B.Sc. (Mathematics)
- ☐ M. Ed. (Mathematics Education)
- ☐ M. Sc. (Mathematics Education)
- ☐ P. G. D. E.
- ☐ ———— others (Please specify)

2. TEACHING EXPERIENCE:

- ☐ Below 3 years
- ☐ 3 to 5 years
- ☐ Above 5 years

3. SCHOOL TYPE :

- ☐ JSS only
- ☐ JSS & SSS.

SECTION B

This section is designed to measure your perception of the JSSMC. Please tick under the appropriate response. SA is strongly Agree, A - Agree, U - Undecided, D-Disagree and SD-Strongly Disagree

	SA	A	U	D	SD
1. The contents are relevant to corresponding instructional objectives.					
2. The contents are irrelevant to current thinking in mathematics education at this level of education.					
3. The contents are relevant to the needs and interests of the learners.					
4. Contents are psychologically relevant because it conforms with the principles of learning and motivation.					
5. The contents are relevant to learners' experience and environment					
6. The contents are not suitable for the stage of mental development of the learners.					
7. The contents are relevant more to the needs of bright learners (elitist) rather than the needs of most learners (non-elitist).					
8. Instructional objectives are clearly stated.					

	SA	A	U	D	SD
9. The instructional objectives are reasonably attainable by most of the learners now known to be in this level.					
10. The instructional objectives are not related to general objectives of teaching mathematics at this level.					
11. The instructional objectives are appropriate for the learners at this particular level of education and stage of mental development.					
12. Instructional objectives are not likely to contribute cumulatively to the general objectives of secondary school mathematics teaching.					
13. The instructional objectives are not important enough to encourage and improve learning in various applicable areas like science, technology, social science and vocational area.					
14. The instructional objectives are not important enough to encourage further learning in mathematics at the next level of education.					
15. Emphasis on computational skills is inappropriate.					
16. Emphasis on concepts and principles are appropriate.					
17. Emphasis on suitable, precise mathematical language is appropriate.					

	SA	A	U	D	SD
18. Topics are sequenced from the known to nknown.					
19. The strategies are not flexible enough to accommodate a variety of methods.					
20. The strategies are feasible with respect to time generally alloted to mathematics is (secondary) school.					
21. The sequencing will not maximize learning.					
22. Topics are not inter-related.					
23. Coverage of number and numeration is appropriate.					
24. Coverage of Geometry and Measure-tion is inappropriate.					
25. Coverage of Everyday Statistic is appropriate.					
26. Topics are sequenced from the part to the whole.					
27. Topics are not sequenced from the easy to the difficult.					
28. The suggested activities will attract and motivate the learners.					
29. Majority of the serving teachers will require inservice training before they can efficiently and effectively use the strategies.					
30. Coverage of Algebraic processes is inappropriate.					

	SA	A	U	D	SD
31. Sequencing is incongruent to the readiness and experience of the learners at this stage of development.					
32. The activities are not suitable for general intellectual level of the learners.					
33. Vital links are established with other areas (like Physics, Chemistry, Economics etc.) where Mathematics serves as a tool.					
34. Adequate guides are not provided for teachers.					
35. Guided discovery approach will not be practicable for lack of teaching materials and/or time.					

SECTION C

This section is to assess your attitude towards Mathematics as a school subject. Tick as in section B above please.

	SA	A	U	D	SD
1. Mathematics is very interesting to me and I enjoy teaching it.					
2. I feel a sense of insecurity when attempting questions in mathematics.					
3. Mathematics makes me feel uncomfortable, restless, irritable and impatient.					
4. Mathematics is fascinating and fun.					
5. The word mathematics scares me anytime it is mentioned.					
6. I am happier teaching Mathematics than any other school subject.					
7. I feel at ease with Mathematics and I like it very much.					
8. It makes me nervous to even think about having to solve mathematics problems in class.					
9. I really (sincerely) like mathematics.					
10. I have never liked mathematics and I hate having to teach it.					

SECTION D

The questions in this section are to measure how well information about the Junior Secondary School Curriculum have reached Mathematics teachers. Answer the questions by ticking under the appropriate response on your understanding of the facts of the JSSMC. Do not guess please.

		Yes	Don't know	No
	The Junior Secondary School Mathematics Syllabus ...			
1.	... is mainly oriented towards teaching a deeper understanding of the theory and formal structure of Mathematics.			
2.	... places the major emphasis on the fun of mathematics; games puzzles and even maths. jokes			
3.	... was prepared by a committee under the Nigerian Educational Research Council.			
4.	... treats geometry without formal proofs of theorems.			
5.	... was written by group of textbook publishers and professional writers.			
6.	... assumes that students have a good background from their primary school matheme-matics.			
7	... was at first rejected by the Federal Ministry of Education			
8.	... was at first rejected by the Federal Ministry of Education.			
9.	... has much coverage of basic statistics			
10.	... was approved at a confe-rence in Benin City.			

APPENDIX C

Department of Education,
Ahmadu Bello University,
Zaria.

2nd March, 1988.

The Permanent Secretary,
Ministry of Education,
Yola.

Dear Sir,

COLLECTION OF RESEARCH DATA

My name is Raymond H. Musa. I am at an advanced stage of a M.Ed. programme in Mathematics Education at the Ahmadu Bello University, Zaria. My research topic is "Secondary School Mathematics Teachers' Perception of the Junior Secondary School Mathematics Curriculum in Gongola State".

