UNIVERSITY OF JOS

THE SORRY STATE OF MATHEMATICS EDUCATION IN NIGERIA

AN INAUGURAL ADDRESS

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As we are gathered here today, we can be sure that, somewhere in the world, million students in schools, and colleges and universities are having mathematics lessons. We can also be sure that during the next 24 hours, million more students will be having their mathematics lessons. This may cause us to wonder why in all countries, mathematics is considered as a subject which students should study in these institutions. Why do students learn mathematics? As an answer to this question, one can give general broad purpose for teaching mathematics. It is interesting to note that mathematics and mathematicians have been the most significant factors in bringing about new developments. Mathematics provide the tools as well as processes for solving problems. Mathematics has an important function in this fast developing technological civilization. Utilitarian function of mathematics has over shadowed the intrinsic beauty of mathematics. There is no, disagreement today, nor will there be in the fore-seeable future-on the vital importance of mathematics, both to the scientists, engineers, or other specialists and to the intellegent layman in his everyday life.

From the beginning of the Nigerian Secondary/Grammar School education to the present time, the teachers of mathematics have insisted that the student may be benefited greatly by the study of mathematics. However, the student population of the early secondary school differed from the one of present day. The students of early secondary school belonged to a rather small and highly motivated selected group. They went to school to prepare themselves for a position of leadership. The students took school work more seriously than now because of their ambition and the rigour of the selection procedure. With the growth of the schools and parents involvement, the secondary school population in the last 20 years kept on increasing. The students form no longer a select group, and of course they now differ widely in interest, industry and ability. Many of those who took mathematics were not interested and consider the subject as useless study. Many others were not able to do the work prescribed in the mathematics syllabuses.

The performance of students in mathematics has been declining, the students attitude towards mathematics tends to be negative, most of the teaching staff in mathematics have been inadequate and ill-prepared for the teaching of mathematics, and the society had the feeling that mathematics is for those with strange things up in their heads. All these have made mathematics teaching and learning in a deplorable state of affairs in all institutions of learning.

Performance of Students in Mathematics.

The details of the performances of candidates who sat West African School Certificate Examination in Mathematics throughout the country has been poor over the years. If we examine the reports of Chief Examiner in Mathematics for WASC, one would see that the students have been perfoming woefully. As was reported by the Chief Examiner in the New Nigerian of 21st October, 1978 the candidates performed woefully. "In Nigeria out of 39,002 candidates whose mathematics 2A results were released, about 27,150 (69.6%) candidates score 9 failure; 8,774 (22.5%) made the pass grades that is 7 and 8; and about 3,078 (7.9%) had credits and above.

Of the 2,295 candidates who offered mathematics 2B; 1,673 failed, 431 passed in grades 7 and 8; but only 139 (6%) candidates scored credits and above.

For modern mathematics, of the 51,475 candidates whose results have so far been released, 23,318 failed, while 15,195 passed in grades 7 and 8; about 11,213 (21.7%) passed with credits and above. The Chief Examiner went on to say that in some schools, every candidate scored less than 10 marks out of a total of 100 marks. Candidates were reported to be increasingly more careless in their working and calculation. The examiners noted that more avoidable numerical errors occured in the candidates work that the year than in the previous years. In effect, the performance has been getting worse.

The Chief Examiner's report (1975) on the performance of the students in mathematics indicated general poor performance. About 90% of the candidates that took the examination scored between 0, and 25% marks (both extremes indusive). Furthermore only 1% of the entire candidates scored marks above 40%. The main cause of this indescribably poor performance of the candidates could be traced to the candidates themselves who were care-free, unconcerned and showed uncooperative attitude. The Chief Examiner went on to call for concerted efforts of all concerned to arrest these deplorable and demoralizing situation at this time when there is a great yearning for technological advancement. The principals should see that mathematics should be taught by their teachers as it should and ought to be taught. The reports of Chief Examiners in mathematics over the years are made available to confirm this poor performances in mathematics.

Uzoma (1980) The National Public Relations Officer of the National Association of Mathematics Students of Nigeria (NAMSN) visited more than 30 secondary schools to assess the situation for his association. In three of such schools he recorded their detailed performance as being very big and renowned schools as shown in this table (names were withheld).

In each of these schools none of them scored a total pass up to 40%. In actual fact those with credits are below 10 per cent. The purpose of this investigation was for the Nigerian Universities mathematics students find out causes of poor performance of undergraduates in mathematics at the university level. One of the reasons was to be found in the poor background of the students coming to the university.

	A1	A2	A3	C4	C5	C6	P7	P8	F9	No of Passes	No. of Failures	Total
a	1	2		1	1	6	11	17	161	39 (19.5)	161	200
b	–	–	1	3	5	10	15	6	111	10 (20.5)	111	152
c	3	1	–	4	10	9	20	15	102	59 (36.6)	102	161

What are the students' testimony about mathematics in the school? One girl at the Girls Secondary School, Yola, said that mathematics is an impossible magic, she should not be bothered by it, since it will not help her to get a good husband. Another girl from one of the secondary schools in Cross River, during the WASC examination in mathematics, wrote her name, and home address in the centre page, with five Naira note, and requested the examiner to use the five Naira to pay for the taxi in order to visit her at the given address. She will be ready to go out with him and be his own if only he can pass her in mathematics. Another pathetic case is from Oyo State. A student said that he was good in all other subjects except in mathematics. This was due to the fact that his step mother used "juju" on him because he is better than her children. He said he had told his father but his father did nothing about it. As such he is appealing for sympathetic consideration for a pass in mathematics. The examiner should temper justice with mercy. One has to be at WAEC marking centres to notice the seriousness of the problems of mathematics education in this country.

A survey conducted in 10 Northern States (Lassa, 1978) confirmed the WAEC Chief Examiner's reports that the performance is steadily falling. In each of the 10 states in the North at least five of the oldest schools in each state were selected for the study. The results of each secondary school over the six years (1970 - 1976) were tabulated to see the trend of performance of the school. In all the secondary schools the study shows a trend of decreasing performance over the years with exception of Offa Grammar School (see Appendix C). If these were regarded as the oldest schools and are better equipped in terms of staff and materials, what is the situation in the poorer schools. Your guess is as good as mine. The general state average performance has been declining at a fast rate. During this period of survey (Lassa, 1978) mathematical objective test was administered to the students to find out their basic mathematical understanding of the syllabus. The result shown in (Appendix A) indicates that no state average is above 42%. The over-all average of the 10 Northern States on that test is 32%. There was marked significant difference between the states and within state on the test. There was also significant difference between the sexes on the test. The boys tended to perform better than girls from the results of the test.

In summary, the performance was poor. On the work presented to examiners, the concensus of opinion was that majority of those taking mathematics were illiterate in the simple arts of number. They believed that they could pass through by chance. One wondered whether some had even seen the inside of a classroom (Report, WAEC 1973).

Attitudes Towards Mathematics

During the past decade a number of published report of conference proceedings have concerned themselves with mathematics learning (e.g. Hooten 1967, Morrisett and Vensonhaler, 1965), but these reports do not treat in detail research on attitude. Because the number of dissertation and published articles dealing with attitude towards mathematics has increased geometrically since Fererabend's (1960) report, it is time to reappraise our knowledge of the topic. It has been stated that more school failures were caused by mathematics than by any other subject. Even with new development in education, it is debatable whether modern curricular have fostered more positive attitude towards the subject. But how general are these negative attitude, what causes them, and what can be done to make them more positive?

Some years ago, the members of a committee formed to study problems in mathematics education asked these questions. Their main conclusion was that more information about biological inheritance and home background of the pupils, attitude, training of teachers and the content, organization, goals and adaptability of the curriculum were needed. A fair question is, what information on the influence of these three types of functions has research provided?

The interpretation of results depends to some degree on the measuring instruments employed in the research. It has been maintained that there are no valid measures of attitude towards mathematics, (Morrisett and Veresonhaler, 1965) but the facts remain that a number of techniques, some of them quite ingenious, are available to measure such attitude. Several of these techniques are described by Corconran and Gibb (1961), including (a) self-report methods such as questionnaires, attitudes scales, incomplete sentences, projective picture and essays, (b) observational methods and interviews. It is observed that although the majority of investigation done dealt with attitude towards mathematics in general, one can also measure attitudes towards specific course or type of mathematics (Lassa 1976).

During the early stages of the writer's association with the schools in the Northern States, students have always expressed their feelings that they dreaded mathematics and the teachers had to be constantly on guard to keep from inducing more fears of the subject to their students. As Philips (1970) said, in most cases this fear was passed on to the pupils by the teachers and this fear stayed with them for the rest of their education.

Mathematics is usually acknowledged in Nigeria as being the most important subject and yet it is a subject that many students disliked (Lassa 1975). In a study conducted by Lassa (1978) in 10 Northern States, on the average, the students indicated negative attitudes towards mathematics. There is no significant difference in students attitude towards mathematics between states at .01 significant level. In the same study Lassa (1978) found significant difference between the sexes. Boys tended to have more positive attitude towards mathematics than girls from the study.

The appendix B gives the pictures of criterion variable of attitude towards mathematics by state and by sexes. As was expressed by Lassa (1978) if 84 - 60 was regarded as a neutral range on the continum scale, then only students from Niger State showed marginal positive attitudes towards mathematics. The case of Niger was a special case because the students are from Federal Girls Government Secondary School, where staffing and teaching standards are above average and the students are well motivated because of the selection process and other factors mentioned above.

