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Balancing The Equation: Girls, Tradition and Science Education in Northern Nigeria

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Despite the diversity of curriculum reform activities in science education all over the world, surprisingly only few projects were aimed at providing opportunities for girls to study science education, especially at pretertiary level of education, and particularly within governmental framework of provisions for education.

However, in Kano State, Nigeria, a move was made in 1981 by the Kano State Government to provide full facilities for girls from Kano State to study all the range of science subjects as part of a large scale science education strategy. The Science Secondary Schools Project. This monograph examines the development of the Girls' Science school.

The findings of the analysis indicate that the Kano State Girls' Science School, arising out of a traditional culture where modern women education has not made significant impact on the society is a bold attempt at providing a long term solution to the problem of encouraging girls to study science. As this monograph shows, the project is still hedged about with problems, which mainly arose due to inadequate administrative planning. But the students, isolated in a fiercely competitive climatic offering of science education, do show strong inclinations to perceiving science as a force in their lives.

موازنة المعادلة

الفتيات والتقاليد والدراسة العلمية فى جنوب نيجيريا

د. عبدالله ابو ادمو - قسم التربية - كلية التربية/جامعة بيارو- كانو - نيجيريا

بالرغم من تعدد وكثرة المحاولات والانشطة لتعديل وتحديث مناهج العلوم فى شتى انحاء العالم ، الان عدد قليل جدا من هذه المشاريع تم

اظهرت النتائج بان هذه المدرسة بالرغم من ظهورها فى مجتمع تقليدى حيث لايوجد دور بارز للمراة الا انه يمثل حجر الاساس لحل طويل المدى لتشجيع الفتيات لدراسة العلوم ٠

ولكن كما هو واضح فان هناك العديد من المعوقات الادارية ٠ وبالرغم من هذا فان الطالبات اظهرن اهتمام شديد لتعليم هذه المواد حتى تمنحهم مصدر قوة فى حياتهم المستقبلية ٠
توجيهها لخلق فرص من اجل تعليم الفتيات العلوم وخاصة فى المراحل الاولية من داخل الاطار الحكومى للتعليم ٠

بدات حركة النهوض بهذا المجال فى كان - نيجيريا عام ١٩٨٠ وذلك بتدريس الفتيات كل محاولات العلوم وذلك حسب الخطة الموضوعة فى مشروع مدارس العلوم الثانوية ٠ يحاول هذا البحث رصد التطور فى مدرسة العلوم الخاصة بالفتيات ٠

Introduction

Despite the diversity of curriculum reform activities in science education all over the world, there were surprisingly only few studies of projects in the literature aimed at providing opportunities for girls to study science and technology disciplines, especially at pre-tertiary level of education, and particularly within governmental framework of provisions for education. This is despite a lot of evidence which reflects growing concern about lack of representation of women in science and technology in all cultures.

For instance, during a Workshop on the Enhancing of the Participation of Women in the Popularisation of Science and Technology held in Dhaka, Bangladesh 19-25 January 1987, a common report of the participants was that:
women and girls are disproportionately underrepresented in science and technology education and as a consequence, also as professionals and technicians in the science and technology disciplines (Commonwealth Secretariat, 1987).

Other studies in various cultures in both developed and developing countries reported similar findings (Combet and Keeves, 1973; Auvien, 1970; Erickson and Erickson, 1984; Okereke, 1986; Kelly 1976, 1981; and Haley-Oliphant, 1985). For instance, Duncan (1989) reports that:

It is difficult to find comparable information on the patterns of educational achievement and participation in different fields of study among girls and women in Africa. However, the information which is available indicates that, as in industrialised countries, women are consistently under-represented in science courses at the secondary and tertiary levels. (Duncan 1989 p.11).

Yet again other studies (e.g. Hardin 1983) suggest that girls are virtually "switched off" studying science subjects because of cultural and social stereotypes that fixed the roles for boys and girls which reflect themselves in the schooling process. The behavioural stereotype for girls held by both fellow students and teachers was one of the factors 'switching' them off studying science subjects in schools.

