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Female Students Participation in Science and Technology Education in Namibia

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Abstract
This paper briefly reviews the education system in Namibia before and after independence. It also provides an overview of the roles of science and technology education in school curriculum in the country. The paper also looks into the extent of female students' participation in science and technology courses at tertiary level. It identifies and discusses the factors that hinder female students' participation in these subjects and provides ways of addressing these factors.

Introduction

Namibia attained independence from the South African regime in March 1990. Before 1990, all aspects of life (including, the education system) in the country were controlled and patterned after the South African system and way of life. The education system was fragmented, segregated and based upon racial and tribal lines to ensure separate development of Namibia's people. As a result eleven education authorities were in existence in the country to cater for less than 1.5 million people. In addition, the Namibian education system was a replica of the Bantu Education system in existence in South Africa. This type of education, advanced the interests of the colonial power rather than those of the individual Namibian learners in the country. For the majority of Namibians, the colonial education was meant to provide a semi-literate Black force that provided a dependent and cheap labour to the colonizers (Salia-Bao, 1991; World University Service, undated).

During the colonial period, mathematics and science subjects were not emphasized in the majority of black schools. Even though, these subjects were theoretically on offer, the reality was very different. Clegg (1989) noted that few black schools and learners offered these subjects. He attributed this to the apartheid regime's belief that blacks were inherently incapable of learning science and mathematics. In addition, it was the South Africa State's policy that different peoples should be trained and educated for their positions in life. Since, the black child's environment was deemed to have no need for mathematics and science knowledge, it was decided not to directly encourage the study or teaching of these subjects in black schools. Where these subjects were offered, the teaching relied on oral presentation of

content with little student participation. The majority of teachers had weak content grasp, emphasized rote learning and the lack of textbooks did little to help the situation (Hoey, 1989; Cunnington, 1989). Salia-Bao (1991) also noted that emphasis in Namibian schools (primary through secondary) was placed on languages rather than science and mathematics. Further, technological subjects were taken almost exclusively by white learners (World University Service, undated).

On attainment of independence, the early concerns of the new government over education included the unification of the different education authorities in the country into a single education ministry. In addition, reform of the school curriculum was carried out to ensure that all students in the country followed one curriculum. Further, the government addressed the imbalances that were a reflection of the former education system, by increasing access to education, equity, equality and strengthening democracy in education (Ministry of Education and Culture, 1993). Science and mathematics subjects that were denied to the majority of Namibians before independence were made compulsory through grade 10. This was also in part, to fulfil the earlier realisation during the years in exile that science and mathematics play an important role in the social and economic spheres of a nation (Angula, 1989).

From the foregoing, it becomes clear that science, mathematics and technology play and occupy an important place in the education system in Namibia. This is reflected in the aims and objectives of science and technological education enshrined in the Ministry of Education document and syllabi in the country (Kasanda and Buchani, 1995). Further more, the provision of subjects such as, Computer Practice (at the Junior secondary level), Design and Technology and Computer studies at the senior secondary level appear to emphasize the importance of science and technology in the country. The establishment of the National Endowment Fund on 31 March 1994, for the promotion of science and technology is further tangible proof of the government's desire to popularise these subjects among Namibian students. The Endowment Fund aims at providing bursaries to deserving students to pursue science, technology and mathematics subjects at tertiary level and is an attempt to popularise these subjects to all studeuts in the country.

The Place of Science & Technology Education in School Curriculum

Science and technology occupy an important place in the Namibian education system. This is due in part to the fact that these subjects were denied to the majority of Namibians during the colonial era. Discrimination had been more obvious in who took science, mathematics and

technology subjects during the past dispensation. Therefore, to increase equity in the education system, science and technology have been emphasised and students encouraged to take these subjects regardless of their ethnicity or race. In addition, Namibia has realized that for social and economic development and empowerment of its people to take place in this technological world, scientific and technological knowledge is essential.

Instructional and/or Communication Technologies are powerful tools that may improve and raise the quality of classroom instruction (Nafzinger, 1998; Perraton, 2000). The effectiveness of any technology depends to a large extent on how it is used and the teacher's familiarity with it and its use in facilitating instruction. Computer technology in schools may be helpful in ensuring that the learners have access to information that may not be available from their teachers, peers or the school library. It may also facilitate dialogue with others who may have this information (Perraton, 2000) through computer teleconferencing or e-mail. Use of simulation software may aid in studying, for example, the chemical reactions in the science laboratories without danger to the learners or damage to the building that may result result due to incorrect use of chemicals.

Further, the use of calculators (including graphic calculators) in the classroom may give mathematical power to learners that is essential for successful learning of other science related subjects (Kapenda, 1998). That is, instead of learners spending time on long and tedious calculations, the calculator or computer may be used to perform these calculations. As a result the time saved in carrying out these calculations can be used for concept development, which may result in meaningful learning. Gaoseb (1997) observed that using instructional technology in teaching may provide a more learner-centred teaching environment. In such an environment, the student becomes an active participant in the acquisition of knowledge and is responsible for his/her own learning. In other words, the constructivist point of view of learning will be emphasized rather than the traditional teacher-centred view, where the teacher is the purveyor of all knowledge.

