

GEOMETRY, ESTIMATION AND MEASUREMENT IN TRADITIONAL SIERRA LEONE

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Summary

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5 old men and 5 old women from each of 5 villages representing 5 different ethnic groups were interviewed. Their ages ranged from 56-68, and they had never attended any western type school.

It was found that people from the subcultures studied were familiar with certain geometrical concepts usually ascribed to Euclid, but they lacked refinement of term and description of plane and solid figures.

They used measurement of time, volume, length and money as related to their daily life activity and experience, but their measures were neither English nor metric. Their estimates of number etc were in relation to the frequency of use of the particular thing.

In conclusion the study points to an approach to curriculum adaptation in mathematics built on society's previous knowledge.

Report

In various parts of the world, societies have developed different and interesting ways of looking at numbers and other mathematical ideas. Among several ethnic groups in Sierra Leone certain objects may be counted while others may not. In the past the counting was done using either a base twenty number system (Mendes and Tennes) which was associated with all the fingers and toes of a man or a base ten number system (Limbas). Whatever system was applied, it was used to count farm products, houses, some domestic animals and other objects which tradition allowed people to count.

There were, also, ways of measuring and estimating. The age of a child was estimated either in relation to the number of farm cycles that had transpired since he was born or in terms of his ability to walk from the home to the farm and back. Instead of the English or metric systems of measure, local cups and containers were used. Small quantities of rice and like farm products were measured in terms of the number of "cigarette cups". Larger amounts were

measured using kerosene tins, bushels or bags. Liquids were measured in bottles or tins. "Country cloth" was measured in arm-lengths where one arm-length was comparable to a yard. Smaller units of length were the hand-span and the pace.

All these things were happening in Mendeland, Temneland and Limbaland before the interaction with other cultures. When "Westerners" came to Sierra Leone they founded Western-type schools and soon Limbas, Mendes, Temnes, and other ethnic groups had to send their children to these schools. The schools were foreign in origin and ideas and in many instances became agents for condemning some of the cherished ideals of the society.

Among the subjects taught in school was one called arithmetic. It had no meaning to the children because it seemed unreal. They were used to sharing their "rice chop" and to grouping such objects as oranges and mangoes. But they had difficulty with the abstract numbers of school arithmetic. The difficulty was compounded by the fact that they received instructions from their teachers in a language, English, which was foreign.

It is this state of affairs which modern curriculum renewal in mathematics in Sierra Leone should try to rectify. If school mathematics can be established on a foundation which draws upon the type of mathematics to which the child's environment exposes him, then there is reason to believe that he will manifest some interest in the subject. This is the spirit behind this study. The aim is to investigate original concepts of geometry, estimation and measurement among the three major ethnic groups in Sierra Leone.

Method of Procedure

Together, the Mendes, Temnes and Limbas make up approximately 80 per cent of the population of Sierra Leone. Each of the first two ethnic groups contributes about one-third of the population, but the Mendes are slightly more numerous than the Temnes. Also, each is made up of two major subgroups. There are Kpaa Mendes and Eastern Mendes as well as Sande Temnes and Yoni Temnes. The investigation was carried out in five villages, each being a representative of one ethnic group or subset thereof. In each location five old men and five old women who have never attended any Western-type school were interviewed. They ranged in age from 56 to 68.

Each subject was interviewed singly and was requested to answer questions which dealt with geometrical concepts and words. Some areas of interest included the kinds of geometrical patterns noticeable in carvings and the houses constructed by the people. Other interests were terms used to describe plane or solid figures.

Then, there were questions on measurement and estimation. How was distance measured or estimated? How was area estimated? How was crop yield measured? How could people tell their ages or how could they tell time? And so on.

All questions were asked by final year undergraduate students of mathematics who were members of the respective ethnic subgroups and who had been specially trained for the project.

There was another aspect of the study which was limited to the largest ethnic group, the Mendes. Part of it involved the two Mende Locations referred

to earlier. In each of them a task on estimation of the quantity of rice in a bowl was set for the 10 adults used in the general investigation as well as for 10 school children and 10 non-school children. The age range of the children was 9 to 13 years. In addition, the Eastern Mende subjects had to estimate both the number of houses in their village and the number of people who lived in those houses.

Findings

The results of the study have been classified into three sections:

- a) the uses of geometry
- b) the uses of measurement and estimation
- c) the results of estimation experiments

a) The Uses of Geometry

One approach to Euclidean geometry is to consider the point as a building block and define other terms in relation to it. For instance, the line segment is defined as a union of points. Among all the three ethnic groups studied there was adequate terminology for the point, the line segment and other related concepts. The word "Kaawoni" which the Mende used for line segment has always existed in their culture but the word "tolon" used by the Limbas has been borrowed from neighbouring Temneland.

It was in their description of plane and solid figures that the sub-cultures showed inadequacy of refinement of terms. All had terms describing the plane. The Mende said "tibi vamei va vevele" which meant that the surface of the table was flat or planar. However, beyond this general recognition, distinctions were blurred. The square, the rectangle, the rhombus and all four-sided plane figures were described in the same language as things having four corners.

Yet the circle was a familiar plane figure. The Limbas described it as "Kilkilli" while the Mendes said it was "Keke". It was clearly differentiated from the sphere which for the Mendes was "si" or dense in matter. The only other solid figures recognised by all the groups were the box or cuboid and the Temne "long-round" or cylinder.

