MATHEMATICS THAT EXISTS IN THE BOKYI CULTURE: IMPLICATIONS FOR PRIMARY SCHOOL MATHEMATICS CLASSROOM INSTRUCTIONS

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Abstract

Teachers of mathematics who during classroom instructions use the mathematics pupils and their parents possess may enhance the learner's interest in and better understanding of the subject. This study therefore, attempts to investigate the mathematics in the Bokyi culture. It also highlights the implications of the identified mathematical ideas and concepts for primary school mathematics instructions. A 31-item structured questionnaire (BECQ) was administered to 50 unschooled Bokyi speaking adults. This sample was drawn from the five linguistic groups (based on the extant dialectal variations) that make up the Boki Local Government Area of Cross River State. The findings of this study reveal some basic mathematical ideas and concepts in the Bokyi culture. These mathematical ideas, we believe, can be used by teachers to enhance the teaching and learning of mathematics in the primary schools.

Introduction

Mathematics and its use are common to all cultures the world over. Every society, no matter the level of its development has an instinctive kind of mathematical knowledge that helps its people to solve daily societal problems (Gilmer, 1985; Enukoha, 1995). That is, we find in every culture a way of counting, subtracting and performing logical deductive reasoning that could be considered unique to that culture (Bockarie, 1993). This is why we find adults and even school age children without formal education exhibiting some basic mathematical competences in their day-to-day activities (Abiam, 2006).

Studies have established the existence of mathematics in some cultural groups in Nigeria. The following could be mentioned: Oladimeji (1977) - among the Yorubas; Enukoha (1979)- among the Igbos; Ekukoha (1981)- among the Efiks and Ibibios; Adaaku (1982) - among the Tiv people of Benue State; Musa (1986)- among the Hausa people of Katsina State, and Okpobiri (2005)- among the Ikwerri people of River State. The findings of these studies, indeed have given impetus to the present study.

In spite of the mathematics pupils and their parents already possessed, mathematics teachers in Nigeria seem to have failed to show any link between school mathematics and such mathematics in their classroom instructions. Yet, in the opinion of Shirley (1998), the mathematics in the pupils' cultures is central to the process of teaching/learning of school mathematics. Again, Gilmer (2005) thinks that a mathematics curriculum aligned to the learner's culture will respond to the needs of increasing number of pupils who ordinarily will think that school mathematics is meant for the intelligent ones. Schultes and Shannon (1997), also reported that students could gain greater appreciation for school mathematics after having learnt the subject matter from a cultural perspective. Similar findings were reported by Zaslavsky, 1973; D'Ambrosio, 2001; Laridon, Mosimege and Mogari, 2005.

We have seen that a cultural perspective in implementing the school mathematics curriculum has been canvassed by most mathematics Educators. This pedagogical position being canvassed is consistent with the provision in the National Policy on Education (FRN, 2004), that as a means of preserving the people's culture, the language of the immediate community of the child should be emphasized, at least at the primary school level.

Primary school Mathematics has a prescribed written curriculum and objectives. Yet, the structure and curriculum of school Mathematics at this level of our education system seem to have failed to recognize or exploit the pedagogical wealth of the Mathematics that pupils and their parents already possessed. That is, the link between Mathematics and culture. That pedagogy would probably have facilitated the teaching and learning of primary school Mathematics. This is the problem to be addressed in this study.

Purpose
The purpose of the study is to investigate the Mathematics that exists in the Bokyi culture.

Research Questions
The following research question was posed:
What Mathematical ideas exist in the Bokyi culture?

Method

The population for this study comprised all the Bokyi speaking adults of the Boki Local Government Area of Cross River State. A sample of 50 unschooled Bokyi speaking Adults was used for the study. A stratified sampling procedure was used. This helped the investigator to divide the Boki Local Government Area into its five linguistic groups vis -a-vis the existing dialectal variations (Asu, 2001). These units constitute the 52 villages/towns that make up the Local Government Area (Abiam, 2006). 10 villages out of the 52 villages-2 villages for each of the five linguistic groups were randomly selected (using hat-and -draw method) for the study. Finally, purposive sampling was used to pick five unschooled adults from each of the 10 selected villages giving the total sample of 50 subjects. The unschooled adults in this study were adults aged 40 years and above.

The instrument used for the study, Basic Ethnomathematical Concept Questionnaire (BECQ) was a structured questionnaire comprising 31 interview questions adapted from Abiam (2006). The instrument was validated by two experts in mathematics education. The two experts independently screened the interview questions, and, each established that the interview question actually measured the purpose as reflected in the research question. Again, two times administration of the same instrument, at an interval of two weeks, were carried out during the trail testing of the instrument. It was reported that the two sets of responses obtained were stable. Hence, the reliability of the instrument was also assured.