However several intervention projects were started in many countries aimed at encouraging girls, especially at secondary schools to perceive science as a force in their lives - both through study and career prospects. This is because as Hardin (1987) argued:

One of the things that has been learnt over the years is that the problem of women and science is complex and requires long-term and sustained programmes for its solution (Hardin 1987 p.7).

Most of these efforts were started by organizations and individuals with a concern for girls in science education, and mainly in developed countries. These included GIST (Girls in Science and Technology) in Britain, Handover Project in the Netherlands, Sex Equity Department of the Government of Sweden, and the Al-Ahram Science Club of Egypt (Haley-Oliphant 1985). There were only few studies of government initiatives in either developed or developing countries aimed at enhancing the participation of girls in Science and Technology disciplines which would enable them to make a more effective contribution to a New Social

Order. Within this framework, this paper provides an insight into a Nigerian government project aimed at enhancing the participation of girls in science and technology through educational programmes.

Methods of Study

Data for the paper was collected during field work conducted for a larger study (Adamu 1988) which explores the effectiveness of manpower development strategies through science education in Nigeria. Information was collected from various documents (both published and unpublished government reports), as well as interviews with key government officials concerned with the project. The massive database generated by the main study provided opportunities for individual studies of specific aspects of the study; of which this paper is one such individual study.

Girl's education in Kano State

No study of girls and science education in a society such as Kano State can take place without first providing an overview of the general education process in the state, especially as it affects girls.

Modern education (i.e. education with roots in Nigeria's colonial past) has never been fully accepted in Kano, especially for girls, because of the historical antecedents which linked the development of education with Christian missionary activities in Nigeria. This was because of the Islamic nature of the people of Kano State who see any links with missionary activities as threats to their Islamic way of life. As a Kano State government Committee (The Galadanchi Committee) set up to analyse the problems of education in Kano observed:

> There is still, in our society, the lingering suspicion of Western education as an agent of Christianity. As a result of this suspicion, it is difficult to convince a great number of our people of the desirability of sending boys to school, let alone girls (Kano State 1976 p.35).

The gravity of the situation as it affects the enrolment of girls into western type schools in Kano is shown in Table 1.

Table 1. Kano State, Nigeria Post-Primary students, 1962-1970

Post Primary Students			
Year	Total	Girls	%
1962	1998	480	24
1963	2465	622	25
1964	2746	452	16
1965	3310	788	23
1966	3512	863	24
1967	3404	771	22
1968	3999	864	21
1969	4707	804	17
1970	6159	939	15
MEAN	3588	731	20

Source: Kano State, 1970

Table 1 suggests a small number of girls in relation to the number of boys who attend post primary schools in Kano State over several years. For instance, the highest percentage of girls in schools was in 1963 when girls constituted only 25% of the post-primary school population in Kano.

The significance of the educational underrepresentation of girls in Kano in Table 1 is more so when the total population of girls of post-primary age in Kano is taken into consideration. According to the 1963 census figures (the most reliable in Nigeria), the 10-14 female population (the bulk of the post-primary population) in Kano was 26,8933 - out of which, for instance in 1962 only 480 were in post-primary schools.

The problem of low enrolment of girls in western type of schools in Kano State persisted up to the 1980s, when the transition rates of girls from primary to secondary schools in Kano was only 12% in 1981 (Kano State 1983).

Balancing The Equation: A Government Initiative

However, in 1977 the Kano State, Nigeria government, worried by total lack of indigenous scientific and technological manpower necessary for social and economic development started a Science Secondary Schools Project to combat the problem. The idea was to select students from all Junior Secondary Schools in Kano State through a competitive screening examination, and those who pass would then be placed in specially created Science Secondary Schools. Due to the high priority given to the entire project, the Kano State government did not spare any expenses in maintaining the schools. The schools were also administered separately from the Ministry of Education through an independent body called Science and Technical Schools Board.

