Women and the Fear of Mathematics: An Analysis of the Myths and Realities in an ODL Context

The paper identifies and examines various beliefs, as encapsulated in myths, proverbs and folktales and how these hinder girls from developing and maintaining a sustained interest in the Mathematics and the Sciences from the primary school level. In spite of the gallant strides women have made in almost all sectors of the economy, their number and achievements are still negligible in comparison to their male folks. The myriad of possibilities and opportunities of Open Education Resources notwithstanding, the number of female undergraduates in Science, Technology, Engineering and Mathematics (STEM) courses at the National Open University of Nigeria (NOUN), an ODL institution, is relatively small. Using the Agindingbi Study Centre, the largest of all the institution's study centres (in terms of student population) as a case in point, the paper carries out a comparative gender analysis of the number of Computer Science undergraduates in the first year and the final year, noting that the number of the female undergraduates decreased considerably. The paper conclusively suggests a number of ways in which e-learning can be made more attractive in Nigeria, especially for women, and how it can be creatively used to deconstruct the myth of Science and Mathematics, thereby increasing the number of women into courses usually dominated by men.

Keywords: Women, Mathematics, Myths, eLearning

Introduction

Social conditioning has provided two sets of training manuals for the male and female. The general intention is that there should be mutual coexistence between the two sexes in a particular environment (Azeke, 1994; Erinosho, 1994; Matsui, 1990). Each society enacts laws and regulations to guide the relationship of all its members to one another, thereby promoting peaceful coexistence amongst all. However, the pattern of the social conditioning has over the centuries been favourably tilted towards a particular sex against the other. This has remained so because many societies are patriarchal in nature, and its mechanism is premised on the fact that one sex is inferior to the other. Patriarchy thus uses this as a working tool to maintain the status quo of members of the male sex being naturally more endowed with positive qualities that are needed for driving a society forward. The belief about each of the sexes is further institutionalised in myths and folklore created to give a veneer of legality to the status apportioned to members of the *weaker* sex.

From childhood therefore, men and women are guided into believing that each are *naturally* endowed with particular attributes which may promote or hinder their participation in nation building. The result of this misconception is seen in all sectors of the economy: politics, Science

and Technology, policing, Mathematics, finance, space, to mention a few. Many of the key sectors necessary for the acceleration of a country's development are driven by men, with support from a few number of women. This is particularly so in the field of Science and Technology. Ironically, the Nigeria 2006 census figures show that of the 100 million people in the country, women make up more than 60% of that figure. However, as at 2011, the National Population Commission reported that Nigeria is made up of a whooping number of 167 million peoples, taking up the 6th position in the most populous countries in the world. (NPC, 2011). Of the 167 million people, the men take up a larger number in most of the 36 states of the country, as the table below shows:

S/N	STATE	MALE	FEMALE
1.	Abia	1,430,298	1,451,082
2.	Adamawa	1,607,270	1,571,680
3.	Akwa Ibom	1,983,202	1,918,849
4.	Anambra	2,117,984	2,059,844
5.	Bauchi	2,369,266	2,283,800
6.	Bayelsa	874,083	830,432
7.	Benue	2,114,043	2,109,598
8.	Bornu	2,163,358	2,007,746
9.	Cross River	1,471,967	1,421,021
10.	Delta	2,069,309	2,043,136
11.	Ebonyi	1,064,156	1,112,791
12.	Edo	1,633,946	1,599,420
13.	Ekiti	1,215,487	1,183,470
14.	Enugu	1,596,042	1,671,795
15.	Gombe	1,244,228	1,120,812
16.	Imo	1,976,471	1,951,092
17.	Oyo	2,802,432	2,778,462
18.	FCT Abuja	733,172	673,067

(National Population Commission, 2013).

