

## Selection of Science Subjects' at Advanced Level by Females : Aetiology and Challenges

*Gudyanga, A and Gudyanga, E*

*Department of Educational Foundations, Management and Curriculum Studies,  
Midlands State University,  
Gweru, Zimbabwe*

### **Abstract**

*This study reports findings from a research carried out on the factors that influence the selection of science subjects by female 'A' level students in Gweru district. A systematic random sampling of sixty (60) students, eighteen (18) parents and fifteen (15) 'A' level science teachers were used. Three schools out of a total of eight (38%) were used. Main design used was Survey. Questionnaires, interview schedules and classroom observations were the main instruments used to collect data. The main factors that influence the selection of science subjects by female 'A' level students included among others subjects stereotyping, type of socialization that the girls experience, and lack of role models. It is recommended that heads of schools ensure that all teachers and staff are gender sensitised; promote science among girls through affirmative action. Publishers are to ensure that the content and style of writings in the text books reflect gender sensitivity. Schools must aim to incorporate positive role models for girls.*

Key words: aetiology, science, gender, subjects, females.

### **Introduction**

From own experience and assessment, there has been more talk on the need for equality between female and male students. In response to this, the government addressed gender imbalances, which were then in existence in the school environment. There has been some legislation to enhance the improvement of women in our society, e.g. affirmative action in Teachers Colleges where 51% of the total enrolment was to be female students and at the University of Zimbabwe and other universities where females with lower points than males are enrolled. A government document, D46, promotes women to be in posts of responsibility as a way of addressing the imbalance. Zimbabwe females have been put on par with their male counterparts, in terms of opportunities to learn all subjects offered on the school curriculum. In theory, there has been an equal opportunity for boys and girls to pursue any career, but in practice, this seems not to be the case. Education of women and girls seems to have lagged behind that of men. It seems there has been some reluctance on the part of parents to allow education opportunities for their daughters as they do for their sons. Tuition fees for schools, other costs such as uniforms, books, general purpose fees, fees for materials used in subjects such as fashion and fabrics, metal work, food and nutrition, building and agriculture, levies raised by parents' association increase annually. It is difficult for many families to raise such fees

especially the rural ones. This results in school dropouts especially the girl children.

Another disadvantage which the girls tend to suffer from, is the prejudice with regards to special ability areas. The researchers' observation is that girls were and are still said to be good in the arts whilst boys were and are still said to be good in the sciences. As a result, teachers generally seem not to bother to encourage the girls to choose science subjects. There is no biological reason for this differential treatment between boys and girls. Cole and Hill (1997:59) say, "Gender is by definition a social construct, that is to say, appropriate gender roles are learned through socialization rather than genetically given". Gross (2001), says that gender refers to the non physiological aspects of being male or female- the cultural expectations for femininity and masculinity. Therefore this means that cultural expectations for men and women (gender) are not separable from the observations about men's and women's physical body (sex). Hence cultural constructions of gender include sex in some sense. Our understanding of biological sex differences is likely to be shaped by our culture's notions of gender.

From the researchers' observation, the girls are still proportionally under represented in school science subjects, which are physics, chemistry and biology. The researchers have observed the same general trend, as shown by the table below:

**Table 1 Lower Sixth Enrolment by school, by subject by gender.**

| School | Year | subject   | Male        | Female     | Total |
|--------|------|-----------|-------------|------------|-------|
| A      | 2009 | Physics   | 23 (92%)    | 2 (8%)     | 25    |
|        |      | Chemistry | 25(68%)     | 12(32%)    | 37    |
|        |      | Biology   | 12 (60%)    | 8 (40%)    | 20    |
|        | 2010 | Physics   | 22 (88%)    | 3(12%)     | 25    |
|        |      | Chemistry | 25 ((69.4%) | 11 (30.6%) | 36    |
|        |      | Biology   | 13 (65%)    | 7 (35%)    | 20    |
|        | 2011 | Physics   | 12 (75%)    | 4 (25%)    | 16    |
|        |      | Chemistry | 24 (75%)    | 8 (25%)    | 32    |
|        |      | Biology   | 11(61%)     | 7 (39%)    | 18    |
| B      | 2009 | Physics   | 16 (100%)   | 0          | 16    |
|        |      | Chemistry | 22 (76%)    | 7(24%)     | 29    |
|        |      | Biology   | 13(52%)     | 12 (48%)   | 25    |
|        | 2010 | Physics   | 10 (100%)   | 0          | 10    |
|        |      | Chemistry | 20 (77%)    | 6 (23%)    | 26    |
|        |      | Biology   | 11(55%)     | 9 (45%)    | 20    |
|        | 2011 | Physics   | 12 (92%)    | 1 (8%)     | 13    |
|        |      | Chemistry | 20 (62.5%)  | 12 (37.5%) | 32    |
|        |      | Biology   | 11(58%)     | 8 (42%)    | 19    |