The collection of data was done by the investigator with the assistance of a volunteer from each village/town where subjects were orally interviewed.

Results and Discussion
Research Question

What Mathematical ideas exist in the Bokyi culture?

The responses obtained from subjects revealed that the Mathematics within the Bokyi culture can be described under the following topics: (i) Numeration/Counting system; (ii) basic arithmetic operations; (iii) fractions; (iv) Zero; (v) telling time; (vi) geometric concepts; (vii) Mathematical games and probability; (viii) rhymes Numeration/counting system.

Counting is carried out at three base levels, viz; (i) sub-base 10, (ii) sub-base 15, and (iii) main base 20. There are special number words for these base numbers: 10=diikpu, 15=onyiryika, 20=bujam and for a number like 200=egot. The counting using the number words goes thus:

1, ebonge (din)
2, byifee
3, bachat
4, byinyii
5, batange
6, nyachat
7, kachatkanyii
8, nyiryinyii
9, katangikanyii
10, diikpu
11, diikpu dii din
12 diikpu, dii efee
15, onyiryika
19, onyiryika dii anyii
20, bujam
21, bujam esim ebonge.

The number words six to nine do not have a well-defined pattern for their formation. In this way, their number words can be said to be multisyllabic and literally constructed. For example, nyachat: 6=3+3; Katangekanyii: 9=5+4.

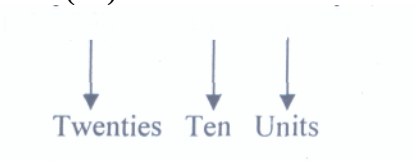
Uses are make of "dii" and "esim" meaning literally, "increase by" and "greater increase", respectively, to form higher number words. This reveals the idea that addition is inbuilt in the counting method. Again, the number word bujam for 20 has "bu" prefixed to "jam" to mean (twenty), while "ba" is prefixed to "jam" (bajam) to mean (twenty) more than one or many twenties. Literally, this can be translated as (twenties)2=20x2= 20+20= 40; (twenties) 3=20x3= 20+20+20+20= 60; (twenties)2 and ten and six =20+2 +10+6 = 56. We see that this method of counting gives rise to addition by expanding the numbers in twenties (20s), tens (10s), and units and multiplication as continuous addition.

The existence of the special number words bujam (20), bajam (20s) and egot (200) has made feasible the formation of number words for numerals up to 1000 and even beyond. There are however rare situations in the daily transactions where the people of Boki are required to count beyond 1000.

Basic Arithmetic Operations

The terms in Boki for +, -, x, :- are cibe, fim, cibe - chow and kyii, respectively. It is obvious that the method of addition in this culture brings out the idea of place value and the writing of whole numbers in expanded form. For example,

115= (20) 5+ 10 + 5



Computation involving addition and subtraction is not done with pure numbers or Hindu/Arabic numerals. For instance, the people do not add 6 to 2, rather, they add 6 objects to 2 objects of the same type to obtain 8 objects. These objects could be stones, oranges, cowries; among others.

Multiplication which is also with concrete objects is not common among the Bokyis, but, it is understood and carried out as continuous addition. Although division is a cultural practice and indeed, natural for the Bokyis, it is difficult to handle when large objects are involved. However, division is treated as repeated subtraction. For instance, to divide or to share 8 oranges among 4 people of the same age and status, the sharer could start with one or two oranges for the first round, then the second round... This process is repeated (as the quantity of oranges reduces or subtracts) until the oranges get finished. The above four basic operations cannot be done in abstraction, except with concrete objects. It does not make sense if a problem like 105 + 85 is asked an illiterate Bokyi person. It does make sense if the problem is posed thus: Add 105 yams to 85 yams.

Fractions

The concept of fraction exists in the Bokyi culture. There are no number words for fractions like 1/2, 1/4, 3/4, 1/3, 2/3, 1/10 (to list but a few) and are not distinguishable from one another. The common name for fractions is Kyice. However, the fraction '1/2' can easily be estimated or determined by the people. Other fractions can each be estimated as each relates to *Vi.* Again, kyice is used to refer to each lobe (or part) of a kolanut (object with a natural dividing line). But, where sharing of meat is involved, the Bokyis refer to a share or part as kyipang. It should be noted that the two terms (kyice and kyipang) are used to describe a part of a whole, but cannot be used interchangeably...

Zero

The number word for zero is chwom-kyifi (nothing/nothingness). The concept of zero is still vague in the Bokyi culture and therefore not in common use. However, if a problem like 7 bananas -7 bananas were asked, a Bokyi man would response chwom-kyifi meaning nothing is left.