Female Students' Participation Rate

In Namibia, female students' participation in science and technology subjects does not equal that of male students, especially at tertiary levels as it is the world over (Gaskell, 1992; Leder, 1996; Kreinberg & Lewis, 1996). The situation is not very different from that found in other countries (Kasanda & Shaimemanya, 1998). Most girls in schools are not getting enough support from their teachers, parents or peers to enrol in the mathematics, science and

technological subjects at the tertiary level. It should be pointed out that in Namibia all learners from grade 1 through grade 10 are expected to take science and mathematics subjects. Nonetheless, in grade 11, these subjects are not compulsory for all students. It is at the senior secondary and tertiary levels that the female students' participation in science, mathematics and technology subjects wanes. For example, in 1995, of the total intake of 169 students in the Faculty of Science at the University of Namibia, 58 or 34.3% were female. The situation was not very different in 1996. Of the 241 students registered in the Faculty of Science, only 33.2% or 80 students were female (Education Management Information Systems, 1996: 1997). As can be seen from the reported figures for the University of Namibia, female students are a minority in these subjects at the tertiary level. Since the secondary schools provide students to the university, the situation is not different at this level either. Indeed, many female students tend to opt for the so called soft options in the school curriculum such as English, biology, history and many other social science subjects rather than science and technology.

Kasanda & Shaimemanya (1998) identified a number of factors that appear to deter the provision of quality education to female learners in Namibia. These factors include; curriculum bias, teenage pregnancy, subject time tabling, economic factors, beliefs and attitudes of teachers, parents and the girls themselves. These factors, besides others may also be operating in the science, mathematics and technological classes and as a result actively hindering the participation of the female learners in these important subjects.

Factors hindering Female Students Participation

As indicated earlier, several factors appear to hinder female students' participation in science and technology subjects at tertiary level. Some of these are discussed in this paper.

Classroom Environment

The atmosphere in the science and mathematics classroom especially at the senior secondary school in Namibia appears to be less female friendly. This is because in many science and mathematics classrooms only a handful of females are found. Although the pass percentages in Table 1 seem to contradict what we have said here, the fact is that the majority of learners included in the "pass category" obtain a grade of D and G, which are the lowest passing marks recorded in the International General Certificate of Secondary Education (IGCSE) examinations.

Table 1. Pass and fail rates in the International General Certificate of Secondary Education (IGCSE) examinations 1995 – 1998

Subject	1995			1996			1997			1998		
	Pass	Fail	Total	Pass	Fail	Total	Pass	Fail	Total	Pass	Fail	Total
Biology	71.7	28.3	7070	83.3	16.7	7907	61.8	38.2	10911	71.1	28.9	10643
Physical Science	77.9	22.1	4106	79.4	20.6	4570	85.2	14.8	5592	87.2	12.8	5592
Maths	65.1	34.9	5288	65.8	34.2	5841	65.5	34.5	7239	65.5	34.5	7239

This may have further implications in discouraging others when they see their friends with such low grades to consider taking them at senior secondary school and tertiary levels. As such the environment may be intimidating to the few females in the science and science related classes. Table 2 shows that the majority of SMT subject teachers are males.

Table 2. Number of female and male science teachers in Namibian secondary schools

Subjects	1997			1998			1999		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Physical Science	550	308	858	583	308	891	620	340	960
Biology	94	88	182	86	103	189	81	102	183
Mathematics	1650	1541	3171	1693	1478	3171	1669	1416	3085
Computer studies	26	39	65	26	29	55	29	36	65

Accordingly, female students do not encounter appropriate role models in the science and mathematics senior classrooms to imitate. Even though Table 2 appears to give a comparable number of male and female science teachers in the country, most of the female science teachers are teaching at the junior secondary rather than the senior secondary schools. As such female students do experience a lack of appropriate female role models in these classes.

The unfriendly atmosphere that exists for female students (and teachers) in British schools are vividly captured by Jones (1991) and Riddell (1992). They observed that usually, male students bullied and teased female students while male teachers made dirty jokes about or sexually harassed them. Riddell (1992: 108) noted that many female students in her study viewed the atmosphere in physics lessons as uncomfortable and alienating.

Sutherland (1999) observed that though little evidence existed of sexual harassment of girls in Western schools, teachers' unhelpful attitude still persists. She notes;

> *... there are still indications of unhelpful attitudes on the part of male teachers when girls choose to study traditionally male subjects. Girls opting for technical, engineering subjects in school or in further and higher education have reported discouraging or plainly hostile attitudes on the part of some men teachers (Sunderland, 1999: 439).*

Howe (1997) after reviewing research on class interactions spanning almost three decades concluded that boys dominated and monopolised science and computer apparatus and class discussions and as a result female students felt "more negatively about the school experience". It is possible that similar situations may also be occurring in Namibian schools. This may be resulting in fewer female students coping with the situation and doing well in these subjects at the higher academic levels.