As shown by Table 1 above, the percentage of female students doing 'A' level science is always lower than that of male students. Thus females are underrepresented in science classes. Gender inequality in education leads to gender inequality in occupation (Johns and Wheatley, 1988). These same authors observed that women are under represented in college technical major subjects and careers in physical science and engineering. Spear (1984) in Murphy and Moon (1989) showed that the percentage of females is less than that of males. Dorsey (1991) observed that females are under represented at the University of Zimbabwe in all faculties with the lowest ratio in agriculture engineering, medicine, physical and veterinary sciences. It is against this background that the researchers were led into the following research question, which forms the basis of this study: What are the factors that influence the selection of science subjects by female 'A' level students?

The fact that society has two sexes, (men and women), this has far-reaching implications for our personal behaviour and for the structuring of social life mainly in terms of gender. The distinction between male and female serves as a basic organising principle for every human culture. Although societies differ in the specific tasks they assign to two sexes, all societies allocate adult roles on the basis of sex and anticipate this allocation in the socialisation of their children. According to Baron and Graziano (1991), gender identity refers to the child's acceptance of his or her own sex as a central part of self-concept. It is the social construction of the self with reference to being male or female. Social inequality involves those social arrangements and enduring patterns by which members of one gender group realises more benefits and fewer disadvantages than members of the other gender group.

Women are seriously under-represented in Science related fields, more so in careers in physical sciences and engineering (Ngochi, 1992). One of the central concerns of educators is to identify those factors that influence students' learning e.g. Why do fewer girls choose science subjects at 'A' level? In all the industrialised countries, women are under - represented in positions of power and influence (Giddens, 1989). Gender discrimination in education and gender stereotyping in education have been considered factors which constrain women's participation in education, particularly in institutions of higher learning (Mbilinyi, in Meena, 1992). When it comes to access to science and technology, women are further marginalized because of socialisation processes which assign certain roles to women and others to men, a factor which affect current streaming for boys and girls in science and arts (Katunzi Halfani, in Meena (1992). Matora's study (1982) in Meena (1992) carried out in Lesotho established that occupational stereotyping played a great role in determining job allocation in Lesotho because women have had no major problems of access to education and particularly institutions of higher learning. Women are therefore marginalized in the management of their societies because of occupational gender stereotyping. Science is not gender neutral. As a matter

of fact, biology has been used by scholars to establish hypotheses, which defend gender and racial discrimination (Mpuchane, 1991 and Mavatsanga, 1991 in Meena (1992). There is therefore need to investigate the factors which constrain female students from participating in the natural sciences. Scientific knowledge has to be directed to benefiting humanity. In Africa, poverty is partly attributed to lack of scientific knowledge and its application in the production process. African women seem to be the least beneficiaries from the existing knowledge and scientific advances which have been made.

In most families, boys are treated differently from girls from their first days of life, when hospitals give boy babies a blue bracelet and girl babies a pink one. These differences become reinforced overtime as the child meets the expectations of parents, teachers and peers and these expectations become internalised. Differences in behaviour observed between boys and girls and later between men and women appear to stem from differences in the socialisation experiences that occur from earliest infancy onwards (Havighurst & Levine, 1979).

Santrock (2005) says that children learn from their parents, siblings, peers, books; from watching television, from computers and from formal schools. This means that early experiences with parents shape development and is continued at school. Gordon [1995 (b)] argued that the primary socialisation of girls and the training they receive at home is continued at school and girls are taught that to succeed as women means not to do the subjects and roles considered masculine by parents and teachers. Attitudes are developed as peers interact and it is during this interaction where different children would tend to show the acceptable norms as they get them from parents and what they meet at school.

### **Methodology**

The three (3) schools out of eight (8) schools were randomly selected (38%). The names of the schools were written onto some papers which were in turn put into a chalk box. Random selection with replacement was done to maintain same probability of choice. The sample size was considered large enough to produce reliable and valid results.