However, the teachers attitude and effectiveness in mathematics are viewed as being prime determinants of students attitude and performance in the subject. As Banks observed: "An unhealthy attitude towards mathematics may result from a number of causes .... But by far the most significant contributing factor is the attitude of the teacher". The teacher who feels insecured, who dreads and dislikes the subject, for whom mathematics is largely rote manipulation, devoid of understanding, cannot avoid transmitting his feeling to the children. On the other hand, the teacher who has confidence, understanding, interest and enthusiasm for mathematics has gone a long way towards ensuring success. There are results of many studies which support this contention (Banks 1964 and Lassa 1976). Furthermore, improving teachers attitude towards mathematics can result in more positive attitude on the part of Students (Philips, 1970; Lassa 1975). Our teachers attitude towards mathematics is negative. In Nigeria, it is an accepted thing to express ignorance in mathematics and admit failure in it, without losing respect. It is not the same in English subject. There are many factors that affect students attitude towards mathematics, namely, sex role, intellectual functions, social functions, parental influences, teaching method (Lassa 1976).

Stability Of Attitudes.

It is generally recognized that attitude towards mathematics in adults can be traced to childhood. There is evidence that very definite attitude towards arithmetic may be formed as early as class three of primary school but these attitudes tended to be more positive than negative in primary school (Stright, 1960). Interestingly enough, there is some evidence of a decline from class 3 through class 6 in the percentage of pupils expressing negative attitude towards mathematics (Stright, 1960). However, the change may be due to increasing social sophistication on the part of the pupils, of an increased willingness to stimulate positive attitudes because they have been told that mathematics is good for them and positive attitude pleases the teacher.

The results of a number of studies point to the persistence of negative attitude towards mathematics as students ascend the academic ladder. In the traditional curriculum the secondary school has been the period during which geometry and other abstract mathematics were introduced, and this is the time during which many of the writers have stated that students began to dislike the subject. Dutton and Blum (1968) made a survey of the reasons for disliking and liking mathematics. The most frequent reasons for disliking the subject were: working problems outside of school, word problems that were frustrating, possibilities of failure in mathematics, and too many rules to learn. A large percentage of the students agreed with the statement that mathematics should be avoided whenever possible, that one cannot use mathematics in everyday life and that mathematics is a waste of time. Favourable attitude expressed by students were that working with numbers is fun and presents a challenge, and that mathematics makes you think, is logical and pratical. Obviously, what we need in order to assess the class distribution and stability of attitude towards mathematics are both cross-sectional and longitudinal surveys. But one difficulty in obtaining this information is the possible inappropriateness of the same attitude measure at different class level.

The Relationship of Attitude To Achievement In Mathematics.

The assessment of attitude towards mathematics would be of less concern if attitudes were not thought to affect performance in some way. Lassa (1976) found a significant correlation between the scores on the mathematics test and the score on the attitude measures among student teachers. But assuming that attitude do affect performance, what are the dynamics by which this is thought to occur? Bernstein (1964) maintained that if certain feelings are experienced for a time they will lead to a particular self-image by the pupil, a self-image which will influence his expectation of future performance, with consequent effect on actual performance. Data collected by Kempher (1962), and being on this assertion, suggests that self-confidence in mathematical ability, as measured by 15-item questionaire, is associated with rigidity in mathematics tasks. Behaviour indicative of the rigidity which students manifest towards frustrating mathematical tasks which cause them to be anxious and hostile towards the subject, are resorting to rote and inefficient methods and relying on other people and dishonest means in order to pass.

Evidence on the question of attitudinal change is mixed with an apparent trend for increase in understanding of mathematics to be accompanied by more positive attitudes. Gee (1965) and Todd (1966), did dictate significant positive shifts in attitudes accompanying growth in mathematical understanding. Rey's (1968) noticed some trend in the same direction. The relationship of attitude to performance appears to be especially important in mathematics. As an illustration, the result of one study (Brown and Abell, 1965) was that the correlation between pupil attitude and achievement was higher for mathematics than for any other subject.

In a study of the attitudes towards problem solving in a group of Brazilian elementary school children, Lindgren et al (1965) obtained a small but significant positive correlation between problem solving attitudes and arithmetic achievement and a possitive but not significant correlation between attitudes and marks in arithmetic (Carey, 1958). Indirect evidence for a relationship between attitude and achievement comes from a survey by Dutton (1962), who found a low positive correlation between the attitude towards arithmetic in college students and their reported arithmetic grades in elementary school. Quite obviously, the evaluation between attitude and achievement in elementary school, although statistically significant, are typically not very large. In fact, one investigation of class six (Cleverland, 1961) found that attitude scale scores did not generally discriminate between high and low achievers in arithmetic.

At a secondary school level, Albert et al (1963), reported significant correlations between performance in mathematics and measures of attitude and anxiety towards mathematics. Although it was found that the achievers were generally more anxious than the underachievers, the achievers had much more positive attitudes towards mathematics. Also when the students were asked to list-their major subjects in order of preference (Degnan, 1967), the achievers gave mathematics a significantly higher ranking than underachievers. In an international study designed to compare the mathematics achievement of 13 and 17 year old (terminal secondary) students in a dozen countries (Husen, 1967), extensive data concerning attitude, interests and certain other variables were also collected. Some of the correlational results of this international investigation were, significant negative rank - order correlations between mean mathematics achievement and mean scores across countries on the attitude scales, rather small correlations between achievement and attitude within countries; moderate to high correlations between achievement and interest measures within countries. In summarizing the results referred to above, the author (Husen, 1967) concluded: "We may say in general that in those countries where achievement is high pupils have a greater tendency to perceive mathematics as fixed and closed system, as difficult to learn and for an intellectual elite, and as important to the future of human society" (p.45). That achievement tends to be a function of attitude has been demonstrated by two independent investigation carried out in Northern Nigeria (Lassa, 1976, Nwaguru, 1977). Both researchers found a direct and significant relationship between the scores on a mathematics test and the scores on an attitude (towards mathematics) measure among students.

Sex Differences In Mathematics Achievement.

In Nigeria, it has long been accepted as true that boys learn mathematics better than girls do (Lassa 1975). This has been caused by the social influence that girls could not study mathematics rather than mental ability of girls to study mathematics. The social role of the sexes in the society was another contributing factor. There have been some studies outside Nigeria that support the earlier contention that sex differences in mathematical abilities are present. In America, Hermgarther (1968) and Madden (1966) found that maturation and instruction appear to sharpen the distinction between sex ability to mathematics as they progress through the school grades. The evidence indicates that boys are somewhat superior to girls in mathematical reasoning (Jonvis 1964; Very 1967) and but girls are somewhat superior to boys in mathematics fundamentals. However, differences in abilities vary with particular sample of examiners and test that were employed. For example, in one investigation (Wozencraft, 1963) girls were superior to boys in both mathematics reasoning and fundamentals in classes three and six. In any event, sex differences in mathematics abilities do not appear to be as large in lower grade levels as in secondary school and college. For. example, the finding of Very (1967) and Dye and Very (1968) provide support that the factor structure of mathematical ability becomes more differentiated with age.

Fennema (1974) reviewed 36 studies and relevant literature relating to sex differences in mathematics achievement and found out that most research appeared to show no significant differences between boys and girls in mathematics achievement before they entered elementary school. However, in her review relating to secondary school, where significant differences did appear they were more to be in favour of boys when higher level of cognitive tasks were being measured and in favour of girls when lower level of cognitive tasks were being measured. If there is sex differences in mathematics achievement, in the case of Nigeria (Lassa, 1977) and probably in some parts of the world, one major contributing factor is the sexism in mathematics education and the materials of instruction which propagates the view.

In writing about sex difference in mathematics I think it is pertinent to mention something about spatial ability and the sexes in mathematics achievement. Male superiority over females in tasks measuring spatial ability is an accepted facts which has been documented by many authors (Garaid and Schenfeld, 1968); Maccoby, 1966; Kegan and Kogan, 1970; Kogan 1972, Shown, 1967. Maccoby and Jacklin (1973) confirmed this again when they summarized the literature by stating "spatial ability continues to be the area (i.e. intellectual area) in which the strongest and most consistent sex differences are found." When significant differences in performance on spatial tasks are found, they usually indicate boys' superiority. However, such differences are often of relatively small magnitude and many times the variation within sexes is greater than the variation between sexes. This is particularly true in the area of the field independence tasks' reported by Witken (Kegan and Kogan, 1970). This sex difference in performance on spatial task has received considerably more attention than sex differences in mathematical ability even though some believe that the difference in spatial ability is much less pronounced and consistent than the sex differences in mathematical ability (Kogan, 1972).

It is interesting to note that this sex difference in performance on spatial task does not appear in all cultures. Kabanova-Meller (1970) reports that sex differences do not exist between Russian boys and girls in classes 4, 5 and 6, although as it's usual in the Russian literature; little empirical data was reported to substantiate this belief. Berry (1966) and Kleinfeld (1973) report that while Eskimos appear to have highly developed spatial skills, no difference is found between spatial ability of male and female Eskimos.

When significant sex differences in spatial ability in our culture appear and, although the magnitude may be small, there seems to be concerns that there is male superiority in performance on spatial tasks, evident at least slightly before or at the onset of puberty and continuing well into adulthood. Of particular importance to this discussion is the paralleling of development of sex differences in mathematics achievement and spatial ability. No significant sex differences in either mathematics achievement nor spatial task performace have been consistently reported in subjects of 4 - 8 years of age. Sex differences in performance on both type of tasks become more pronounced between upper elementary school years and the last years of secondary school, and the differences show a pronounced increase during this time span (Fennema, 1974; Maccolz and Jacklin, 1973).