The major aim of the study is to find out how teachers with different professional and academic backgrounds assess the worth of the curriculum from their experiences with it in the classroom this far. The research will require the administration of questionnaires on Mathematics teachers in all the secondary schools in Gongola State.

It is therefore imperative that I write to seek your permission and support for this study, particularly in communicating with teachers. I would be glad if you could assist me by writing a covering letter to the principals on the study, and also to allow me use your established communication channel with the secondary schools.

Apart from the direct benefit that the state will derive from the findings of a research of this nature, it could also revitalize teachers' vigour in the cause of their everyday teaching of the Curriculum in our schools.

Attached is a copy of the questionnaire to be administered on the teachers.

Thanking you for the anticipated cooperation.

Yours faithfully,

RAYMOND H . MUSA
(RESEARCHER)

APPENDIX D

Ref: No. EST/CITC/33/III/408

Ministry of Education,
Post Primary Division,
Yola.

Date: 7th March, 1988

The Principal,

_____

_____

_____

I am directed to inform you that the Bearer of this letter is a M.Ed. final year student of Ahmadu Bello University, Zaria, studying "Mathematics Teachers' Perception of the Junior Secondary School Mathematics Curriculum in Gongola State" as part of a requirement for a Masters' degree programme.

2. We would appreciate it if he could be assisted to make this exercise possible.

3. Above for your information and necessary action, please.

(G. MANJABA)
FOR: PERMANENT SECRETARY.

APPENDIX E

Department of Education,
Ahmadu Bello University,
Zaria.

2nd March, 1988.

The Principal,

_____

_____

Dear Sir,

COLLECTION OF RESEARCH DATA

I am carrying out a study on secondary school mathematics teachers perception of the Junior Secondary School mathematics curriculum. The research entails the administration of questionnaires on teachers who have had the experience of teaching the Crurriculum.

The Uniform use of the Junior Secondary School Mathematics Curriculum in all Secondary Schools in Gongola State began in the 1983/84 School session.

It has become implicative for me to solicit your support for this study. I would be very glad if you could direct that the questionnaires be completed and posted to me with minimal delay so that it could reach me around 31st March, 1988. I deeply appreciate you doing this favour for me.

Please accept my sincere thanks for your cooperation.

Yours faithfully,

RAYMOND H. MUSA
M.Ed. (MATHEMATICS EDUC.)
CANDIDATE.

APPENDIX F

STATISTICAL TECHNIQUES.

1. The general model being postulated for the analysis of variance (ANOVA) in this study is the additive model. This stated symbolically is given by ;

$$X_{ij} = \mu + \alpha_i + \beta_j + \alpha\beta_{ij} + e_{ij}$$

where $i = 1 \ldots 3$

$j = 1 \ldots 5$

(For details, see Winer 1962, Glass & Stanley 1970).

2. Pairwise significance test (Scheffe's)

$$|x_i - x_{ij}| \geq \sqrt{2m_i \, MS_{error} \, F}$$

where m_i = levels of the i^{th} factor

MS = Mean sums of squares due to the error term (within cell)

F = $F_{(k-1,\ df_{w.cell})}$

$$\therefore \sqrt{2m_i \, MS_{error} F} = \sqrt{2(3)\ (52.31)\ (2.86)}$$

$$= 29.96.$$

APPENDIX G

SCORES OF TEACHERS ON THE VARIABLES

Perce-ption	Attit-ute	Knowl-edge	Perce-ption	Attit-ute	Knowl-edge	Perce-ption	Attit-ute	Know-ledge	Perce-ption	Atti-tute	Know-ledge
18	10	3	-11	8	2	7	10	-2	-17	6	1
27	8	-1	11	10	-3	17	8	0	17	8	4
16	10	0	27	10	-1	7	10	0	28	10	1
23	10	0	16	10	-1	3	5	-2	28	10	1
20	10	-1	28	10	-1	2	8	0	30	10	0
20	10	-4	13	2	-4	18	8	2	24	10	4
32	10	-1	24	10	4	28	8	-1	-18	9	4
16	10	-1	8	8	2	32	10	-5	12	10	1
19	10	0	23	8	0	19	10	-2	28	10	-1
26	10	3	19	10	-2	25	10	1	17	7	3
30	10	1	22	9	-3	7	10	-1	21	10	1
13	10	2	19	10	-2	9	8	2	12	7	-1
-8	10	0	-1	4	-1	-3	8	4	15	10	0
16	10	-1	3	1	3	-3	8	4	-6	10	-3
24	10	7	15	10	2	2	6	3	14	10	-1
-1	8	-2	20	10	3	-11	10	-1	13	10	3
31	10	-2	33	10	1	29	10	2	5	10	0
18	8	-2	18	10	0	10	10	-4	35	10	2
28	10	7	24	9	-2	8	10	-5	33	10	2
-1	10	2	1	10	-1	15	8				
26	10										

SCORES OF TEACHERS ON THE VARIABLES (CONT'D)

Perception	Attitute	Knowledge
22	9	1
22	9	1
19	8	3
22	10	2
25	10	2
2	8	-1
25	6	-4
11	10	-1
23	8	0
-3	10	1
25	10	-1
30	10	-2
18	8	-2
-4	9	-2