From the three (3) co-educational schools, the lower sixth (L6<sup>th</sup>) classes and upper sixth (U6<sup>th</sup>) classes participated in the study. A total population of three hundred and seventy (370) female students existed at the time of study. From each school a class register of students in each form was used. Where there were two classes in a form, a coin was tossed to determine a class to participate in the study. Systematic randomization was used. Twenty female students were selected in each school. Altogether, sixty (60) female students participated in the study out of a population of three hundred and seventy (370) students, making a reasonable sixteen (16%) sample size.

Fifteen science teachers randomly chosen from the same schools participated in the research. The heads and deputies of all the three (3) schools participated in the study. From each school, six (6) other female students were conveniently selected to request their parents or guardians to fill in questionnaires. Eighteen (18) parents became part of the participants in the study. Three data collection instruments were used, namely questionnaires, interviews and classroom observation. The researchers were aware that each type of method has its own particular strengths as well as weaknesses and that no data collection method is perfect. Triangulation is characterized by a multi-method approach to a problem in contrast to a single method approach, and this is what the researchers used in their study

Four different sets of questionnaires were designed by the researchers. All were in English. It was assumed that even rural parents will be able to comprehend the English language. The sets were for students, school administrators, teachers and parents. In school A, the twenty (20) students were gathered in the Home Economics classroom for the purposes of data collection. In the second school, the twenty (20) female students met in the science laboratory. In the third school, the female students met in a classroom, which was not in use at that time. In all instances, expected norms were put across to participants and all ethical considerations were spelt out before questionnaires were completed. Fifty eight [58 out of 60 ] i.e. (97%) questionnaire return was achieved.

For the Heads and deputies, the instruments (questionnaires) were left in the offices for completion at convenient times. Five out of six (83%) questionnaire return was achieved . Questionnaires from eighteen (18) parents were to be brought to the offices of the school heads for central collection. Fifteen (15) out of eighteen (18)- i.e. eighty three (83%) responded and returned them. In all instances of non-return, no specific reasons could be established. Of the fifteen science teachers who received the questionnaires, thirteen (13) were returned (87%) through their Head of Department (HOD). Procrastination in completing the questionnaires by teachers was the main obstacle until the researchers got satisfied with the 87% returned. For triangulation purposes, interviews were carried out on three students and 3 teachers who never completed questionnaires all from each of the three schools. Random sampling was used to determine the teachers and the students who would be the participants. Interview sessions were for about 30 minutes (to avoid boring sessions if they are too long). During the interviews, the researchers used a tape recorder, which speeded up the interview process and also frees their attention from writing notes on the interview. The tape enabled the researcher to study the interview responses more closely and to compare how a respondent had answered similar issues raised by questionnaires and the interview. The tapes were transcribed

for analysis of common themes. The tape-recorded data was played back more than once and could be studied much more thoroughly than would be the case if data were limited to notes taken during the interview.

Classroom observation was carried out at two schools only, because this method of gathering data is time consuming. Three lessons in physics, three in biology and three in chemistry were observed to find out if the type of interaction between participants is biased towards female students or male students. This was a very difficult task to measure and agree upon for it is based on personal interpretations. To minimize the degree to which the presence of the observer changes the situation being observed, the observer visited the classroom a number of times before recording any observational data, so that the class became accustomed to being observed and reacted normally when the research data were actually collected.

The researchers analyzed school documents to determine the patterns of enrollments by subject and gender (table 1 above) and science staff by subject and gender in three high schools (tables 5 and 6 below). The percentage of female students (as shown by table 1 above) ranged between 0-25% in physics, 24-37.5% in chemistry and 35-48% in biology. The female students doing the three science subjects are fewer than male students. The proportion of A'level male science teachers is higher than female 'A' level science teachers (tables 5 and 6 below). Fewer females choose to be 'A' level chemistry teachers. There are no female physics teachers in the three schools under study. Highest percentage of female teachers teach Biology (50%). This is because biology, though a science subject is considered to be more feminine than physics in relation to their daily life and feminine roles with the family. Table 6 showed that in these three schools under study, 50% were male biology teachers and the other half (50%) were female Biology teachers hence there is gender equity in this subject. The results from questionnaires, interviews, classroom observation and documentation were compared and contrasted. Questionnaires from parents were analyzed and percentages were calculated. The same was done for questionnaires from teachers and students. Interview data collected through audiotapes were transcribed and organized into themes.