It appears reasonable to hypothesize that since there is this concurrent developmental trend and since tests of spatial ability contain many of the same elements contained in mathematics, the two abilities might interact and affect the learning of mathematics. Perhaps less adequate spatial ability may partially explain girls inferior performance in mathematics. Tittle (1973) has shown that many tests, commonly used to measure achievement, are usually biased. Certainly if mathematics test contains many test items that require spatial ability to solve, girls will not do as well as boys.

Mathematics Teachers.

One of the primary concerns of mathematics educators is the preparation of prospective Mathematics teachers. The problem of preparing teachers is complex and is complicated by the fact that good teaching is an elusive and ill-defined concept. Presently, efforts of training mathematics teachers have been diverse and generally not based on any theoretical foundation (Cooney, 1971). Mathematics teacher education must provide a mathematics teacher with competence in mathematics. Perhaps the greatest necessary condition for good mathematics teaching is the possession in oneself of sound and adequate competence in mathematics. There is a Latin phrase: "Nemo debit quad non habit." No one gives what he does not possess. While this is not completely true - we can often help others find things we do not have ourselves but one has a hard time teaching or guiding the mathematics students without adequate mathematical competence oneself. Teachers must have a thorough mastery of the mathematics they need to teach and learn more mathematics than the materials which they are expected to teach. There are good reasons (Lassa 1980), why this principle is so widely accepted, but sometimes its implication is ignored and to make any challenge is tantamount to advocating mediocrity in the preparation of a teacher. No matter how good the mathematics curriculum is, if you do not have well qualified, trained and motivated teachers, we may not achieve our goal. At present the standard, quality and quantity of teachers preparation in our colleges is low and inadequate even at the University level.

Several studies have attempted to assess the mathematical competence of pre and inservice elementary school teachers (Lassa, 1977), Melson, 1965). The results consistently show that teachers do not have the knowledge of modern curriculum in mathematics, expected as prerequisite of effective teaching. In a study (Lassa, 1975) carried out on mathematics tutors in teachers colleges, it was found that there was no significant relationship between mathematics scores of the prospective students teachers and tutors perception of students teachers opportunity to learn mathematics content in the test items. If the tutors are not capable of assessing what the students can do and cannot do, how can they help them. In another separate study (Lassa, 1980) carried out to examine the preparation of prospective NCE teachers in the area of geometry, it was found out that the performance on the test, ought to be of concern to us. The very low level of their understanding of rather simple aspects or ideas of geometry should be taken seriously. In general the preparation of teacher in geometry and probability and statistics remained weak, which need to be examined by the university lecturers. The quality and originality of recent research into characteristics and behaviour of effective teacher are not at all evident in studies of pre and inservice education. Neither has the recent research in mathematics teaching produced any major breakthrough in the research of personal characteristics, education or classroom behaviour of effective teacher. However, several promising trends are emerging in the focus and techniques of research.

A FRAMEWORK FOR RESEARCH IN MATHEMATICS EDUCATION.

RYANS (1965) has pointed out that, in discussing the orientation of research, one might describe half a dozen levels of research procedures, beginning with the lowest level which consisted of casual and more or less random observation and data gathering, and reaching the highest level which is characterized by selective observation and data gathering directed at the testing of relevant hypotheses which have logically deduced premises. Research at this level requires the existence of some theoretical framework - a framework of influence employing:

(a) vigorously defined and unambiguous terms
(b) assumptions accepted as true for the purposes of the theory and
(c) postulate and their corollaries tentatively assumed to be true.

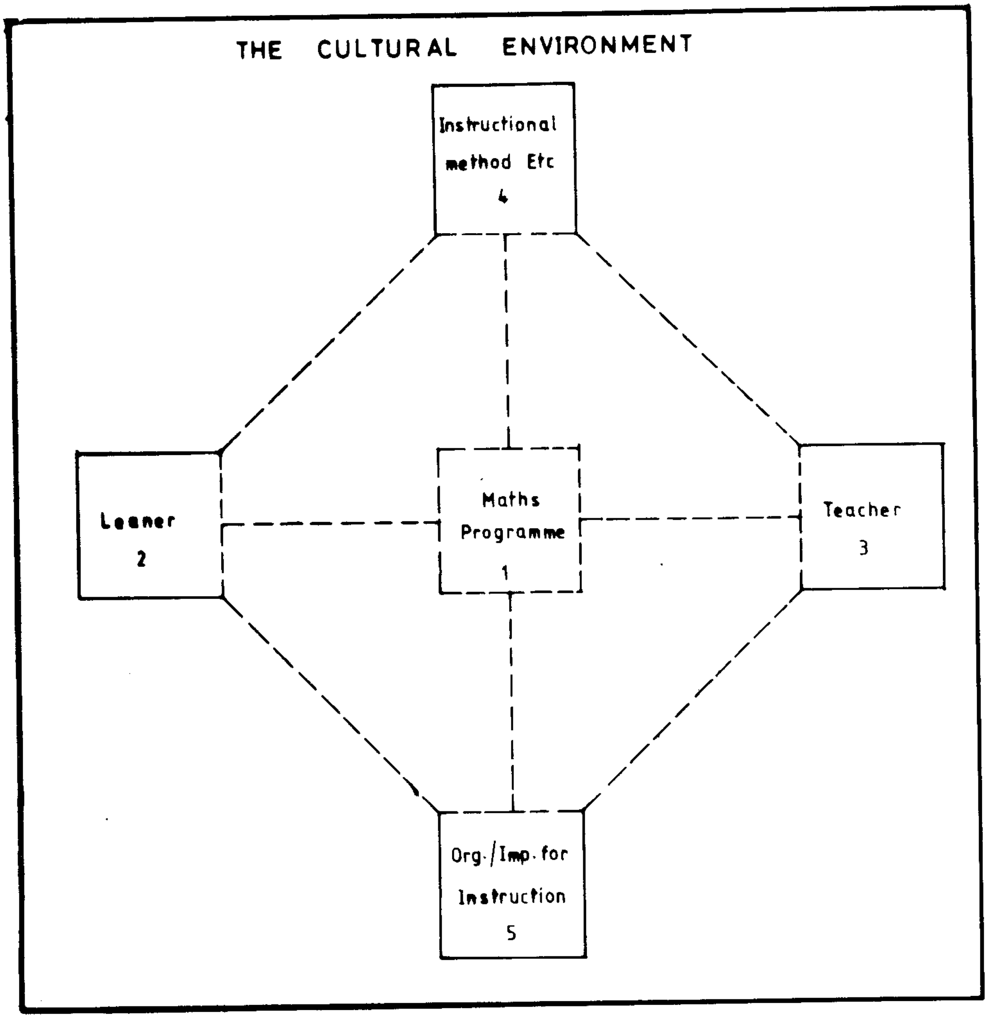
Regardless of its level of orientation, research pertaining to mathematics education should be theory-oriented to one degree or another. **But it** also must be theory-oriented **uniquely to** mathematics education.

A strong case can be built in support of developing a comprehensive framework for research in mathematics education. I would suggest five components which I feel must be considered *within the context of the cultural environment,* in establishing any comprehensive framework for research on mathematics education in school settings.
These components are:

1. the mathematics programme.
2. the learner.
3. the teacher.
4. instructional methods, materials, media and activities.
5. organization for implementing instruction.

These things are viewed as necessary components to be considered in the development of a framework for viable research in mathematics education. Whether or not these components also are sufficient is not crucial for this presentation. The components identified as things which at least must be considered in developing any comprehensive framework for viable research on mathematics education in school setting. The components have been represented below in a manner that suggests relationship and interactions among them.

What factors within the cultural environment, and what intercultural differences, have particular relevance for the suggested components and their interaction? This is an over-riding question that must be considered in connection with assumptions and hypotheses associated with any framework for research on mathematics education. It should be kept clearly in mind but it need not be repeated explicitly as we consider each component in turn.



Components to be considered in developing a comprehensive framework for viable research on mathematics Education (Weaver, 1969, Lassa, 1978)

The questions that I now raise pertaining to each component should be viewed as illustrative and not necessarily exhaustive or definitive.

THE MATHEMATICS PROGRAMME.

What is the scope of content for the mathematics programme? How is this content organized and sequenced? What attention is given to conceptual development to mathematical processes? to the development of skills or concepts? to the development of problems solving ability in its broad sense, encompassing more than just word problem? Where alternative interpretations of content and alternative mathematical procedures are possible, which shall be included in the programme? How are the contents for primary to be articulated with that for secondary and that of the secondary to that of the university or college.

Our assumptions and hypotheses regarding questions such as these are at the heart of any comprehensive framework for research on mathematics education. To one degree or another they determine the nature and direction of investigations we design and pursue.

The Learner

But we are concerned with the learning of mathematics by students. Our consideration of the mathematics programme cannot be in isolation of other components, particularly the learner.

What cognitive and effective attributes of the learner are especially relevant to the learning of school mathematics? Are the attributes relevant to conceptual learning the same as those relevant to skills learning, or to problem solving ability? Are differences in the learners "Cognitive styles" of relevance for the learning of mathematics? Is the cause of mathematical learning among school pupils to be viewed essentially in developmental or maturational terms or in stimulus - response terms, or in some other terms (Piaget 1952). Expressed as learner's mathematical behaviours; just what are the objectives of mathematics programme? Are the goals to be differentiated in any way in relation to characteristics of learning? If so, what characteristics? Our assumptions and hypotheses regarding questions such as these as they pertain explicitly to the learning of mathematics are an integral part of any framework for research on mathematics education.