However, whether there are more men than women or vice versa, patriarchal structures and institutions have made it difficult to shift ideas and policies in favour of the empowerment of women. The inequitable relationship between the men and the women starts from within the confines of the home, where boys are encouraged to be daring, inquisitive, and adventurous, while girls are conditioned to be homely, caring and submissive. These social expectations are extended towards the number of school age children that are admitted into primary schools. In an April 2013 statistics of the UN Millennium Development Goals Survey provided by the National Bureau of Statistics, the percentage of girls that entered primary school nationwide was higher than that of boys, and at the final year, primary six, plummeted down, lower in percentage than that of the boys:

Percentage of Children of Primary School Age as at April 2013:

SEX	**PRY. 1(%)**	**PRY. 6 (%)**
Male	33.7	98.2
Female	37.3	97.0

Many factors could be adduced for the fewer number of girls at the final year level of primary school. But the chief among them is the social factor, which opines that girls are education can always be side stepped as their primary role is to be wives and mothers. Even though there has been an increased number of girls in school, from the primary to the tertiary levels, in particular contexts where a decision would have to be made between the boy and the girl staying in school, the decision would most likely be favour of the former. Social conditioning of boys and girls also influence the subjects girls and boys are encouraged to have interest in. Many myths are built around some subjects, so much so that this affects the number of boys and girls that, for example, are take to Science and Mathematics, and the same in Home Economics and Food & Nutrition.

Social conditioning carried out through the creation and assimilation of particular types of folklore, especially myths, proverbs and folktales, also influences woman's participation in the formal sector. In the field of education, for example, many female academics in the more than a 100 universities in Nigeria are in the lower and middle positions on the hierarchy, with few women professors in relation to the number of male professors (Udeani and Ejikeme, 2011). In a general household survey conducted by the National Bureau of Statistics in conjunction with the World Bank for the year 2010/2011, the number of women in core sectors of the economy including education and science and technology related sectors were negligible:

S/N	**MAIN WORK**	**MALE**	**FEMALE**
1.	Agriculture	49.1	33.3
2.	Manufacturing	3.2	1.0
3.	Construction	4.9	0.1
4.	Buying and Selling	10.5	37.0

5.	Personal Services	8.7	9.1
6.	Education	4.5	3.7
7.	Public Administration	4.8	2.7

As the table shows, the few number of women in public administration translates into few policies that will equip them to contribute significantly to nation building.

'The Male is Maths, the Female is English'

> Educational bias and prejudices steer girls/women
>
> towards the arts and humanities, whereas boys and
>
> men are prepared for Science and technology.
>
> (Federal Ministry of Education, 1989).

The physical and mental attributes ascribed to boys and girls further provide the material to create myths about particular subjects. In other words, some subjects assume masculine features, while others are seen as feminine in nature. Therefore, boys that are interested in subjects or issues classed as 'feminine' are usually regarded as 'soft' and 'unmanly'; while girls who are in male dominated courses like Engineering, vocational and entrepreneurship training courses, Construction, Science, Technology, Woodwork, Metalwork, Aviation, Public Administration, Political Science, amongst others, are praised and addressed as 'men' for doing the impossible: breaking into the man's world.

The Educational Ordinance enacted by the British colonial government in 1926 reflected the Victorian philosophy of the British colonialists that women are fit for only the 'caring' professions, and so girls taught domestic subjects like cooking, needlework, nutrition, nursing, amongst others, while boys were engaged in skills involving gardening, woodwork, medicine, to mention a few. More boys than girls sit for Science and Mathematics oriented courses like Physics, Chemistry, Statistics, Technical Drawing, and Further Mathematics. Matyas (1985), Mama, (1996), Isa and Balarabe, (2009) have observed that girls and women are generally less inquisitive and less adventurous in identifying and creating new ideas.

Mathematics, one of the core components of Science and Information Technology, has generally been deified to assume a larger-than-life status. It is believed that it is abstract, tough and complex and that only aggressive and intelligent minds can conquer it, and these minds naturally belong to the boys. Thus, many girls and women shy away from any subject that involves a fair amount of calculations (Hyde and Linn, 1988). If only women know that a large amount of their

daily living involves some Mathematical calculations: their market transactions, their decisions pertaining to the care of the family and the organisation of their homes, the management of scarce resources at home and at the office, to mention a few, all these are mathematically based. But many women have been conditioned to believe that Mathematics is not their forte. Many girls are not trained to be confrontational, critical and to ask questions; whereas boys are conditioned to be speak out, laugh loudly, defy odds, achieve results, be analytical in their thinking, and to challenge situations.