### **Results and Discussion**

A total of 18 questionnaires were sent to parents, 15 to teachers, 6 to heads and 60 to students. The percentage return of questionnaires from teachers was 87%, parents 83.3% students 96.7% and heads (83.3%). Of the 15 parents who returned the questionnaires, their educational background was as follows:

**Table 2: Parent's subject areas of specialization (N = 15)**

|         | Science | Commerce | Arts | Other | Total |
|---------|---------|----------|------|-------|-------|
| Males   | 5       | 1        | 1    | 1     | 8     |
| Females | 1       | 3        | 3    | 0     | 7     |

Of the 8 male parents, 5 specialised in science subjects. Of the 7 female parents one (1) specialized in a science area. All the 15 parents agreed that science subjects are masculine subjects. 14 parents said that science subjects are too difficult for female students. One parent who said that science is not difficult for female students argue that female students are intelligent enough to do science. All the 15 parents agreed that science subjects are taught mainly by male teachers. Generally, all parents above tend to believe that science is for males. Such parents are most likely to socialize their children accordingly during their upbringing. They may also influence the selection of science subjects by female 'A' level students since the family is the main socializing agent of the child during early life. Parental encouragement to students is of paramount importance for them to choose 'A' level sciences. Parents need to be motivated to accept that science subjects are not masculine in order to encourage the girl child with ability to do sciences.

Parents' attitude towards the education of girls and the self-image, which girls have as a result of cultural conditions, are some of the factors, which could account for fewer female students selecting science subjects at 'A' level. Home influence includes both material conditions and more complex characteristics such as parental attitudes and encouragement, (Havighurst and Levine, 1979). The family also plays an important role in transmitting the values and norms of society, thus contributing to the socialization of children for their future adult roles in the economic system.

### **Findings from students**

Fifty-eight students out of sixty returned the questionnaires and are distributed as shown by table 3 below.

**Table 3 Respondents by choice of A/Level subject specialization (N=58)**

| Subject     | Number of students |
|-------------|--------------------|
| Arts        | 30                 |
| Sciences    | 12                 |
| Commercials | 16                 |
| Total       | 58                 |

The most common reasons that students gave for doing their various subjects are as follows: Art students said: I had better grades in the art subjects; my elder sister who is my role model had done art subjects; my parents said art subjects were easier to pass; my friend is doing art subjects and I wanted to do subjects done by my friend. Science students said; I want to break new ground which used to be men; because I wanted to do medicine; I enjoy science subjects. Commercial students; Commercial subjects are very interesting and are for the job market demand. Both commercial and art subjects said science subjects are very difficult, challenging, too demanding, very few females do them. Just to quote some of the words which they used: My parents said that science subjects especially chemistry and physics were for the boys. Not free to do male dominated subjects. These results were supported by Table 4 below which shows the number of students who agreed and disagreed with the listed items;

Table 4 Number of students who agreed or disagreed to some selected items (N=58).

| Item                                                                          | Agreed | Disagree |
|-------------------------------------------------------------------------------|--------|----------|
| 1. My parents encouraged me to take up a science career                       | 10     | 48       |
| 2. Science subjects are too difficult for me                                  | 45     | 13       |
| 3. Girls have no self- confidence to do science subjects                      | 42     | 16       |
| 4. Science subjects are masculine                                             | 42     | 16       |
| 5. I am intelligent enough to do sciences                                     | 16     | 42       |
| 6. Science subjects must be based on one's ability                            | 5      | 53       |
| 7. Men generally make better physicists and chemists than women               | 42     | 16       |
|                                                                               |        |          |
| 8. Most of my friends are doing sciences                                      | 5      | 53       |
| 9. My O' level science teacher made me believe that science was too difficult | 40     | 18       |
| 10. Science subjects are taught mainly by male teachers                       | 58     | 0        |
| 11. Male students believe that girls are not good in science                  | 50     | 8        |
| 12. Teachers favor male students during lessons.                              | 29     | 29       |
| 13. Most science textbooks are gender sensitive                               | 18     | 40       |
| 14. Heads of schools encourage us to do sciences                              | 5      | 53       |

These results were confirmed by the three students who were interviewed, indicating that the above is the general trend.