The Teacher:

What cognitive and affective attributes of the teacher are especially relevant to students' mathematical learning? Are differences in "teaching styles" of relevance for the learning of mathematics? What factors facilitates the teacher-student interaction process within the classroom? More basically, just what is the role of the teacher in connection with pupils' mathematical learning, particularly in relation to the revolutionary forces in teaching and learning which Gage and Unrah (1967) identify as programmed instruction.

Any framework for research on mathematics education must come to grips with questions such as these pertaining to the teacher as they relate to the learning of mathematics on the part of school pupils.

Instructional, Methods, Materials, Media and Activities

What instructional methods, materials, media and activities are especially relevant to the learning and teaching of mathematics within the school setting? How desirable or necessary are unique sets of representative materials? What is the role of assisted instruction? Of programmed materials? Of discovery? Are the same methods, materials, media and activities equally appropriate for all teachers, for all learners and for all factors of the mathematics programme, e.g. for conceptual development, for skills development and for the development of problem solving ability? Are such questions to be answered in the same way for primary as for secondary and as for colleges?

As we formulate postulates and hypotheses regarding instructional methods, materials, media and activities and their relation to the learning and teaching of mathematics within a framework for research on mathematics education, we would do well to consider Brownell's (1966) .... "belief that we cannot hope to evaluate programmes of instruction as whole. Instead, we must settle for evaluating them only in part, on this basis or that, and we need to describe fully the condition which imposes restriction on the content to which our findings can be generalized.

Closely associated with this belief is Cronbach's (1966) conclusion tha: "I have no faith in any generalization upholding one teaching technique against another, whether the preferred method be audiovisual aids, programmed instruction, learning by doing, inductive teaching, or whatever. A particular educational tactic is part of an instructional system; a proper educational design calls up that tactic at a certain point in the sequence, for certain period of time, following and preceeding certain other tactics. No conclusion can be drawn about the tactic considered by itself." This seems to me to be particularly true for learning, teaching, and instruction in school mathematics.

Organization For Instruction

I have deliberately decided to regard this as a separate component for consideration rather than sub-suming it under the proceeding component. Issues pertaining to schools and class organization are of sufficient importance to warrant explicit consideration in relation to mathematics programmes learning, teaching and instruction, and in relation to building a framework for research in mathematics education. Specific cases in point are:

(a) inter and intra-class grouping of pupils, and
(b) the self-contained classroom versus other forms of organization which utilize special teachers of mathematics to one degree or another.

In conclusion, viable research in mathematics education, at various levels of orientation cannot be realized unless it starts from a suitable framework. General theories of learning, of teaching, of instruction and of curriculum may point out our thinking in provacative direction. But such theories have not been sufficient in themselves when judged on the basis of high relevance in implementations for mathematics education and research in mathematics education. The need is for a framework that is uniquely oriented to mathematics within school settings.

Recommendation for Improvement

Before I conclude this address I shall like to make a few recommendations for the consideration of mathematicians, mathematics-educators, teachers of mathematics, curriculum planners, school administrators and policy makers on education. These recommendation are not the end of our efforts but a beginning.

1. Mathematics is pervasive in todays world. Mathematical competence is vital to every individuals' meaningful and productive life. It is moreover a valuable societal resource, and the potential of our educated citizen to make significant use of mathematics is not being fully met. It is then recommended that *"more mathematics study must be required for all students and a flexible curriculum with a greater range of options; should be designed to accommodate the diverse needs of the student population."* When a student discontinues the study of mathematics early in secondary school, he or she is foreclosing on many options. Many doors both in university programmes and in vocational training, are at once closed to that person. These facts should be communicated more effectively to both the student and their parents.

2. *Stringent standard of both effectiveness and efficiency must* be applied to the teaching of mathematics. What is termed relative to a topic, how long it is retained, how readily it is applied, all these depend on the learning process the students pass through and how effectively they are engaged in that process. It is fruitless to consider topics taught apart from the way learners meet these topics.

3. *The success of mathematics programmes and student learning must be evaluated by a wider range or measures than conventional testing."* The first purpose of meaningful evaluation in school mathematics should be the improvement of learning programmes, teaching and materials. Educators must evaluate to have information for sound decisions. Evaluation is a part of mathematics teaching, and hence mathematics educators should be certainly involved in the evaluation process.

4. *Mathematics Teachers' must demand of*

themselves and their colleagues a high level of professionalism. This must be done to provide the nation, its young people and its future with the mathematics programmes worthy of them and of that future.

5. *Public support for mathematics instruction must be raised to a level commensurate with the importance of mathematical understanding to individual and society.* Solutions to the problems indentified in previous sections of this paper cannot be achieved solely within the education community but require active participation and support by parental and societal groups.

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APPENDIX A

CRITERION VARIABLE MATHEMATICS: A BREAK–DOWN BY STATE AND SEX

STATE		MEAN	STD. DEV.	VARIANCE	NUMBER
BAUCHI STATE	TOTAL	13.80	7.51	57.28	56
	M	18.96	7.54	56.92	26
	F	9.33	3.88	15.06	30
BENUE STATE	TOTAL	18.26	6.62	43.80	41
	M	20.67	6.62	43.88	18
	F	15.39	6.11	37.34	23
BORNO STATE	TOTAL	15.31	7.16	51.29	70
	M	20.40	7.65	58.59	30
	F	11.50	3.52	12.36	40
GONGOLA STATE	TOTAL	15.40	7.05	49.69	55
	M	16.54	7.33	53.70	26
	F	14.38	6.75	45.60	29
KADUNA STATE	TOTAL	17.11	6.80	46.27	36
	M	19.47	7.84	81.51	17
	F	15.00	5.03	25.33	19
KANO STATE	TOTAL	21.03	8.87	78.71	36
	M	21.03	8.87	78.71	36
	F				
KWARA STATE	TOTAL	14.81	4.33	18.82	22
	M				
	F	14.81	4.33	18.82	22
NIGER STATE	TOTAL	14.75	3.10	9.64	8
	M				
	F	14.75	3.10	9.64	8
PLATEAU STATE	TOTAL	17.93	8.23	67.84	27
	M	21.06	8.10	65.68	17
	F	12.60	5.40	29.15	10
SOKOTO STATE	TOTAL	17.18	7.66	61.90	83
	M	21.48	7.11	50.64	42
	F	12.78	5.98	85.77	41
ENTIRE POPULATION		16.51	7.51	56.43	434

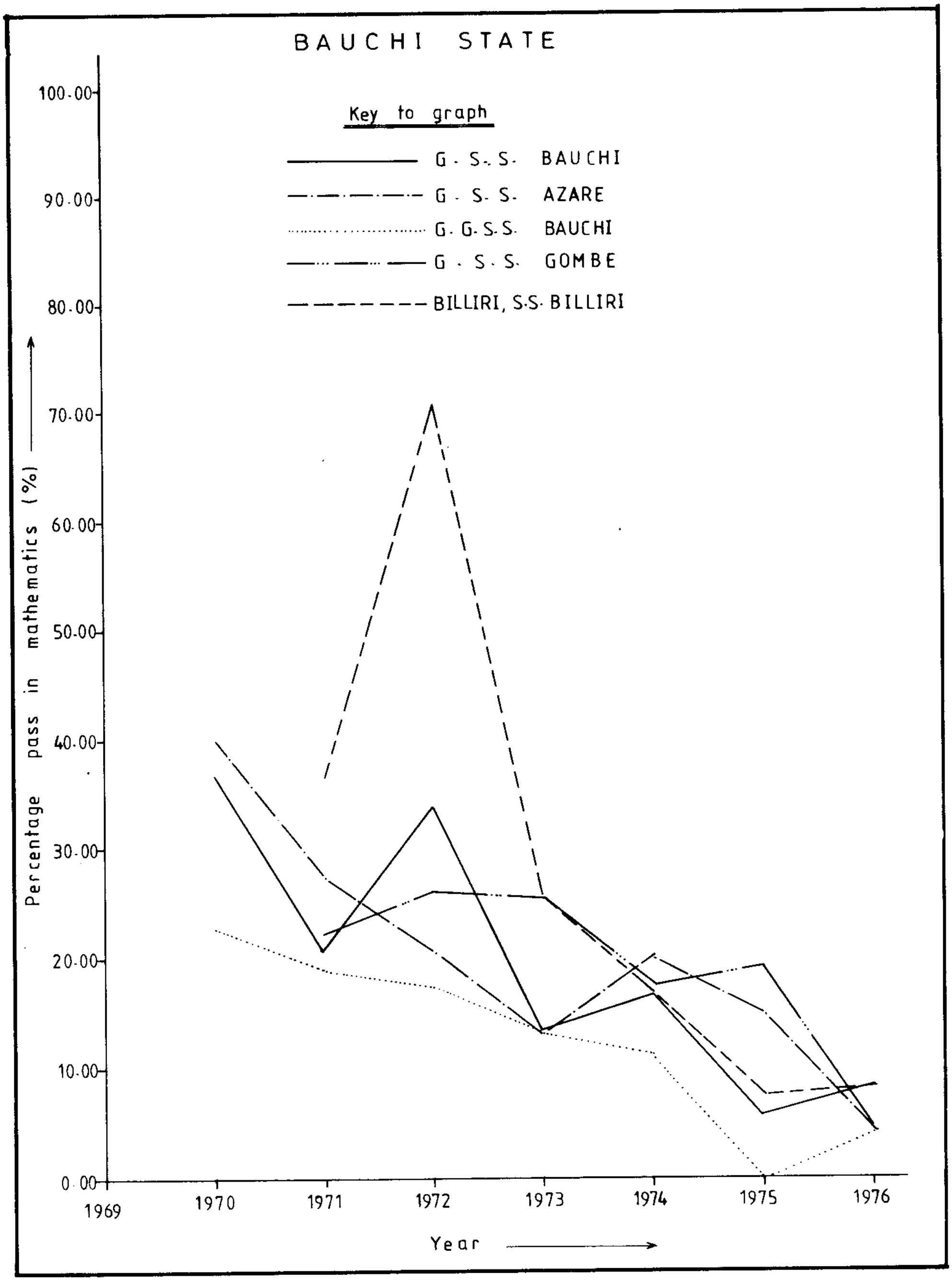
*THE MAXIMUM AVERAGE SCORE IS 50 ON THE MATHEMATICS TEST.