A number of factors apart from the social conditioning undermine women's interest in Mathematics and its related subjects, some of which include domestic responsibilities and marriage, child bearing/rearing, poor exposure to Mathematics and Science subjects from secondary school, inefficient library services, lack of female role models, epileptic electricity supply, inadequate and out modeled Science laboratories, and Mathematics is poorly taught. The tremendous contributions of women in Information Technology, Science, and Mathematics notwithstanding, their number, impact and visibility remain low. The patriarchal belief that Mathematics is a tough and demanding field that can only be successfully handled by men contrast sharply with centuries-old religious and cultural beliefs and practices, of which folklore plays an integral part, that women are weak, soft, petty, talkative, subjective, emotional, and incapable of grappling with profound complex ideas and issues. Women are therefore fit for disciplines such as language, literature, religion, nursing, food and nutrition, teaching, etc.

Myths on gender restrict the potentials and abilities of women to a very limited sphere that women are still trying to break away from, which is, women have over the years fought to expand the space through their ideas and contributions to nation building. Myths are being created and recreated to reflect contemporary times and thoughts, and so we have political myths (of Marxism, democracy, socialism, post colonialism, liberalism, and other 'isms'); economic myths of globalization, free markets, first, second, and third worlds. Myths are generally perceived to be sacred and binding. Even though Levi Strauss (1970: 12) defines myths as "operating in men's minds without their being aware of the fact", and David Bidney (1973) states that myth is not a conscious creation of individuals but is rather a product of man's spontaneous expression of emotions, the formation of myths transcend spontaneity and involves a good amount of consciousness and deliberateness. Myths are formed from a creative consciousness, transmitted orally over time, and manipulated by their users to achieve specific aims.

Many patriarchal myths undermine women's efforts and accomplishments by describing them as "manly" and new myths are created to diminish the popularity of some Nigerian heroines. For example, a female reagent, Pupupu, the founder and first ruler of Ondo Town, was eventually deposed because of the vote of no confidence passed on her by her male chiefs because of her perceived rigid stance. A myth was created and popularized that she was asked to step down because of her frivolities in attending to family matters and to her poultry. The same negative myth was woven around a 12th century female ruler, Oluwu, of the ancient Yoruba city of Ile Ife.

In spite of the innovative ideas she introduced in buildings and construction of roads, which are still visible in the town today, she was deposed and the myth was that she was a slave driver who made her subjects to work all day. Her case is usually cited as the reason why women cannot be traditional rulers of Ile Ife (Kolawole, 1994).

The different reasons given for women's fear of Mathematics can be categorized under three broad classes – biological, social and psychological. The biological posits that women are naturally weak and of not much intelligence and so cannot cope with the complex demands of sums and figures. They should therefore be confined with domesticity and nurturing children (Broverman *et al*, 1998; Benbow and Benbow, 1984).The social dimension cites women's natural docility and passivity are contrary to the demands of Mathematics (Birkeil, 1986). In line with this reasoning, the cognitive development theory asserts that a particular social process ascribes particular gender expectations to each sex. The social learning theory further posits that the home and the school play significant roles in the socialization of girls into gender-specific roles. The psychological reasons given for women's fear of Mathematics revolve around personality variables like interest, attitude and self concept. In all these, boys respond more positively because they are conditioned to be inquisitive and adventurous, while girls are more interested in the 'emotional' aspects of Science, like Medicine, Nursing, and Pharmacy. Engineering, Information Technology, Construction, Technical Drawing, Wood and Metal Work are still fields yet to be fully explored by women. The self concept personality variables attributes women's low interest in mathematically inclined courses to their (that is, women) poor perception of themselves as a result of the inferior status ascribed on them (see Matyas, 1985; Ehindero, 1986; Erinosho, 1994).

Women + Mathematics + ODL

The average Nigerian woman comes with the negative social conditioning ascribed for her into the new possibilities offered by open distance learning (ODL) education. Departing greatly from the conventional mode of education, which has, among other characteristics, fixation of hours for lessons, physical structures as classrooms, face-to-face teaching interactions, inability to assuage learner disabilities, amongst others, the ODL education emphasises accessibility to knowledge and information, flexibility in terms of learning hours, methodology, testing, course content, to mention a few. Rotating on the axis of information technology, ODL through open educational resources, caters for the 'left overs' from conventional institutions, that is, those who could not meet the rigid entry requirements for admission. These include, amongst others, secondary school leavers, housewives, labourers, women in purdah, and nomadic women.