As shown by Table 4 above, more students 45 out of 58 (77.6%) said that science subjects were too difficult for them and 42 out 58 (72.4%) agreed that science subjects were masculine. Only 16 out 58 (27.6%) of the students believed that they were intelligent enough to do science, 42 out 58 (72.4 %) of the students lack self confidence. Lips (2008) found out that males have more confidence than females in their mathematical, scientific and technical abilities. Self confidence is affected by gender role socialization. Simply labeling a task "for girls" or "for boys" raises the expectations of 'appropriate' group for successes on the task.

Only 5 out 58 (8.6%) had friends doing science and hence they opted to do sciences, hence peer pressure plays a role. It seems to me that peer group pressure is the possible strongest force, which affects the way teenage girls make decisions. Due to societal pressures, girls conform a lot to peer, parental and to some 'feminine' ideals. As a result, most girls do not set their insights and perceptions high enough.

42 out of 58 of the girls (72.4%) also said that men make better physicists and chemists than women. Results from questionnaires which are supported by interviews revealed that science subjects are gender typed by females. Biology is seen as a feminine subject because it is seen as more useful to girls in relations to occupations, daily life and feminine roles with the family. This is as indicated by Table 6 where 50% of the biology teachers are females. Physics and chemistry are strongly stereotyped as masculine and are therefore believed to be more difficult than Biology.

Gender role socialization has perhaps contributed to the creation of certain pressures and conflicts, which discourage female students from continuing in science at 'A' level. Attitudes appear to be developed as peers interact. It is during this interaction where different children appear to show the acceptable norms to each other as they get them from their parents and what they meet at school.

All the girls agreed that science subjects are taught mainly by male teachers. Another important factor in inspiring attitudes towards science is the composition of the teaching staff. Science is dominated by male teachers. Lockwood (2006) found out that college women reported being inspired more often by outstanding females than male role models. Role models are therefore important when it comes to encouraging girls to choose non- traditional career paths. Girls, to some extent seem to lack role models. The researcher has also found out that more girls from single sex schools than co-educational schools study science. A possible explanation for this trend seems to be that Girls High Schools almost exclusively employ female teachers and hence provide appropriate role models for girls taking science courses. They are exposed to many high-status female role models than do girls in co

educational schools. Therefore this stresses the importance of adequate role models for girls. The social learning theory by Bandura (1969) emphasizes the importance of observing and modeling the behaviors, attitudes, and emotional reactions of others. Bandura (1977:22) states: "Learning would be exceedingly laborious, not to mention hazardous, if people had to rely solely on the effects of their own actions to inform them what to do. Fortunately, most human behavior is learned observationally through modeling ( from observing others, one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action)."

From table 4 above, 50 out of 58 (86%) of the girls said that male students believe that girls are not good in science and 29 out of 58 (50%) said that teachers favour male students during lessons. The other half which said that there is no favouritism, were from an all girls high school. This is also supported by results from classroom observation, where the researchers have also found out that teachers tended to interact more with male students as compared to female students. This differential treatment may affect the decisions, which the students make about their future performance and careers. Becker (1981) in Baron and Graciano (1991) noted that teachers hold different expectations for their students based on gender. It is these expectations, which appear to make the students respond differently in class in accordance with sex-role expectations of their teachers and society. Teachers' attitudes therefore can be of crucial importance in encouraging or discouraging girls from pursuing studies in science. Traditional gender stereotypes are reinforced through parental and teacher attitudes. Pupils who do not measure up to the teacher expectation are considered deviants. Teachers also seem to cherish implicit expectations about the social roles that males and females should play both in the classroom and in adult life.

Table 4 above also shows that 40 out 58 (69%) of the girls said that most of the science text books are not gender sensitive and only 31% said that they are gender sensitive. During the interview, the students went further on to say that most pictures in science text books, show males carrying out science experiments while girls look on and male teachers carrying out a demonstration to a class.

### **Findings from Teachers**

Nine male and four female teachers returned questionnaires giving a total of 13 teachers out of 15. One male and (one) 1 female teachers did not return the questionnaires. The 13<sup>th</sup> participant only completed section A of the questionnaire which was on demographic data. Section B was left blank. Effectively this made 12 participants to this section of the research. The following table 5 shows the composition of teaching staff by gender per subject.

Table 5 Teachers by subject by gender per school

| School | Subject   | Number of Teachers and sex |
|--------|-----------|----------------------------|
| A      | Physics   | 1 male                     |
|        | Chemistry | 2males                     |
|        | Biology   | 1male and 1 female         |
| B      | Physics   | 1 male                     |
|        | Chemistry | 2 males                    |
|        | Biology   | 1 male and 1 female        |
| C      | Physics   | 1 male                     |
|        | Chemistry | 2 females                  |
|        | Biology   | 1 male and 1 female        |
|        |           | Summary: 10males 5 females |

This table 5 above shows that girls lack role models. In these schools, there are more male science teachers than females, reinforcing the notion that science is for the boys. The trend is generally the same in the sampled schools as shown in table 6 below.