APPENDIX B

CRITERION VARIABLE ATTITUDE: A BREAK–DOWN BY STATE AND SEX

STATE					
BAUCHI	TODAL	70.55	19.20	368.76	56
	M	77.46	18.12	328.49	26
	F	64.57	18.33	336.32	30
BENUE	TOTAL	76.34	21.59	466.28	41
	M	82.72	12.73	162.09	18
	F	71.34	25.75	663.14	23
BORNO	TOTAL	71.04	19.74	389.72	70
	M	80.66	16.52	273.12	30
	F	63.83	19.02	361.73	40
GONGOLA	TOTAL	70.63	20.13	405.31	55
	M	73.27	22.20	492.84	26
	F	68.28	18.15	329.42	29
KADUNA	TOTAL	71.83	21.64	468.25	36
	M	71.59	27.57	160.13	17
	F	72.05	15.32	234.72	19
KANO	TOTAL	80.19	20.57	423.02	36
	M	80.19	20.57	423.02	36
	F	-	-	-	-
KWARA	TOTAL	63.77	29.01	841.80	22
	M	-	-	-	-
	F	63.77	29.01	841.80	22
NIGER	TOTAL	90.75	18.47	341.07	8
	M	-	-	-	-
	F	90.75	18.47	341.07	8
PLATEAU	TOTAL	78.04	14.45	208.96	27
	M	83.71	12.69	160.97	17
	F	68.40	12.39	153.60	10
SOKOTO	TOTAL	75.06	17.45	304.67	83
	M	85.12	11.36	129.03	42
	F	64.75	16.65	277.24	41
ENTIRE POPULATION		73.45	20.27	411.11	434

*ANY SCORE MEAN THAT IS BELOW 80 TENDED TO SHOW NEGATIVE ATTITUDE TOWARDS MATHEMATICS.