Telling of Time

The Bokyis could tell the time of the day by looking at the length and position of one's shadow as determined by the sun. When the length and position of the shadow is within or a little away from the legs, it is morning time (ofu), at a length estimated to be half the expected full length of a person's shadow, is midday (Busun boo/zonge), when the shadow moves away from the direction of the sun and more than half the length of a person's shadow, is afternoon (busun boo/fern reshi) and when the shadow remains in that direction and attains its full length, it is evening (busun boo/biri orim). Their ordering of the time of the day coincides with the person's length and position of its shadow. The adults estimate almost correctly the time of the day and this is said to be a function of practice and experience.

Geometric Terms/Concepts

There is a dearth of geometric terms in the language of the Bokyis. Where such terms exist, they are found to be used descriptively; or technically put they are used in the topological sense (example, enclosure, proximity, separation) as the Euclidean notions are lacking in the Bokyi culture. Some of these geometric terms found are shown in Table 1.

Table 1
Geometric Terms in Bokyi Language

English	Bokyi
Straight	Dandang
Line	Busan
Edge	Nkong
Angle	Dyimonge
Circle	Kekere
Round	Kerekere
Length	Butang
Square	Bankobanko

Again, some geometric concepts or forms deduced from the Bokyi cultural artifacts (example, baskets, mats, native drums, thatched houses) included: rectangles, squares, straight lines, curves, angles, circles symmetries, diagonals, parallelism,... The artistry depicted in these artifacts is a rare attribute. These artifacts could have been formed by observing the natural environments, thereby consciously or unconsciously producing these geometric forms.

Mathematical Games /Probability/Rhymes

The people of Boki play various kinds of interesting games. But one of the games with mathematical significance is 'songe-songe' game. In the 'songe-songe' game, a playing object in the form of an Abacus is used. A playing rhyme which runs like this: 'Giri-giri nyangbe ke obi obiu etalo' is used to facilitate the playing of the game (see Abiam, 2006, for details). Songe -songe game could be used to teach counting, subtraction and the concept of probability.

It is possible to teach a child in Boki to count the five fingers using the finger counting rhyme: zim, afee, achat, anyii, atang. This corresponds to one, two, three, four, five.

Implications for Primary School Mathematics Instructions

This study has created awareness of the type of Mathematics that exists in the culture of the Bokyis. Therefore, it has some far reaching implications for curriculum developers, Mathematics educators and teachers of Mathematics at the primary school level. The present school Mathematics is rooted on a foreign culture. This has, to some extent, made difficult its implementation by both Mathematics educators and teachers of Mathematics in the country's education system. Poor pupils background in the subject could equally be attributed to a Mathematics that is dominated by foreign ideas and concepts.

Inquiring into what obtains in the learner's culture or subculture could reveal some of the mathematical ideas that could enhance classroom instructions. Therefore, Mathematics educators and teachers of Mathematics need to investigate rhymes, games, cultural artifacts and Mathematics that

exist in the culture of the pupils they teach. Indeed, the instructional process in Mathematics must reflect the culture of the learners if it is to make sense to them.

The method of addition in the Bokyi culture reveals the idea of place value and writing of whole numbers in expanded notation. Again, the counting rhyme can be used by teachers to introduce counting, to pupils in Primary one.

The songe-songe game provides elements of the culture that could be used to enhance the teaching and learning of primary school Mathematics. When pupils have to solve the problem of how many 'seeds' a player holds up, counting and addition are involved; the number of 'seeds' a player can hold is a probability activity.

Fractions in Boki whether it is 1/3 or 1/5 or 1/50 or 3/4... have one common name. Furthermore, the use of local geometric terms and cultural artifacts with geometric forms would help pupils to understand basic concepts in Practical Geometry in primary schools. Thus, an early awareness of these ideas and concepts in the Bokyi culture could encourage teachers to take them into consideration in their Mathematics instructions.

Conclusion

This paper has attempted to reveal the Mathematics that exists in the Bokyi culture. Its implications for teaching primary school Mathematics were highlighted. If pupils begin to see the link between the Mathematics in their environment and the school Mathematics, their interest in and attitude towards the subject would improve. This would in turn improve their achievement scores and enhance a better understanding of higher concepts in Mathematics.

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Footnote

Bokyi people are in both Nigeria and Cameroon. The study area was restricted to the Bokyis in Nigeria. Bokyis in Nigeria, with a population of over two hundred thousand, are located in the rain forest zone of the Central Senatorial District of Cross River State.

They form the largest contiguous linguistic unit in the Northern part of the State, and occupy the largest geographical area of approximately 3, 500 Kilometres Square.

At present, they constitute one Local Government Area in Cross River State. The geographical area is referred to as 'Boki', while the language spoken as "Bokyi"