Table 6 Summary of Science Teachers by subject by Gender

| Subject    | Number of Teachers | Males     | Females   |
|------------|--------------------|-----------|-----------|
| Biology    | 6                  | 3 (50%)   | 3 (50%)   |
| Chemistry  | 6                  | 4 (66.7%) | 2 (33.3%) |
| Physics    | 3                  | 3 (100%)  | 0         |
| Total      | 15                 | 10        | 5         |
| Percentage | 100                | 67        | 33        |

Male 'A' level science teachers as shown in table 6 above, are more than female 'A' level science teachers who are just 33%. This might mean that male students have more role models as compared to female students.

The teachers were asked to indicate whether they agreed with the opinions or not.

**Table 7 Teachers' Responses to some questionnaire Opinions**

| Item                                                               | Agreed | Disagreed |
|--------------------------------------------------------------------|--------|-----------|
| 1.I encourage female A' level students to take up a science career | 6      | 6         |
| 2.Female students lack self confidence                             | 10     | 2         |
| 3.Science subjects are too difficult for female students           | 4      | 8         |
| 4.Science subjects are masculine                                   | 5      | 7         |
| 5.Female students are intelligent enough to do Sciences            | 6      | 6         |
| 6.Men generally make better physicists and chemists                | 5      | 7         |
| 7.Science subjects must be based on one's ability                  | 6      | 6         |
| 8.Science subjects are mainly taught by male teachers              | 12     | 0         |
| 9.Teachers generally believe that girls are not good in science    | 7      | 5         |
| 10.Generally girls participate in science lessons more than boys   | 4      | 8         |
| 11.Science textbooks are gender sensitive                          | 0      | 12        |
| 12.I treat female and male students equally during science lessons | 7      | 5         |
| 13.Female students lack self-confidence in science                 | 9      | 3         |

10 out of 12 (83%) of the teachers compared to (2 out 12 (17%) said that female students lack self confidence, this could be a factor in subject choice. Lack of self confidence can be manifested either in dependence, in which one does not trust oneself to do the right

thing without guidance at every step, or in a reluctance to have too much contact with a teacher who might perhaps have already noticed some inadequacy. Hence lack of self-confidence by girls could contribute to girls' science anxiety and a reluctance to pursue subjects. Their class participation is also very low. This perhaps leads to teachers to believe that girls are not good in science. In one school, there were 10 girls to 30 boys doing the sciences and from classroom observations, their participation in class is equally good. In most co-education schools, girls' participation appears low. This could be attributed to the fact that the boys laugh at girls when they give wrong answers during lessons, or perhaps naturally most girls look shy in the midst of boys. Science subjects therefore will appear to represent a male preserve. Because of the socialization we experience in our lives, some females still believe that science is for the males or that science is masculine. As a result of subject stereotyping, female students choose the subjects, which are traditionally stereotyped as feminine despite the encouragement to take any subject of their choice.

Eight out of twelve (67%) of the teachers said that boys participate in science lessons more than girls. Although teachers (7/12) said that they treat female and male students equally during science lessons, a completely different scenario was observed during classroom observations as previously alluded to. Teachers were giving boys more time to answer a question, more hints at the correct answer and further tries if they gave wrong answer. They interacted more with boys who were constantly called upon to answer questions or to give a class demonstration. This is supported by Sadker and Sadker(2003) who also found out that in many classrooms, teachers spent more time watching and interacting with boys while girls work and play quietly on their own. They also found out that boys get more instruction than girls and more help when they have trouble with a question. Most teachers do not intentionally favour boys by spending more time with them, yet somehow the classroom ends up with this gendered profile. All agreed that science subjects were mainly taught by male teachers.

### **Findings from Heads of schools**

Of the three heads of schools only one was a female and of the three deputies only one was also a female giving a total of 2 females and 4 males. Of the six heads of schools and their deputies, five returned Questionnaires and one male did not. Only one deputy female had done sciences, 2males had done science subjects; 2males had done art subjects and one female had done commercial subjects. Even in posts of responsibility, in these three schools, fewer heads and deputies are females as indicated by these results. Fewer females (during their time) had done science subjects at A' level as compared to males.

