WOMEN AND SUSTAINABLE DEVELOPMENT IN NIGERIA: EMPOWERING THE GIRL-CHILD MATHEMATICALLY

By

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ABSTRACT

Fewer females participate in Science, Technology and Mathematics (STM) worldwide. In Nigeria, the attrition increases as one proceeds from primary to tertiary institutions where intellectual capacity to produce and utilize knowledge is acquired. To gain admission into tertiary institutions in Nigeria, a credit in Mathematics in the Senior Secondary Certificate Examination (Ordinary Level) is required of all students. The number of females meeting this requirement is low and so also the number of females who can contribute to national development. To tackle this problem effectively, intervention methodologies should begin from the primary school level where the foundation of learning Mathematics is laid. This paper therefore, discusses the role ethnomathematics can play in empowering the Nigerian girl-child mathematically so that she can acquire the intellectual capacity for contributing meaningfully to sustainable development.

Introduction

Sustainable development can be defined as economic development without polluting the environment or economic development maintained within acceptable levels of global resource depletion and environmental pollution (Microsoft Encarta, 2007). Others see sustainable development in terms of human capacity building. Meena (2005) described

sustainable development as a development process which enhances people's capacity to create and consume wealth on a lasting basis. She further opined that such development requires among others, a socio-economic, political and cultural environment which enables people to engage in and sustain the process. Okebukola (2007) identified four elements of sustainable development namely, environmental sustainability, economic sustainability, social sustainability and political sustainability. For any human capacity building to occur, education of the citizenry must focus on the four elements of sustainability. **All** members of the population have a role to play.

Nigeria's population in 2006 was put at 140,003,542 with 71,709,859 males and 68,293,683 females (FRN, 2007). These figures show that females constitute approximately 49% of the population. Thus, for the Nigeria nation to experience meaningful sustainable development, the female population cannot be ignored. This paper highlights the present situation in Nigeria with regards to female education. The role ethnomathematics can play in empowering the Nigerian girl-child mathematically so that she can acquire the intellectual capacity for contributing meaningfully to sustainable development is discussed.

Where we are

There are more illiterates than literate people in the world today. It was in realization of this fact that the Education for All (EFA), an international commitment was first launched in Jomtien, Thailand in 1990 to bring the benefits of education to "every citizen in every society." It is also a general knowledge that there are more literate males than females in Nigeria and other nations of the world. This drew the attention of the nations of the world which resulted in the Millennium Development goals and in particular goal number 2 which seeks to achieve Universal Basic Education for all children, boys and girls alike by and goal

number 3 to Eliminate gender disparity in primary and secondary education, preferably by 2005 and to all levels of education no later than 2015. Other measures also taken by peoples of the world include that contained in Agenda 21 which is to Measures to eliminate illiteracy among females and to expand the enrolment of women and girls in educational institutions, to promote the goal of universal access to primary and secondary education for girl children and for women, and to increase educational and training opportunities for women and girls in sciences and technology, particularly at the post-secondary level (UNDESA, 2004).

Nigeria being a signatory to these declarations has since pronounced universal basic education for all Nigerian children. But by 2003, the Net Attendance Rate (NAR) was 60.1% that of males was 63.7% and 56.5% for females (Huebler, 2005a). The Figure in the secondary school seems more disturbing. The NAR at this level dropped to 35.1%, with that for males at 37.5% and 32.6% for females (Huebler, 2005b). These statistics show sharp decline of attendance from primary to secondary schools of about 26% and 24% for males and females respectively. These figures drop further in the enrolments into universities with the females getting even fewer. The National Universities Commission (NUC) stipulates that all applicants to the university must firstly; achieve a specified minimum level of performance in the Joint Admissions and Matriculation Board (JAMB) examinations. Secondly, each one of them must have obtained six credits including Mathematics and English at the Secondary School Certificate Examinations (SSCE or O'levels). The inability of many of such candidates to score a credit in Mathematics has resulted in their not being able to gain admission into the university. Of course, once more, more females cannot proceed to the university or other tertiary institutions. It is important to note that it is at the tertiary level of education that individuals develop the intellectual capacity, skills and ability to utilize knowledge acquired for application to activities which will ensure sustainable

development. Thus, Nigeria has a need to increase the number of students getting into tertiary institutions. In recognition of such needs, the World Bank had a package drawn up for developing countries known as Education for the Knowledge Economy (EKE). It is geared towards assisting these countries develop their human resources so that they can equip themselves with the highly skilled and flexible human capital needed to compete effectively in today's dynamic global markets(World Bank, 2008). EKE encompasses a wide range of efforts, comprising:

- Secondary education to lay the foundation of a healthy, skilled, and agile labour force
- Tertiary education to create the intellectual capacity to produce and utilize knowledge
- Lifelong learning to promote learning throughout the life cycle and help countries adapt to changing market demands
- Science, technology, and innovation capacity to continually assess, adapt, and apply new technologies
- Information and communications technology (ICT)to multiply access to learning opportunities for those who need them most (such as out-of-school youth and children with disabilities) and to improve the quality of teaching and learning outcomes

- **Cross-cutting efforts** to rethink the role of the state away from sole provider to enabler and quality assurer, identifying options for sustainable financing, strengthening labour market linkages, and addressing the political economy of reform

Many such programmes have been put in place, but what are their impacts? Adeyemi and Akpotu (2004) reported that a gap existed between females and males in university enrolment in all aspects but wider gap in sciences and science-based discipline. This was collaborated by Aguele and Agwagah (2007) who noted that university enrolment in Science Technology and Mathematics appears to favour the males more than the females for 12 states in Nigeria as shown on Table 1 below:

Table 1: University Enrolment in STM for 1998/1999, 1999/2000, 2000/2001, 2001/2002 Academic Sessions for 12 states

Year	Technology		Science		Total	
	M	F	M	F	M	F
1998/1999	4830	1011	4000	1900	8830	2911
1999/2000	7800	1500	6800	3500	14600	5000
2000/2001	8468	1400	9460	3924	17928	5324
2001/2002	7840	2400	10450	3650	18290	6050

Source: Federal Office of Statistics 2003 Abstract in Aguele & Agwagah, 2007

For each of the areas, females constitute less than half the number of males. This trend must be reversed. According to Levine et. al., (2008), the size and competitiveness of tomorrow's labour force will be shaped by today's girls' education and skill building and by how much these girls use their education and skills in formal and informal economic activity. This paper therefore, discusses the role ethnomathematics can play as an intervention strategy f empowering the Nigerian girl-child mathematically so that she can acquire the intellectual capacity for contributing meaningfully to sustainable development.

Ethnomathematics as an intervention strategy

Ethnomathematics is defined as the way different cultural groups mathematise (count, measure, relate, classify and infer) (D'Ambrosio, 1984). Pompeu (2005) opined that ethnomathematics refers to any form of cultural knowledge or social activity characteristic of a social and/or cultural group that can be recognized by other groups such as 'Western' anthropologists, but not necessarily by the group of origin, as mathematical knowledge or mathematical activity.

The Nigerian girl child is involved in domestic activities especially in the rural areas and in

poor families. These activities range from carrying water, caring for the younger ones and doing chore. The chores may include weaving of baskets, designing caps or calabashes, plating and so on. Such activities are perfect experiences for teaching concepts in Mathematics. According to Hardaker (2004), when one does the art maths happens. There is also the call for mathematics educators to bring theory and practice together by harmonising practical day to day use of mathematics with mathematics taught in school (Nunes et. al.).

Mathematics exists in the cultural practices of every group of people. As noted by Lave (1988), Mathematics in the "real world" is shaped by the dynamic encounter between the culturally endowed mind and its total context. Thus if mathematical concepts in the cultural activities of the child are identified, the children will find it easier to learn such concepts since they will be interacting with familiar materials. As noted by Saxe (1990), increasing evidence show that children gain mathematical understanding through their participation in out-of-school cultural practices. Also, from the social constructivist viewpoint, it is important to take into account the background and culture of the learner throughout the learning process, as this background also helps to shape the knowledge and truth that the learner creates, discovers and attains in the learning process (Wertsch 1997).