The availability of the internet and the accessibility to owning a mobile phone have further made open distance education acceptable by many people. Though still seen by some as not been able to give a total education in terms of content, open distance education has come to stay, as seen in

the practice of many conventional universities operating distance learning institutes simultaneously with the traditional ones. The major tool of knowledge dissemination is through e-learning, which is synonymous with other terms as online learning, open learning, virtual campus, global classroom, technology-mediated learning. Through open educational resources like the internet, intranet or extranet, satellite television, CD-ROM, audio or video tape, video and audio online conferencing, students can receive lectures, engage in group chats or tutorials, submit assignments, receive advice and counseling, to mention a few. Through e-learning, transfer of skills and knowledge occurs in a matter of seconds through time and space.

First generation learners were taught in the conventional mode, leaving one's home or office to attend classes in a top down teaching style of the teacher talking down at the student. Over time, this form of education was complemented with distance education through correspondence education, adult education centres, weekend programmes, part time programmes, and teachers' institutes. This was the experience of second generation learners, and the present learners, the third generation, are taught through the Open University system, distance learning centres, and a combination of some of the other examples cited above.

How do the benefits and advantages of open distance learning impact positively on the productivity of the average female Science undergraduate? First, the benefits. These include cost effective of running a programme, consistency of information and skill transfer, accessibility to information, elimination of age barrier, as even septuagenarians are eligible, dropout rates are minimal and a great reduction in illiteracy. However, there are many challenges that may hinder the female undergraduate, especially of Mathematics and Science, from gaining maximally from these benefits. The first barrier is the social conditioning that restrict women to nurturing courses, 'soft' and 'safe' courses that align with patriarchal labeling of women. Thus, few women dare to break the social barrier and enter into a man's world. These few women encounter some problems in the course of carrying out, for instance, their assignments, which may entail going to a cyber café or a telecentre. The accessibility of these centres and their operating hours may constitute safety hazards to female students.

A major constraint is that Nigeria is yet to fully develop its engineering and technological depth and this would impact on service delivery. Another challenge is constant electricity, which should constitute a basic necessity to any ODL student, for everything becomes impossible to access without electricity. Generators are more expensive to buy and maintain. Other challenges include the poor awareness of e-learning among employers and students; low computer literacy among university students (Brennan, 1991); men tend to have an easy flair for computers and IT gadgets than women, as evidenced in the higher number of male students in the Computer Science unit of the Agidingbi study centre of the National Open University of Nigeria. There is also the high cost of implementing and maintaining hardware resources, especially in terms of available funding. All these barriers further discourage female students from pursuing a course in Mathematics or the Sciences.

The 2012/2013 registration report of Computer Science students of Year 1 and Year 4 was of the Agidiingbi Study Centre, the largest of all the study centres of the National Open University of Nigeria, was analysed. In the first year out of a total of 85 students, 23 are female, while in their final class, Year 4, out of a total of 108 students, 37 are female, less than half of the total number. These low figures further highlight the thrust of this paper about social conditioning that prevents women from pursuing Mathematics-based courses. We have to use Computer Science because there is presently no Mathematics department in the institution, and because Computer Science reflects the Information Technology ODL is premised on.

However, the ODL system can put in place certain processes and structures that will enhance women's full participation in Science and Mathematics related courses. Below are some of the recommendations:

- The Learner Support unit should be expanded or upgraded to include electronic face-to-face interactions with existing undergraduates and potential ones, in order to enhance the level of interaction.
- The provision of telecentres which registered students would be eligible to use, without the fear of molestation that they might otherwise exhibit if they are to use the ones that are privately owned.
- Gender training workshops should be organised for facilitators and course writers, so that course materials would reflect gender sensitivity.
- Projects that are 'blind' in the areas of gender, race and religion should also be encouraged to enhance wider participation from all. For example, the creation of virtual libraries.

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