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G. G. S. S. BAUCHI
G. S. S. GOMBE
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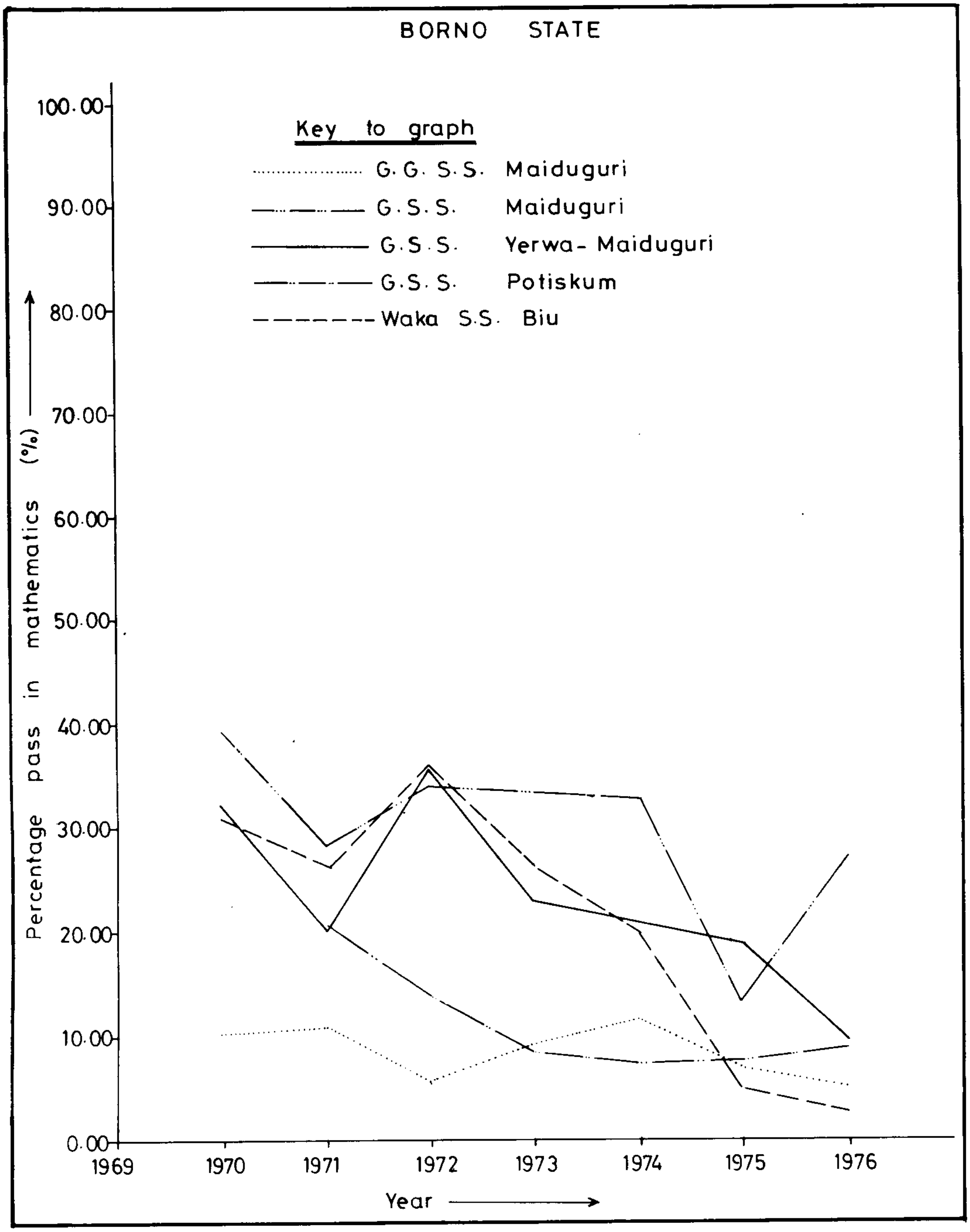
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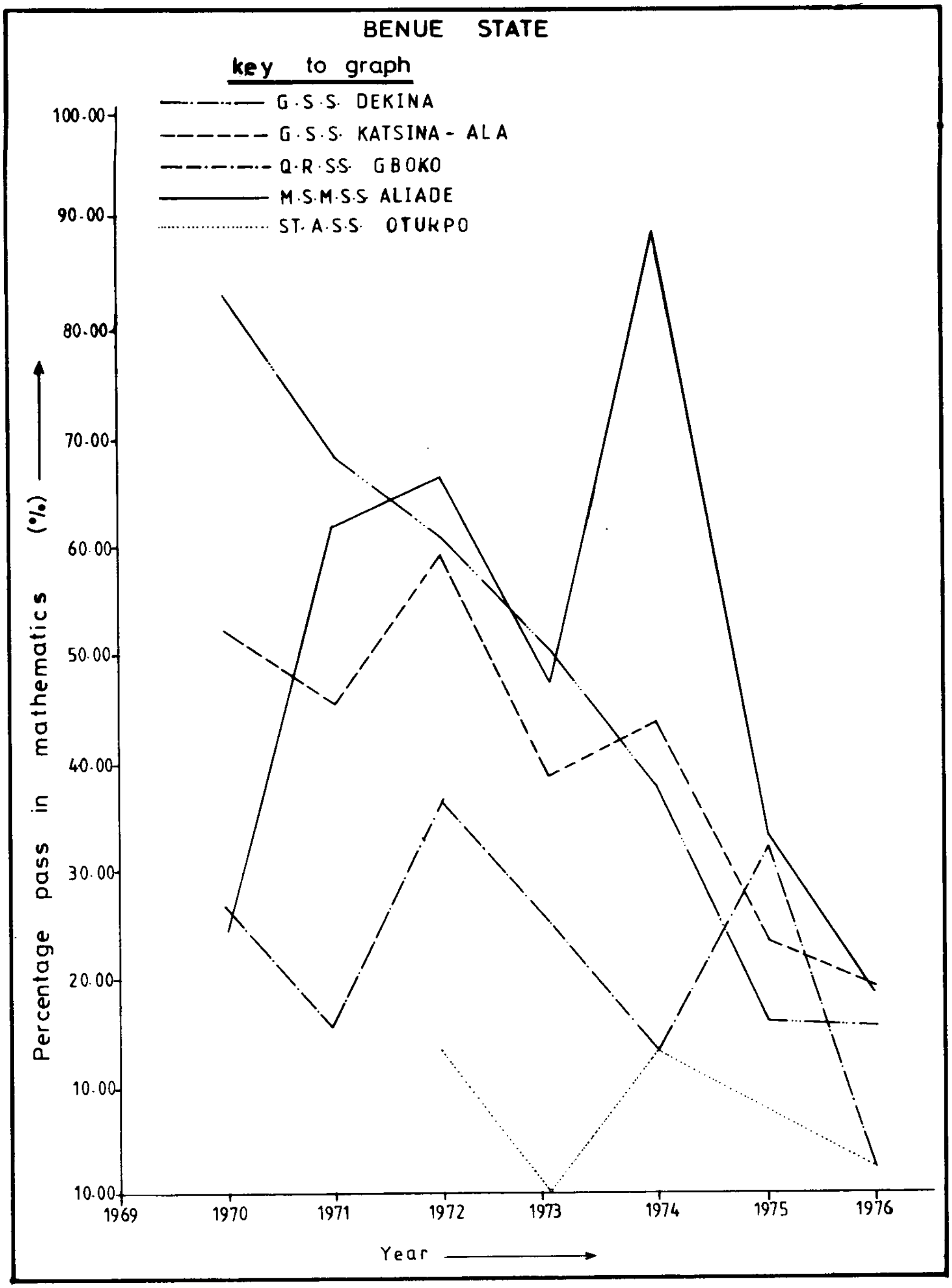
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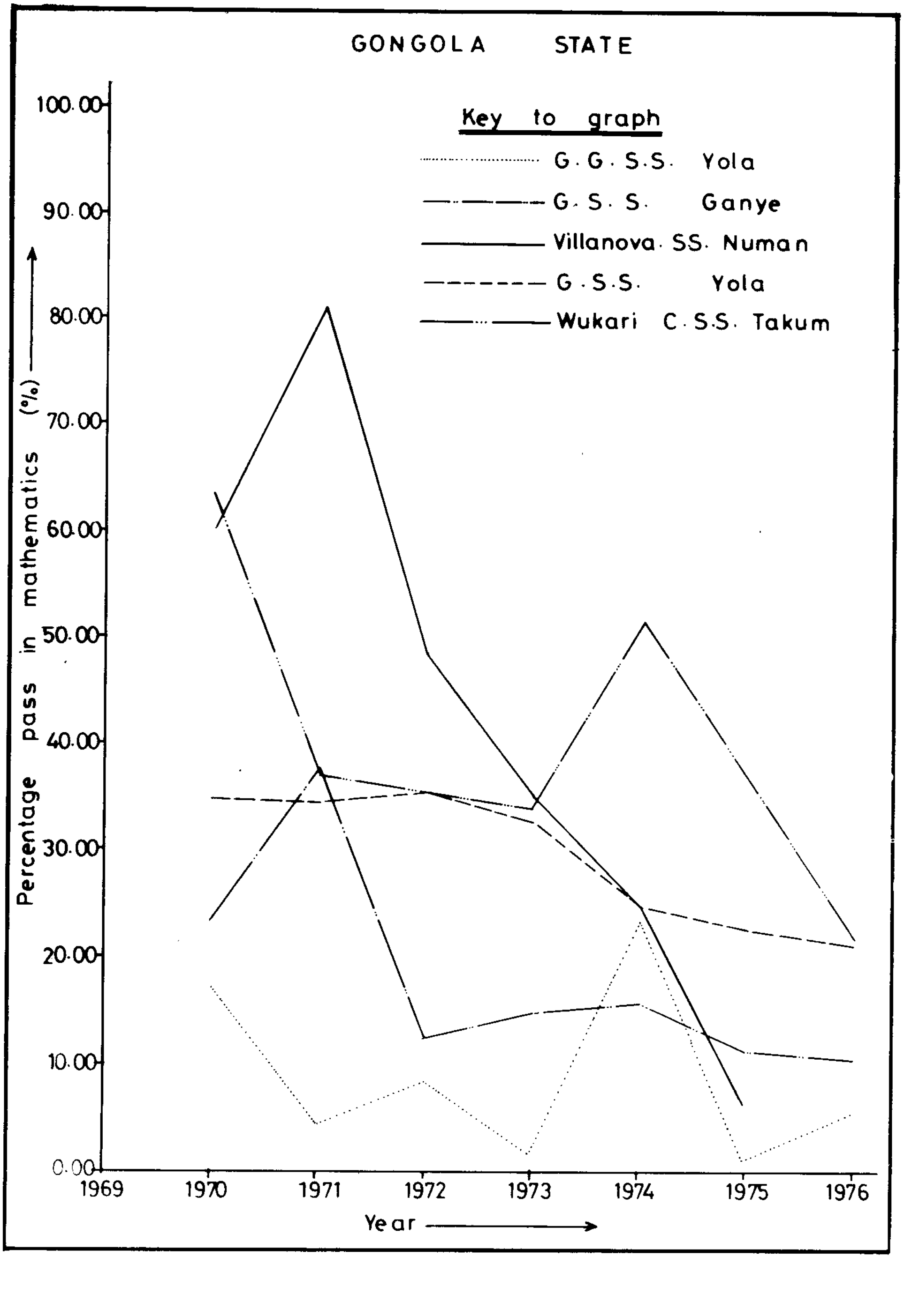
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Villanova SS. Numan
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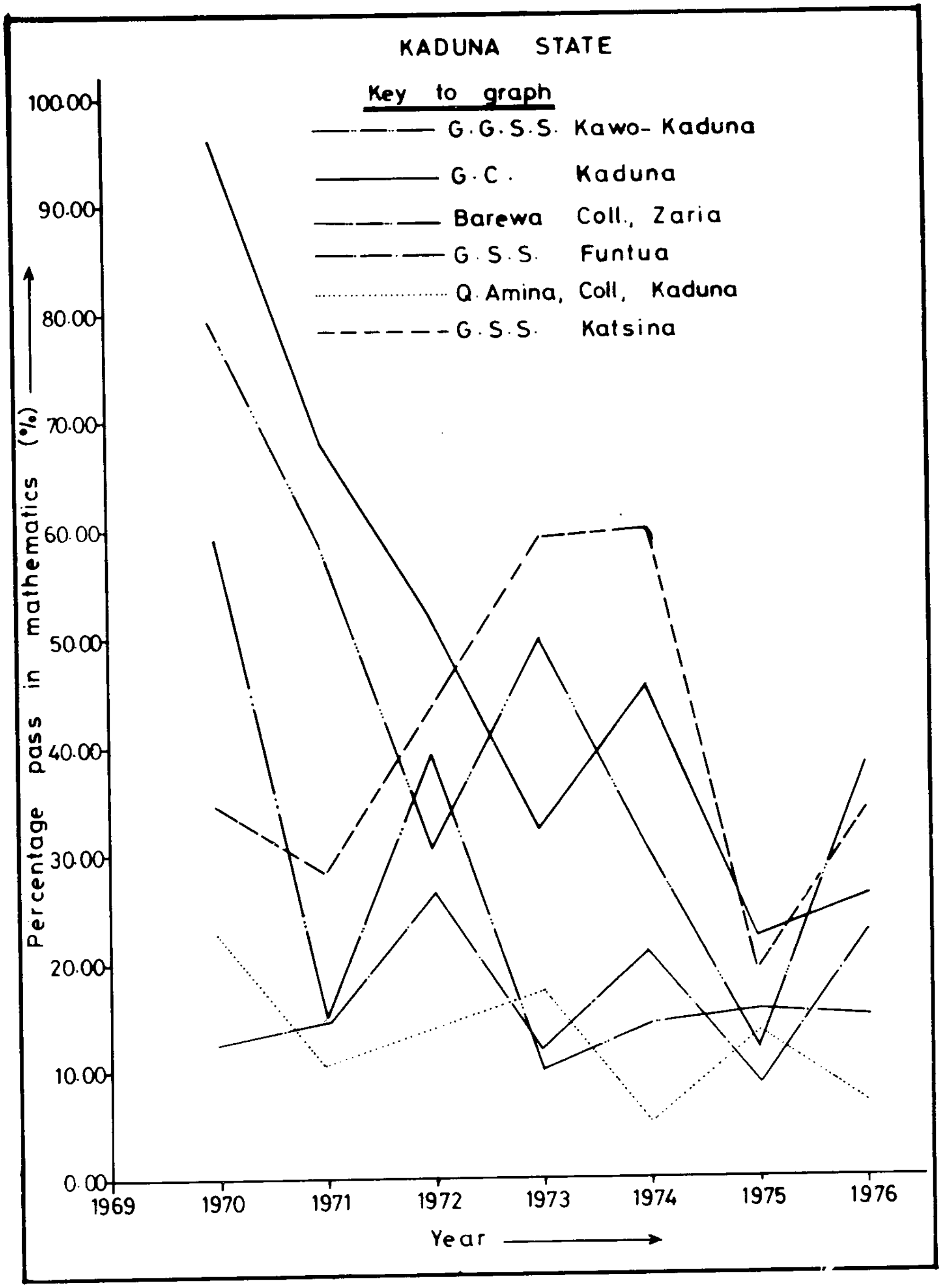
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G.C. Kaduna
Barewa Coll., Zaria
G.S.S. Funtua
Q. Amina, Coll, Kaduna
G.S.S. Katsina
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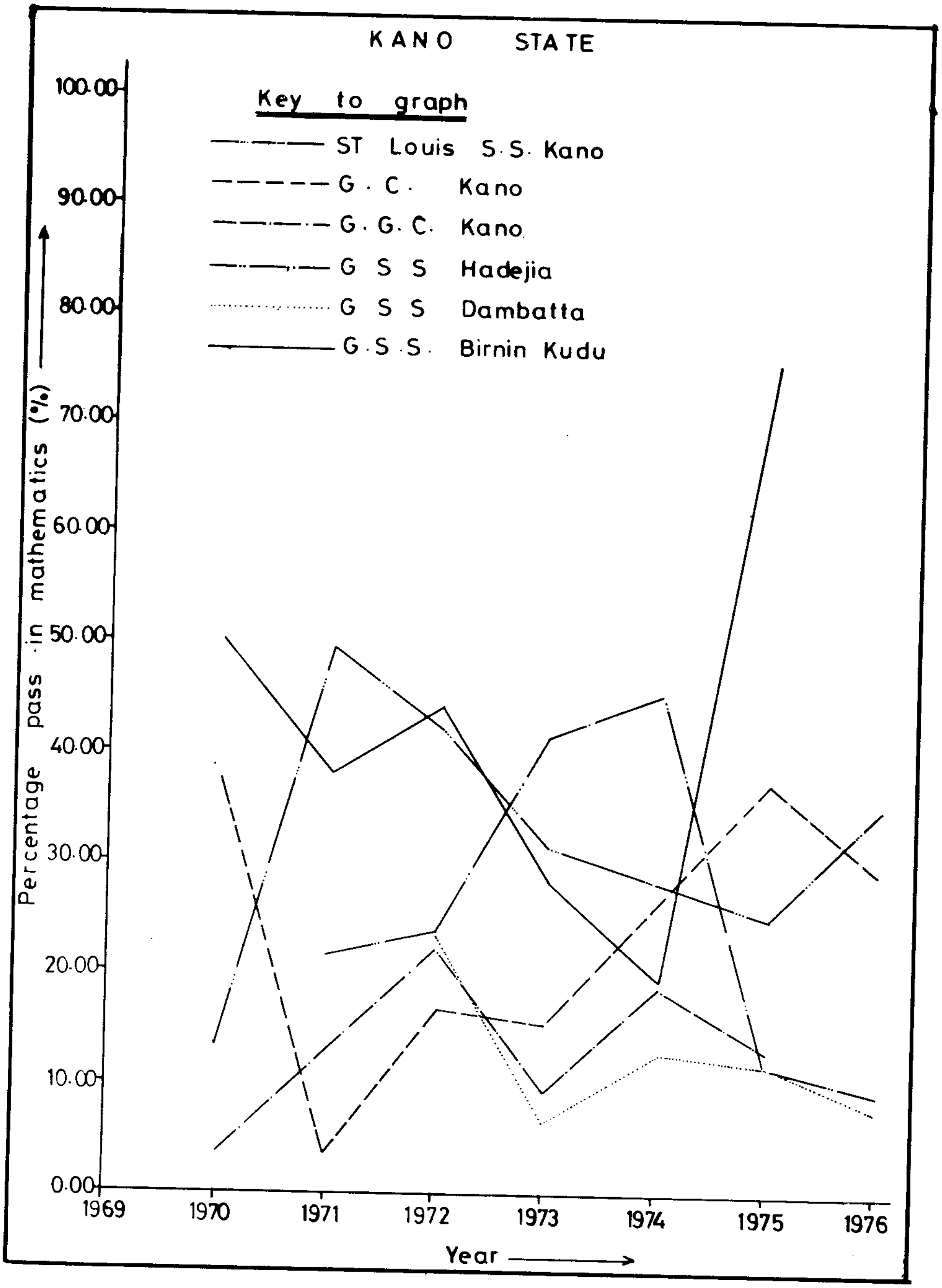