For an illustration of this point made above let's take a look at Figure 1 below. The figure shows the caps worn by males in the Northern parts of Nigeria. These caps are usually sewn by women in their houses. The girls do lend helping hands to assist their mothers complete the work. A close look at the designs shows some geometrical plane shapes such as rectangles, triangles, circles and so on. Other concepts that can be taught using these caps are symmetry and transformation (tessellations), cylinder, surface area of cylinders and volumes. Thus, caps like these which are available in all homes and communities of the Hausa speaking people of Nigeria come in handy when these concepts are to be taught to children

living in such communities.

Figure 1: Caps

Another cultural activity from which mathematics concepts can be identified is the calabash crafting. This is an age long traditional activity in the Northern parts of Nigeria. It involves the use of plane shapes, lines and curves and can be used to teach these concepts effectively (Figure 2). Sphere, hemisphere, circles and their properties, capacity and using a whole calabash to represent the earth, Longitude and latitude can be drawn on its surface.

Figure 2: Straw Mats and Calabashes

Other cultural materials that also depict mathematical concepts are the wrappers (cloth)

manufactured in Nigeria. They are usually colourful and show many plane shapes, lines and curves (Figure 3). These wrappers are available and used by people both in the urban and rural areas. So they are good resource materials for teaching.

Figure 3: Nigerian Textile Materials (Wrappers)

Figure 4: Fulani Straw Hat and Garments

Other traditional woven cloths also have mathematical concepts embedded in them. Examples are the traditional Fulani cloth shown in Figure 4 above. Other communities all

over the country have their traditional clothes and are also useful for teaching some mathematical concepts.

Solid or 3-Dimensional shapes are used in bead making, for example, cylindrical and spherical shaped beads (Figure 5). Circular and rectangular ornaments are also used. Examples of irregular shapes can be presented. The beads can also be used for counting, teaching colours, basic operations

To teach composite shapes, the huts lived in by the Fulanis (Figure 6) can be described as a cone sitting on a cylinder with a rectangular door. Some other communities have triangular prism sittinh on a cuboid or cube. Even the houses in the urban areas are made up of composite

shapes.

Figure 5: Ceramic Beads

Figure 6: Traditional Fulani Huts

Food stuff such as rice, gari, granulated sugar, salt and so on are displayed in large bowls in such a way that the visible part is in the form of a cone and the bowl a hemisphere (Figure 7). This is a common site in our market places.

Figure 7: Bowls of Rice Grains

For children in urban or semi urban areas, modern buildings do play a role in teaching a number of mathematical concepts. Such concepts include geometrical shapes, parallel and

perpendicular lines, horizontal and vertical lines, planes and so on. The concepts will depend on the building under consideration. Children from rural communities can take a trip to see such buildings (Figure 8) and thus have the opportunity to learn the concepts practically. 

Figure 8: 1000 Seat Auditorium, Nasarawa State University, Keffi, Nigeria

There are so many Nigerian cultural activities too many to mention, that are amiable to the teaching of several Mathematical concepts. A visit to the market in a yam producing area exposes the children to the numbers used frequently to display the yams. For example, in Keffi market, in the North Central Zone of Nigeria, Yams are put in 5s, 10s, 20s, 50s or even hundreds (Figure 9). This implies that the child in this area is already familiar with counting in these numbers. Number bases can therefore be introduced from this previous knowledge. These familiar grounds should be brought to the mathematics class so as to show a relationship between classroom mathematics and everyday living.

Figure 9: Yam Tubers

Gilmer (1999) noted that tessellations is widely used and understood by African American hair braiders and weavers but they do not think of it as being related to mathematics. This is also the case with hair braiders and weavers in Nigeria. Gerdes (1998) collaborates this finding but adds that mathematics is in other cultural activities such as ceramic, beading, mural decoration, tattooing, and so on.

There are many other cultural activities that can be studied such as hair braiding, folklores, bronze casting, games, festivals, traditional religions, wood carvings, pottery, mat and basket weaving, and so on. Every mathematics teacher needs to begin to turn to the culture of the community they teach to find materials that will make learning mathematics not only easier for the child but exciting too.

Conclusion

Every activity of a group of people has some mathematics in it. Since learning is easier from known to unknown, identifying the mathematical concepts in the cultural activities of a people and using it as a starting point for classroom teaching will go a long way to demystify mathematics. The need to do this is even more for girls so as to attract them to study mathematics. This will enable them acquire the knowledge necessary for them to contribute meaningfully to sustainable development of Nigeria.

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