Female Students' Attitude toward Science and Technology

Science, mathematics and technology subjects become elective at grade 11 and 12 in Namibia. By this stage many female students have developed concrete perceptions of mathematics, science (physics and chemistry) and technology as difficult and for the intelligent few. The impression created by the colonial curriculum in Namibia that science, mathematics and technology were for the privileged few intelligent blacks in the country has not been easy to erase from the minds of many Namibian students. As a result most students are afraid of pursuing these subjects and discontinue the study of science and science related subjects at senior secondary school. Further, the low grades attained by most female students in mathematics preclude them from studying science courses at tertiary institutions, which require a better pass in mathematics as an entry prerequisite. This state of affairs therefore, acts as a hindrance to the study of these subjects and a discouragement to the majority of female students who would like to pursue careers in science, mathematics and technological fields.

Relevance of Science and Technology to Female Students' Future Careers

The society we live in has tended to stereotype jobs into two categories: some appropriate for females and others appropriate for males. Often the careers, which have been regarded as feminine have tended to be those which require minimal or no science or technology. Accordingly, females have tended to choose subjects in which the need for science and technology knowledge is minimal. This is often in preparation for their future careers. Since science and technology do not usually feature in their plans, they do not feel inclined to study

these subjects. Unfortunately, such a decision inevitably preludes them from entering highly paying careers. In Namibia, female students still appear to choose career fields such as nursing, secretarial and commerce. One way of resolving this situation is to make the female students aware of the detrimental effects of not pursuing science and technology courses at tertiary levels as far as their future career choices are concerned. The use of appropriate female role models who have made it in the male perceived careers may help the female students to realize that they also have the potential to make it in science and technology careers.

Teenage Pregnancy and Peer Pressure

Namibia has been experiencing a high rate of female drop out at all levels of the education system. The Ministry of Health aud Social Service (1992) found that 4044 female students in Namibia had dropped out of school due to pregnancy, and that "about two percent of girls 15 years and younger, six percent of 16 year olds, 19 percent of 17 year olds, 36 percent of 18 year olds and 45.5 percent of 19 year olds were either mothers or pregnant with their first child". These are ages when the majority of female students are more mature than male students and do not therefore continue with their higher education, a fact which inevitably reduces those opting to study science and technology subjects at senior secondary and tertiary institutions. In addition, many female students tend to drop these subjects due to the fact that they express less interest in studying them (Keeves and Kotte, 1996). Further, since many of their close friends are no longer taking these "difficult and masculine subjects," they also tend to follow suit.

Parental and Social Expectations

Kasanda et al (1996) investigated the class interactions taking place in the mathematics, geography and English classes in several secondary schools in the Caprivi, Erongo, Northern and the Ondangwa East and West educational regions. They concluded that gender imbalances against females existed in Namibian schools. That is, teachers tended to interact more with male than female students. They attributed these imbalances to the inferior position of females in society, the females' own inferiority complex, socio-economic and cultural factors. As Ernest (1991) observed, teachers do not live in a vacuum and are therefore socialized in the norms and beliefs of the society in which they live. These norms and beliefs are, as a result, reproduced in the classroom (Ernest, 1991; Gaskell, 1992). Since Namibian science, mathematics and technology teachers do not live in a vacuum, it is assumed that they would

also reproduce what the society at large in which they live believes in with respect to females' status in society in their classrooms.

It should be pointed out that most of Namibia society's beliefs and norms relegate females to an inferior position and the kitchen. This situation is reproduced in schools and the classroom. Accordingly, females are not expected to compete on an equal footing with males and are not expected to study science and technological subjects. Further, classroom interactions and teaching tend to reflect this expectation. Female students are often left out during classroom interactions and teachers tend to spend more time with male students and encouraging them. The fewer numbers of females in the science and technology classes makes it possible for teachers to ignore them. As Kasanda et al (1996) concluded, there is an urgent need to sensitise the Namibian society in general and the teachers in particular as powerful socializing agents in society to the detrimental effects of expecting less from female students in our society both socially and economically.

Concluding Remarks

Several factors appear to be preventing the full participation of female students in Namibian schools in science and technology subjects. These factors need to be addressed by all stakeholders in the education system openly and critically to ensure that all students are given the chance to show their full potential and contribute to the economic and social development of Namibia. In addition, there is need to ensure that during pre-service and in-service training, science and technology teachers are exposed to instructional and communication technology as learning and teaching tools, which will enhance students' interest in their subject, and a teacher's interest in technology may in the end rub off to the students.

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