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G. C. Kano
G. G. C. Kano
G S S Hadejia
G S S Dambatta
G.S.S. Birnin Kudu
Percentage pass in mathematics (%)
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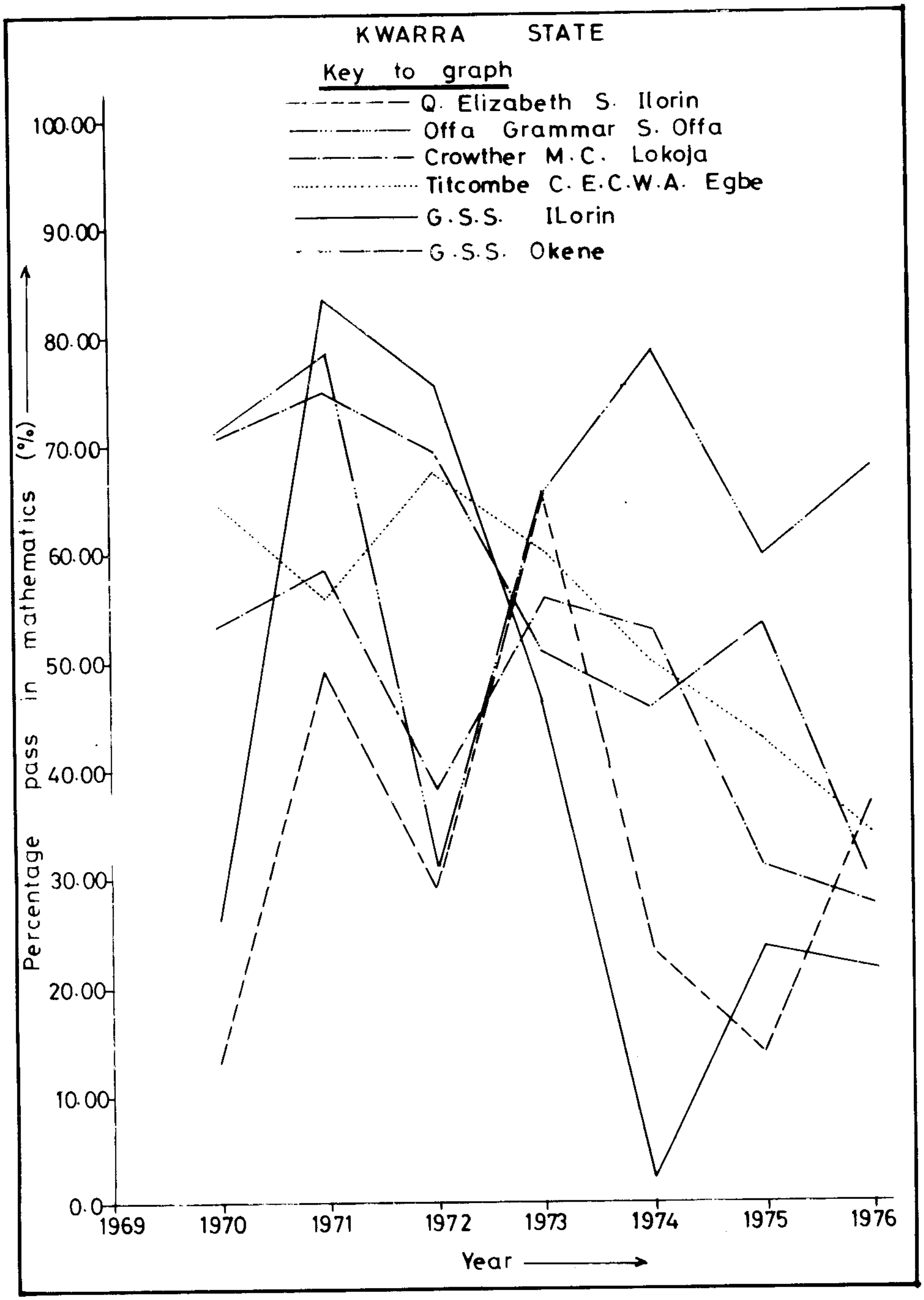
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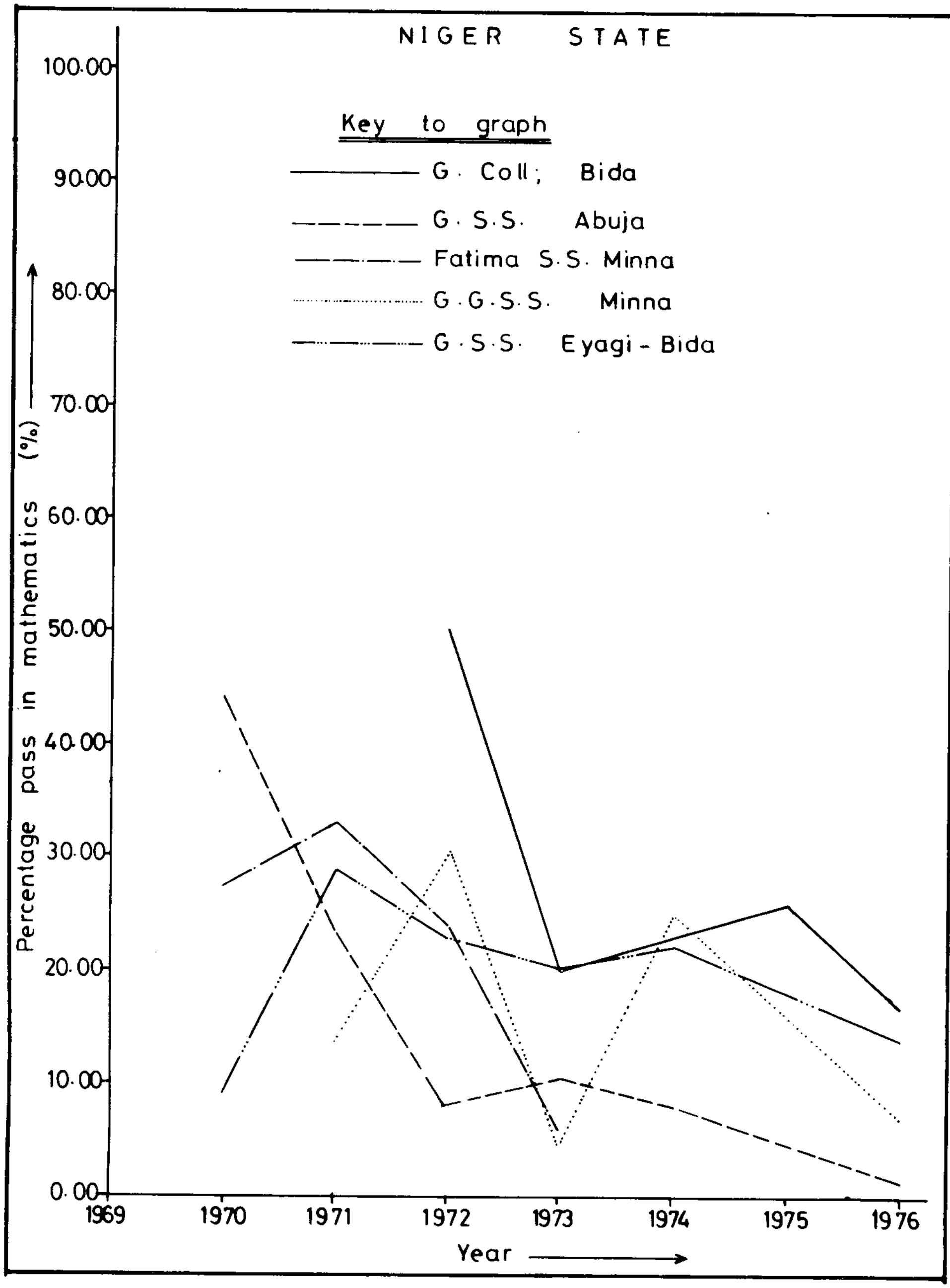
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Fatima S.S. Minna
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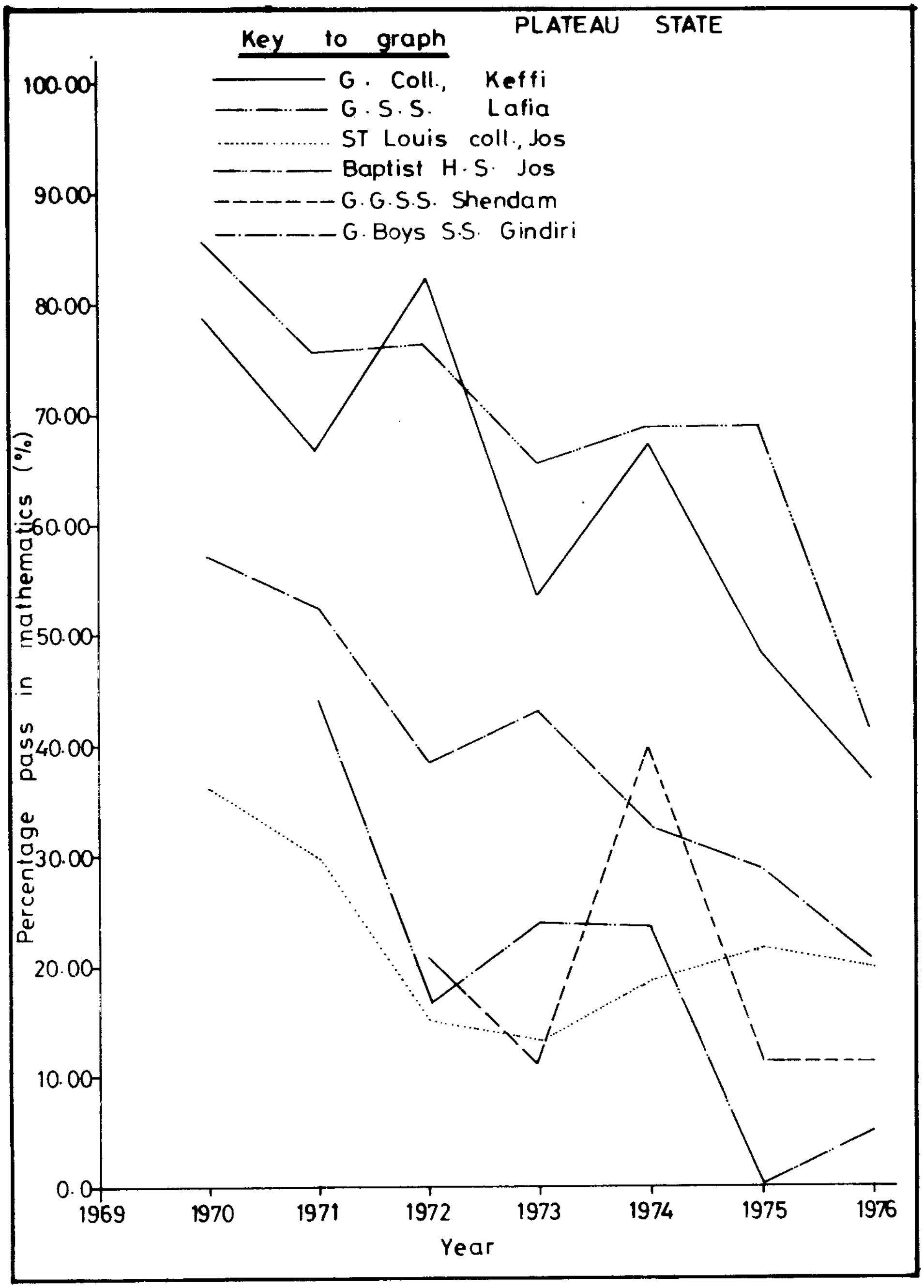

