WOMEN AND SCIENCE-RELATED CAREERS: NEED FOR EDUCATIONAL REFORM

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BY

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ABSTRACT

Girls and boys at the primary school level start off as equals in interest and performance in science and mathematics. The enrolment of girls in physical science especially, begins to take a downward turn once courses become optional in the secondary school. This paper examines Women Education and Science-Related Careers: Need for Educational Reform. Firstly, it examines the position of research on attitudes, interest and achievement of boys and girls in science. Secondly, the paper suggests what can be done to improve the situation. Thirdly, in the discourse, the kinds of intervention programmes possible are enumerated and fourthly, the need to harmonize such programmes with educational reform movement in science education. Finally, the paper discusses the importance of role models and improving self-concept and self-image among girls in institutions of learning. Women Associations are urged to take up the challenge of solving the problem.

INTRODUCTION.

The dearth of women in science-related careers is not new and has not been overcome yet. The situation in Nigeria is identical with what obtains in most developing countries of the world. The phenomenon stems from lack of interest and low enrolment in mathematics and science subjects attributed to girls in
secondary schools and tertiary institutions. Girls and boys, start off as equals in interest and performance in science and mathematics. They appear to perform well in both subjects in the primary schools (Science Education Digest, 1990). However, the enrolment of female students in mathematics and especially the physical sciences begins to take a downward turn once subjects become optional in the secondary schools. The situation is accompanied by decrease in achievement. The implication of this is that most female students are not being prepared for careers in science and the technical fields in the universities. This is an undesirable situation that calls for systematic intervention and return in the educational system.

This paper firstly, examines the position of research on attitudes, interest and achievement of boys and girls in science. Secondly, the paper suggests what can be done to improve the situation. Thirdly, in the discourse, the kinds of intervention programmes possible are enumerated, and fourthly, the need to harmonize such programmes with educational reform movement in science education. Finally, the paper discusses the importance of role models, improving self-concept and self-image among girls in institutions of learning.

**METHODOLOGY**

Data collected from five selected secondary schools in Ilorin metropolis show poor female student enrolment in science subjects. (See Table I).

Similarly, a comparison of male and female graduates in a tertiary institution shows low achievement rate for females (See Table 2).
<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>A ALL MALE (GOVT.)</th>
<th>B CO-EDUCATIONAL (GOVT.)</th>
<th>C ALL FEMALE (GOVT.)</th>
<th>D CO-EDUCATIONAL (GOVT.)</th>
<th>E CO-EDUCATIONAL (GOVT.)</th>
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**TABLE 1:** ENROLMENT FIGURES OF SECONDARY SCHOOL STUDENTS IN FIVE SELECTED SCHOOLS IN ILORIN METROPOLIS (Danmole, 2000)
<table>
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<th>Year</th>
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<th>2nd Class Upper</th>
<th>2nd Class Lower</th>
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What is the Position of Research on the Phenomenon?

Several researchers have documented findings on attitudes and interest of pupils in science at the primary school level. (Bolarin, 1988; Aigbomian, 1990). Others have conducted studies on achievement in science subjects. These include those of Inomiesa 1989; Onocha and Okpala, 1989; and Danmole, 1998). There is a consensus of opinion in the findings that differences in male and female pupils performance in mathematics and science do not appear at the primary school level (Archer, 1992).

At the secondary school level a substantial member of studies have been conducted on interest and achievement of students in science. Such studies are those of Fennema and Sherma 1977; Bajah, 1979; Balogun 1979; Daramola, 1983; and Jegede 1984). Others are those of Fakunle, 1986; Oraifor, 1986; Orji, 1997 and Archer, 1992. Several studies have recorded disparity in the interest and performance of male and female students at this level of the educational system in spite of a uniform curriculum. Orji (1997), observed that boys retained learned materials better than the girls in his investigation. A possible reason adduced for this is that boys constituted the majority in most of the samples. However, no significant difference in the mean retention-test score was recorded between boys and girls on the average. Although research has established poor attitude, lack of interest and low participation rates of female students in science relative to male students. However, there is still much not understood about reasons for low rates of participation of women in science related careers. Furthermore, the evidence suggests that there are alterable features of schools that constitute constraints to female students’ participation in science-related courses. Subsequently, For careers in the scientific field, attainment has been found to be dependent on three factors, namely; the opportunities to learn science and mathematics; achievement in science and mathematics and students’ decision to pursue science and mathematics related careers (Oakee, 1990).
The experience students have acquired is closely linked with the opportunities they have been given to learn science. It has also been identified that motivation to enroll for science subjects differed among male and female students. For males, parental expectations for their sons to enroll for scientific and technical courses that would lead to related careers are high. While for females, parental expectation for daughters for such courses are low. Male aspirations are supported and attainment celebrated without reservations, female educational aspirations are often regarded with skepticism. Besides, the motivations that provide the drive to enroll are often intrinsic reasons. Therefore, girls have to be more self-motivated to choose science courses (Armstrong in Tsuji and Ziegler, 1990). At the junior level both sexes are unaware of career options and the educational requirements involved, hence the lack of disparity at that level.

**How can the situation be Improved?**

**Intervention programmes are required to bring about the desired change.** Intervention approaches differ and may be designed to attract students at one or more levels of the domains of knowledge; cognitive, affective and ability or achievement. **Intervention approaches that should be considered are:**

1. Cognitive – focussed Intervention Programmes which consists of programmes with a focus on the cognitive domain. Such programmes are designed to provide information and increase awareness.