The project started in September 1977 with two boys' schools; it was only in 1981 that a girls' Science Secondary School was created. In 1985 and 1987, two more schools, one for boys and the other for girls were started respectively. This brought to five the total number of Science Secondary Schools in Kano State by 1988. Both the entire concept of the Science Schools, as well as special provisions for girls to study science in under the framework of the Science Schools were the first moves of their kind in Nigeria's educational development.

The special entrance examination to the Science Secondary Schools acknowledges differences either in direct achievement between boys and girls, or in the processes that influence achievement since they are weighed in favour of the girls.

For instance, girls who scored 30% in the examinations are admitted to the schools, while boys have to score a minimum of 40% in the selection examinations. While this was aimed at encouraging girls to be admitted for the schools, selecting girls on this basis has a ricochet effect, as we will soon see.

The most controversial aspect of the Girls' Science Schools was in the range of subjects

offered to them. The six core subjects associated with science and technology careers are compulsory to them - as for boys. In essence, this is the most distinguishing characteristic that makes the Science Schools different from the non-science schools - the lack of subject option system in sciences. The core subjects are: Biology, Physics, Mathematics, Geography and English. The discrimination - some may perceive it as such - against the girls is that they must also offer a choice of either Home Management or Food and Nutrition. In the boys' schools, the six core subjects are also compulsory, but in addition, the boys can choose two electives from Technical Drawing, Agricultural Science and further Mathematics. The overall idea is for the students in the Science Secondary Schools system to offer nine subjects for Senior School Certificate Examinations (SSCE). The girls were therefore not given chances of studying 'technical' subjects within the science schools system.

In the face of lack of girls in general schooling system, establishing the two Girls' Science Secondary Schools in Kano State would certainly seem to be a radical move away from the tradition. In the end, it emerged probably as the only way in which girls could become exposed to science and technology disciplines. The science school for girls appears therefore to be unique because it was the first time the Kano State government (or any other arm of the Nigerian government) has made such explicit statement about the science education of girls.

By 1987, the total population of the Girls' Science Schools was 560 (Science and Technical Schools Board, 1988). It is in this figure that the Kano State policy initiators of the project see the Girls' Science Schools as something of an achievement: creating a learning context where over five hundred girls from a predominantly conservative Muslim State such as Kano State learn the main core science subjects on a nonoption basis necessary for scientific and technological career advancement.

However, the importance of participation of women in science and technology has become recognized by the Nigerian government, especially after the establishment of the Girls Science

Secondary Schools. As The Triumph newspaper of Monday 29th May 1989 (p.2) reported:
Over N 300,000 has so far been spent this year by the women education unit of the federal Ministry of Education to promote the education of girls in the fields of science, technology and mathematics. The ministry has also launched a women education Science Technology Mathematics (STM) scholarship scheme to cover tuition, boarding, transportation and books for senior secondary school girls in the federal and states secondary schools.

In a more radical move, the Fedral Ministry of Education intended establishing new Federal Technical colleges at Akwa Ibon (in Southern Nigeria) and Sokoto (in the Far North of Nigeria) States for girls only. The literature on Science Education in Africa reveals this is one of the first strategies of its kind in any class of manpower development initiatives (see, for instance, Duncan 1989).

Perhaps not surprisingly, even in this move to provide more opportunities for girls to study science education within a legislative framework, especially in a traditional society such as Kano, elements of stereotyped stratification from officials about the students' eventual careers was somehow inevitable. For instance, in most official statements, it was made clear a major objective of the Girls' education in Kano is to produce women doctors and nurses. Not much emphasis was given to the need for the production of women engineers, geologists, aeronautic engineers, computer scientists, veterinary doctors, or agricultural engineers. As an official rationalized:
if you go to the Hospital today, you will find that up till now the ratio of medical personnel is more men to few women attending to females; you see more men attending to female patients than females attending to female patients. By the establishment of the Girls' Science School, this problem should be reduced. Interview 29/9/1986).