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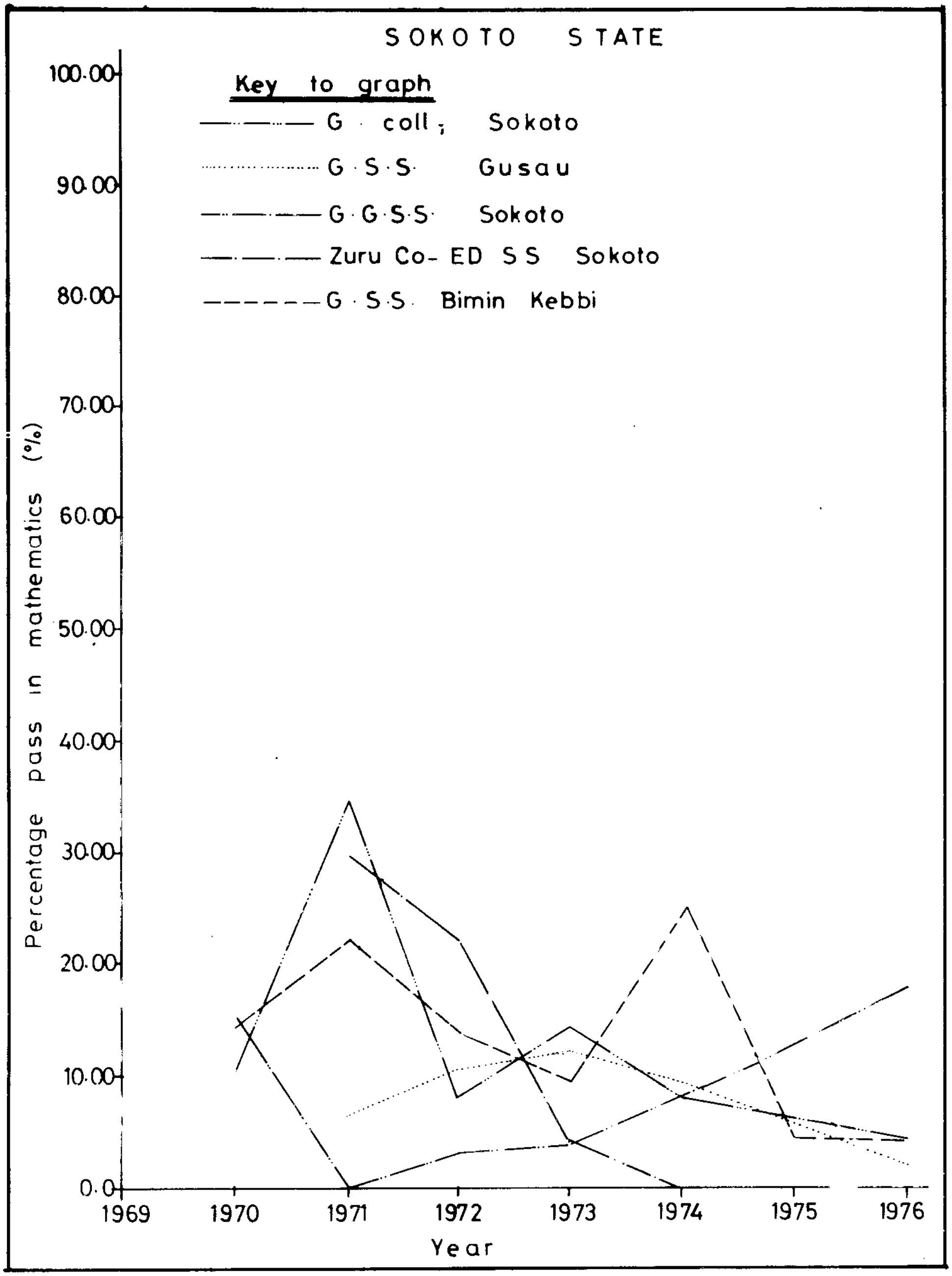

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