2. Affective – focussed intervention programmes, which increase self-confidence or relieve anxiety and also enhance self-concept.

3. Ability or Achievement focussed Intervention Programmes, which increase ability and achievement.

Tsuji and Ziegler (1990), posit that interventions aimed at the effective domain or achievement levels seem to influence behaviour more than those aimed at the cognitive level.
What are Possible Intervention Programmes?

A variety of worthwhile intervention programmes have been identified and methods for evaluating their effectiveness. Davis and Humphreys (1985), grouped intervention programmes into five types, for the purpose of improving science learning. The role of teachers as facilitators in the implementation of intervention programmes cannot be overstressed.

1. Short term programmes
2. Experiential learning programmes
3. Audiovisual and printed products
4. Long term programmes
5. Teachers Education Programmes

1. **Short Term Programmes**
These programmes are mounted to cover a specific but short duration of time. They contain speakers series, one-day conferences or workshops that increase the awareness of female students. Consequently, changing their attitudes towards science. Several of these programmes would be required to redeem the situation.

2. **Experiential Learning**
Fieldtrips fall into this category of intervention programmes because of the first hand information and experience they provide. Individualized instruction packages also provide personalised experience and enhance knowledge. The advantage of individualized instruction is that the learner could be given assignment in science at his or her own pace to complete in addition to the general school work.

3. **Audiovisual and Printed Products**
The value of audio-visual and printed products as interventions to increase awareness, change attitudes and increase knowledge cannot be quantified. These are books, games, puzzles, exhibits, video tapes and career posters;
which may be used to provide information about science careers in a most concise and appealing manner. Information must be clear and unambiguous.

4. **Long Term Programmes**

These consist of course and curricula intentionally designed to improve and increase learning as well as gradually change attitudes. These programmes are of long-term duration. Several processes of science must be incorporated into the programme to ensure that the learners are “doing” science by being fully involved. Girls must be encouraged to participate during demonstration of phenomena during practical classes in science, just like the boys: This would instil in them confidence in the handling of science apparatus.

5. **Teachers Education Programmes**

Teacher education intervention programmes may be organised or as in-service programmes. The purpose is to modify teachers’ behaviour and improve their skills in order to bring about an improvement in the attitudes and performance of their students.

Reform in teacher preparation must be given special focus because the teacher is the central figure in the teaching/learning process. Alternative teaching and assessment tools such as Clinical Interview and Concept mapping techniques must be part of the programme apart from the traditional assessment techniques which have been widely criticized (Novak & Gowin, 1984).

**How do Intervention Programmes relate with Educational Reform in Science Education?**

Stakeholders in education, agencies and concerned individuals involved in science education are advocating for measures that are beneficial to all students. Consequently, such moves should help increase the number of women in mathematics and science – related courses and careers.

There is a consensus of opinions by reformers that more hands-on activities be used in science, preferably in a co-operative learning situation. Girls are known to benefit from such instructional strategies. If the claim as some research data imply
that current teaching strategies are responsible for early gender differences in attitudes, which then led to differences in participation of boys and girls, changing teaching methods as well as revising the curricula should help reduce the trend.

Reports of current reform in science education have proposed several common ground science process goals that should enable all students experience success in science, male and female. Some of these are: making the total science curricula personally meaningful; ensuring that tests and assessment procedures are unbiased and use of heterogeneous and co-operative groups to promote high level participation among students. In addition, arranging for science role models, supporting enriching science education opportunities, classroom interactions and increase support for science achievement of girls from parents, peers and the community (Klein 1990). These goals would foster equity and encourage educational reform.

Above all, science curricula should focus on personal needs, create career awareness and include the study of science-technology - science in terms of problems arising in the community or those highlighted by the media.

Conclusion

An attempt has been made in this paper to examine literature available on the lack of interest, low enrolment of girls and subsequent lack of women in science-related careers relative to men. I have suggested intervention programmes that are possible to improve the situation. Some are short term and others are long term. The need to focus programmes on the affective domain has become imperative in order to change attitudes of girls towards science and mathematics. Reformers are advocating the provision of a variety of opportunities in the learning of science to encourage participation of all students. It is important that school time be used more efficiently for academic work. Expectations of parents for girls must begin to be high to increase their motivation and self-confidence towards science subjects. Teacher education programmes must receive more attention. It must include new teaching and evaluation techniques.

Science and Engineering Societies have career brochures that are targeted at women. Such brochures are invaluable in our desperate desire to improve the
participation of women in science and related careers. The increase in national networks of women in science, engineering and other science-related careers to foster dissemination of information on careers and profiles of role models to encourage our girls is necessary and of intrinsic value.

The need of educational reform cannot be over-emphasized and has become inevitable. Women organisations such as National Association of Women in Science, Technology and Mathematics (NAWSTEM) must be resuscitated at the national and state levels. Others, such as Science Teachers Associations of Nigeria (STAN) and indeed, National Association of Women Academics (NAWACS) concerned with education are being challenged to work towards finding solution to the problem.

In the new millennium, perhaps there is the need more than ever before to re-examine the school science curricula in totality in order to identify constraints confronting women in the learning of science, mathematics and technology. The extent to which such constraints are resolved would go a long way in ensuring full participation of women in science.

References