This expectation, of course, may also be a reflection of Kano State economy and social structure; women doctors may be in higher demand than computer scientists or engineers. However, the expectation that girls should enter into the

"caring professions" is prevalent in many other countries. For instance, Kelly et al (1982) carried out a survey of gender roles at home and school and found that British parents rate the job of doctors and nurse for girls on higher mean rating of suitability than for boys.

Further, the reluctance to perceive women as engineers or scientists is a general Nigerian problem, not only limited to the socio-cultural characteristics of Kano State alone. For instance in 1984 a lady mining engineer wrote to The (Nigerian) Guardian newspaper to narrate her: bitter experience with our government for pursuing the course of my choice which I thought was for both sexes. I am a holder OND (Ordinary National Diploma) in Mining Engineering from one of the fedral Polytechnics in the country and looking for Industrial Attachment to enable me to undergo my Higher National Diploma programme. But surprisingly my application was orally turned down by a director in the Ministry of Mines and Power, saying he finds no reason why ladies should go for the course (Mining Engineering). I could not understand this in a developing country and regard it as mere jealousy. I am already in for mining. I am afraid nobody can stop me from the course and I will not be discouraged. But for the sake of ladies that may be queuing up for it, I advise the government to include in the entrance forms to all the higher institutions in the country the courses considered for both men and women. (The Guardian 3 April 1984 p.6).

This case was investigated by a then newly formed organization - the Association of Professional Women Engineers of Nigeria (APWEN) - which acknowledges that sex discrimination is prevalent in all labour sectors of the Nigerian society. As the President of the APWEN explained: male bosses treat women engineers like secretaries ... They do not give them tasking jobs, and on few occasions when that is done, a male engineer would be attached to handle the job with the woman. (The Guardian 6 May 1984 p.4).

These are problems acknowledged, although a solution - beside counselling - does not seem readly provided, even in developed countries. For

instance, it was argued that in Britain:
a major barrier to women employment is the current social climate which still considers engineering as a male preserve. This results in young people being encouraged to view technological careers as for men only. In view of the low number currently employed in these occupations, girls are unlikely to know women technicians, scientists or engineers personally (Watson 1984 p.11).

The role of the Girls' Science Schools in Kano State in attempting to balance the equation can be better appreeciated against this background.

Outcomes of the project

As is the case with the whole Science Secondary Schools Project in Kano, the main criteria used to determine the success of the project are the ordinary level examination results of the students. Government officials argue that establishing the schools has enabled a production of higher number of science students, including girls, who can go on to higher institutions. The results of the GCE Ordinary level examination taken in the Taura Girls Science School since 1984 are shown in Table 2.

Table 2. Taura Girls' Science Secondary School Summary of GCE Level Examination Results, 1984-1988

Although the students offer Geography, Mathematics and Physics - good combinations for astrophysics, geology, aeronautic engineering, mining engineering etc, nevertheless their achievements in Physics and Maths would seem to steer them more towards nursing and catering professions than hard core sciences. This is reflected in their relative successes in Biology and Chemistry.

This observation is borne out by an analysis of the results of the Taura Girls' Science School in Table 2. As the table shows, although there was a mean pass rate of 56% in all the 10 subjects offered, this was not because of their achievement

Subject	No	Credit	%	Pass	%	Fail	%
Geography	235	77	32	120	51	115	49
Chemistry	362	61	16	171	47	191	53
Biology	364	48	13	173	48	191	52
Physics	364	45	12	116	32	248	68
Maths	364	39	10	116	32	248	68
English	362	31	8	97	27	265	73
Mean	341	50	15	132	39	209	61
Hausa	362	285	78	338	93	24	7
I.R.K.	364	218	60	303	83	61	17
H/MNGMT	63	36	57	62	98	1	2
F/NUTRIT	278	75	26	242	87	36	13
Mean	266	153	58	236	89	30	11
T.Mean	311	91	30	173	56	138	44

Source: Adamu, 1989

in the science subjects. The table shows that the five subjects in which the students were most successful were Hausa Language, Islamic Religious Knowledge, Home Management, Geography and Food and Nutrition.