Both the Mendes and the Temnes built two types of houses - the rectangular house and the more popular round house. The Temne round house has been described by Mr. Littlejohn (1960). The round construction was made in a manner similar to the construction of a circle in Euclidean geometry. The instruments used were a rope, a hoe and a peg. The peg was used as the centre and one end of the rope was tied on to it. The hoe at the other end of the rope acted as the pencil end of the compass.

Consistent with the philosophy of traditional African education, there was much observation and imitation. This was borne out by the fact that many geometrical patterns could be recognized in carvings. On the whole, most carvers copied what they had seen elsewhere and did not stop to think about the geometrical significance. The origins of the first patterns remain obscure.

b) The Uses of Measurement and Estimation

Among all the subgroups studied, there existed ways of measuring

length and weight but not of measuring time. Only rough estimates of time could be given. Length was measured in terms of man's hand-span, arm-length or pace depending on the object. Neither the British nor the Metric system of weight or volume measures was known. Instead the people used local cups and other containers. Small quantities of rice and comparable farm products were measured in cups; larger amounts were measured in bags. The arm-length was used to measure "country cloth".

It was tempting to conclude that these units were not standardized but this conclusion could be misleading. The units were understood and used not only in Mendeland, Limbaland and Temneland but also in many other societies in West Africa. Moreover, only minor variations were observable if one moved from one locality to another.

The ethnic groups recognized dawn, dusk, mid-day and evening. The cock crew at dawn. There were, and still are, both the wet and dry seasons around which revolved the farming activities of burning the bush, ploughing, sowing, weeding, scaring birds, harvesting, and storing the products of labour. Events such as births and deaths were recalled in terms of this cycle of farm activities.

In connection with the measurement of time, Gay and Cole (1967, p.71) have observed in a related situation:

"The measurement of time differs from the measurement of money, volume and length, in that certain terms which appear to measure time cannot be numbered. Such terms might be called intensive measures of time rather than extensive measures. They measure the quality of the moment, not the quantity. The same phenomenon appears in English."

Currency was in the form of "country cloth" or in the form of "iron money." "Country cloth" is a heavy handwoven piece of valuable cotton material made up of strips sewn together. The typical strip is rectangular and about six feet long and four inches wide. The normal size "cloth" measures approximately six feet by four feet. It was the currency for exchange of valuable property.

"Iron money" is a cylindrical piece of rod which is usually less than one foot in length and less than one-fifth of an inch in diameter. One end is pointed and the other has two fins. Between these ends there are about 15 to 20 turns obtained from twisting the rod. Its value was set from time to time by secret societies.

c) The Results of Estimation Experiments

In both the Kpaa Mende and Eastern Mende locations, 10 adults, 10 school children and 10 non-school children were requested to estimate the number of cups of rice in a bowl in which 20 cups of rice had been put. Table 1 shows the results obtained. One thing that the accuracy of the estimates (especially by adult subjects) indicates is familiarity with the measure for small quantities of the staple crop. This is consistent with the emphasis which traditional education put upon observation.

Table 1. Comparison Of Estimates Of 20 Cups Of Rice For Six Sub-groups

Statistic	Adults		School Children		Non-School Children	
	Kpaa	Eastern	Kpaa	Eastern	Kpaa	Eastern
Mean	18.0	17.0	19.9	16.1	18.8	14.9
Median	18.0	18.0	18.0	12.0	16.5	15.0
Standard Deviation	3.3	2.4	5.4	7.2	9.5	3.1

The Eastern Mende subjects were further asked to estimate the number of houses in their village and the number of people who lived in those houses. There were altogether 259 persons in 33 houses. The results obtained are displayed in Table 2. It is not surprising that the estimates of people are worse than those of cups of rice. Not only are the numbers involved in the former case larger but the idea of counting human beings is foreign to this land.

Table 2. Comparison Of Estimates Of Houses and Persons For Three Sub-groups

Statistic	Adults		School Children		Non-school Children	
	Houses	Persons	Houses	Persons	Houses	Persons
Mean	33.8	278	36.5	227	31.3	292
Median	33.0	265	39.0	225	28.5	153
Standard Deviation	5.6	85	13.4	124	13.6	285

Conclusion

In Sierra Leone, as in many other parts of Africa, some of the forces which should help shape the nature and content of school curricula have not received adequate attention. One of these forces is the background of the students in the sense of the role that the African environment should play in curriculum development and adaptation. Both the content and methods of mathematics education should arise from past and present experiences in the immediate environment and beyond. As some authors (Gay and Cole, 1967, p.1) have emphasized:

"We must know more about indigenous mathematics so that we can build effective bridges to the new mathematics we are trying to introduce."

An attempt has been made in this study to get an insight into certain aspects of the type of mathematics practised by traditional Sierra Leone. Among other things, it has been discovered that:

1. The sub-cultures studied are familiar with certain geometrical concepts usually ascribed to Euclid.
2. Measurement is used in the daily lives of the subgroups studied.
3. The measures so used are neither English nor Metric.
4. Estimates of the number associated with certain objects are made, and accuracy depends, on the frequency of use of the particular object in the society.

In a related study on the real number system in these three sub-cultures, the author has found that the arithmetic operations of addition, subtraction, multiplication and division is used in the sharing of the products of farming. Thus, in general, it may be claimed that traditional Sierra Leone has practised a type of mathematics related to its needs.

Yet, the history of the development of mathematics shows clearly that when man is faced with puzzling problems, he invents new numbers, new methods or new systems. There is reason to hope, then, that an approach to curriculum adaption in mathematics which builds on the society's previous knowledge is likely to succeed.

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