Hard core science subjects rated low achievement percentage ranging from 16% credit level in Chemistry to 13% in Biology and 12% in Physics. Mathematics and English rated the lowest with 10% and 8% credit achievements respectively. Thus the overall mean results in science were not encouraging. Only 15% of the students got credit level achievements in the six core science subjects, 39% overall passes, and a majority of 61% failed in these core subjects over a period of four years.

These results provide a basis for many possible interpretations. One rests on the assumptions that deal with the intellectual capabilities of girls, no matter their social and economic background. For instance, Ferguson (1981) noted that in more scientific terms, the suggestion

is that girls are not able to "do" science well because of biologically determined inferior mathematical and spatial-visual abilities, and that efforts to improve their participation are futile and misdirected.

However, she further pointed out that such evidence is hardly convincing enough to account for the differences. There does seem to be a variation of the earlier view in Kano State. As the female Principal of a conventional (i.e. non-science) Girls' Secondary School explained:

The students in this school are lazy with regard to science subjects. They really don't want to study maths; and that is what is hampering their pursuing science subjects. And you find that most of them study arts or commercial subjects. They avoid science not really because they have no capacity to study it but because they are lazy. (Interview 15/10/1986).

Another possible reason to explain the girls performance in Science in Table II is more compelling - and rooted in the cultural matrix of Kano society. As a one time Principal of one of the Girls' Science Schools explained:

The serious obstacle to women education in Kano State is that with all the opportunities and necessary encouragement given many girls are not allowed to complete their school. They are withdrawn by their parents in order to get them married early. The academic performance of those allowed to continue is affected by the marriage contract. Girls whose marriage contract are made while they are still in school often feel that their future is settled and they have no need to work hard in schools (Principal's School speech 8 November 1985).

It is quite normal for girls in Kano to be married by the age of 16 - when they have just finished their secondary school education - in the urban areas, and in the rural areas as early as 10 years. The female Principal I interviewed in the conventional Girls' Secondary School placed the situation in context:

It is because of the society. A girl knows that whether she makes an effort or not she will end up marrying. Some of them even get married off when

they are in their Year 3 or 4. So probably that does not make them interested in further studies. They don't have the incentive; and therefore no motivation to make extra effort. (Interview 15/10/1986).

In the light of these explanations, it is possible that the results of the Taura Girls' Science School in Table II were affected by social expectations of the role of women in the community prevalent in the society, rather than intellectual factors of achievement. However, it must also be noted that since the students selected into these schools are given preferential treatment in the selection examination (i.e. allowing girls with low marks to be selected for the schools) this might reflect itself in their final examinations scores.

Yet still other explanations are possible. For instance, the science results of the girls might reflect faulty teaching process, or high demands from the curriculum. Whatever the case, more investigations needed to be carried out if the phenomena of the girls science schools is to be fully utilized and refined as a means of encouraging women into science and technology, especially in a developing society such as Nigeria.

While data about examination results from other girls non-science schools in Kano is not presented here (the purpose was not compare the two categories of schools), nevertheless the Science and Technica Schools Board officials record their satisfaction with the trend of the results shown in Table 2. As an official commented about the results of the Girls Science School in one year:
It is gratifying to note that 18 girls out of the 65 that sat for the GCE ordinary level examinations (in the Taura Girls Science School in 1984) obtained five credits and above; thus qualifying for direct university entrance. Interview 18/101986).

Policy makers further point out that the production of an average of 341 girls who have undergone pure science training from the Taura Girls' Science School is more than for entire Kano in the last five years before establishing of the girls' science school. This alone justifies this interventionist strategy to encourage girls science education in Kano State.

Yet even if many girl science students graduate from the Girls' Science School, there was no way of ensuring they can actually follow up both their educational and career aspirations in a traditfonal society such as Kano, especially as expected by the policy makers. For as the Science Schools Board officials acknowledged:
despite the fact that the first batch of Girls' Science School students have performed better in their examinations as compared to other girls in Kano State, very few of them are now pursuing Science and Science related course in our institutions of higher learning (science and Technical Schools Board, 1985).

This statement is backed by an analysis of the distribution of 63 of the first students from the Girls' Science Secondary School who graduated in 1985. This is indicated in Table III.

Table 3. Occupational Distribution of Students from Girls Science Secondary School, Kano, 1985

Occupation	Number
Nursing	11
Lab Technology	7
Pure science	6
Midwifery	3
Health assistants	2
Catering	2
Engineering	2
Islamic Law	2
Teaching	3
Political Science	1
Mass Communications	1
Married	23
Total	63

Source: Science and Technical Schools Board, 1990.

Those listed as married in Table III are those who are not engaged as full time house-wives, while all the others were fully engaged in the various occupations listed (in addition, of course, to some of them being married). As the table indicates, Nursing is the most popular occupational category as a field of further study by some of the students of the Girls Science Secondary Schools - thus conforming to the unwritten expectations of the project; which was to produce mainly nurses. Relatively few students from the graduating class of 1985 studied engineering subjects (2), while six studied science. Interestingly, quite a few decided to study for laboratory technology (seven); thus providing the medical profession with the greatest number of the students in all the occupational categories, since 23 of the students studied medically related disciplines. Surprisingly, none of the students decided to study medicine with the view of becoming a medical doctor.

Thus finding so few female students actively engaged in science and technology occupations beyond the Girls' Science Secondary Schools could not be because parents are against the idea of their daughters studying science subjects, although a high proportion of the students - almost 50% -were married and not involved in any formalised science and technology occupations. That many parents allowed their children to take the entrance examinations to the Girls' Science Schools indicates their willingness to participate in the project. Indeed, from various discussions with education officials, the Girls' Science Schools seemed to have acquired a prestigious status (although, as the officials are fond of emphasising, admission to all Science Schools in Kano is strictly by merit, and not social status). This is another area where further investigation is needed to fully refine this type of science education strategy, especially in social contexts such as that offered by Kano State.

Conclusion

It is therefore clear that although concern for women in general education, and especially their participation in science and technology

disciplines has become an international issue, few long lasting strategies were suggested to solve the problem. Most of the initiatives centre around enlightement services with interest groups - mainly in developed countries - drawing attention to the problem.

In the light of this, the Kano State Girls' Science Schools, arising out of a traditional culture where modern women education has not made significant impact on the society is a bold attempt at providing a long term solution to the problem of encouraging girls to study science and technology disciplines. There are many barriers - mainly to do with predominant cultural attitudes - to overcome . However, a government backed project would seem to indicate a significant step towards overcoming these barriers.

The Girls' Science Schools project is just a step towards a New social Order that includes every member of the society,regardless of sex or ability. Other strategies can be taken to refine this process to make it possible for more girls, especially those not within the Science School system to participate in science and technology for development.

These strategies may be been either as areas where improvements are needed to encourage girls to study science, or where more empirical investigations needed to be carried out to determine how to utilise such opportunities to favour girls.

For instance, to make science education more functional for girls in Kano, and to make the Girls' Science Schools live up to their expectations of being science schools, wider and more scientific curricular offerings must be made available to the students. For starters, Agricultural Science should be given a serious consideration in the curriculum of the girls science schools. At least if the stereotype of the role of women in the society must be maintained by the science and Technical Schools Board, then this subject might make it possible for the students to apply knowledge of agricultural practices at home and thus enrich the quality of life of their families.

Generally, if the policy initiators of the project are convinced of the value of science education for girls, then there is no reason why the girls should not be given the same curricular offering as the boys. After all, the Girls' Science Schools were established on the same equal intellectual footing as the boys' schools.

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