The following table 7 below shows results from heads and deputies of schools

**Table 7 Responses by School Heads and Deputies (N=5).**

| Item                                                               | Agreed | Disagreed |
|--------------------------------------------------------------------|--------|-----------|
| 1.I encourage female A' level students to take up a science career | 3      | 2         |
| 2.Female students lack self confidence in science                  | 2      | 3         |
| 3.Science subjects are too difficult for female students           | 2      | 3         |
| 4.Science subjects are masculine                                   | 2      | 3         |
| 5.Female students are intelligent enough to do Sciences            | 2      | 3         |
| 6.Men generally make better physicists and chemists                | 2      | 3         |
| 7.Science subjects must be based on one's ability                  | 4      | 1         |
| 8.Science subjects are mainly taught by male teachers              | 5      | 0         |
| 9.Teachers generally believe that girls are not good in science    | 4      | 1         |
| 10.Generally girls participate in science lessons more than boys   | 1      | 4         |
| 11.Science textbooks are gender sensitive                          | 0      | 5         |
| 12. I treat female and male students equally at this school        | 5      | 0         |
| 13.Female students lack self-confidence in science                 | 5      | 0         |

The results shown above reflect or reinforce what has been shown by teachers and though they are administrators, they were trained to be teachers and they are still teachers.

The school therefore, plays a critical role in gender socialization and has a potential to act as an agent of change. However schools also tend to maintain gender inequalities which are also present in the communities. The organization and teaching within schools have tended to sustain gender inequalities. According to female students' view, teachers make students believe that science is too difficult for female students. This could be due to the way the teachers (as well as heads of schools and their deputies) were also socialized by the school as well as their community.

### **Conclusion**

The factors that influence the selection of 'A' level science subjects by girls include subject stereotypes, parental attitudes and encouragement, peer pressure, teacher attitudes, lack of self-confidence by the girls as well as lack of role models. A host of factors within our society, social and educational system contributes to under-representation of women in science. Confidence in science, course enrollment, expectations of parents, teachers and peers and exposure to role models all combine to reinforce at each level of development the choices girls make in school. Baron and Graziano (1991) advocate that girls are often socialized into dependence and passivity. It is important that female students be encouraged to break off their submissive behavior patterns and learn to be independent and self-reliant.

### **Recommendations**

Education is above all a matter of socialisation. Education seeks to fit individuals into society by teaching them the accepted and established values, ideas and practices. Education was and is one of the main factors by which women's status is changing. However, it seems simple access to education is not by itself changing the prejudices against women. It would appear that most curricular still perpetuate gender stereotypes which reflect traditional men and women roles. Therefore a switch is needed from access to the same education and training, to access to gender - sensitive education and training. This means producing textbooks free of gender prejudices, and developing gender-sensitisation training programs for teachers in order to promote non biased attitudes. Therefore a change in pedagogy is recommended to facilitate this radical change. This might imply that there is need to involve the following organs: -

**Teachers must be involved in a change in pedagogy. For instance, teachers are recommended to:** give equal attention to girls and boys, encourage girls to participate fully in classroom and school activities and promote science among girls through affirmative action.

**School heads should** act as positive role models. They should ensure that all

teachers and staff are gender sensitised and ensure that they equally give attention to boys as well as girls.

**Publishers** : must ensure that the textbooks they produce are gender responsive and organize workshops for textbook writers and editors to become gender-sensitised.

**Writers** : must also ensure that the content and style of writings reflect gender sensitivity and incorporate positive role models for girls in textbooks.

**Policy makers and educationists** are to support the development of gender responsive curricular and textbooks should promote gender responsive policies in the field of education and ensure that resources and facilities are equally available for both boys and girls;

**Parents must also** support their daughters in the study of science. They should abandon out dated traditions and gender discrimination and guide their daughters in their career choice. Role models (according to Bandura's social learning theory) serve as an important source of career information and will provide the students with inspiration, support and confidence to pursue similar occupations. Bandura (1977) asserts that individuals are more likely to adopt a modelled behaviour if the model is similar to the observer and has admired status and that behaviour has functional value.

Parents need to encourage the female 'A' level students to select science at 'A' level. Parents and teachers should therefore encourage girls to take higher-level science courses. Girls need to be encouraged to improve their self-concept and self-esteem. Since science is male-dominated, there is need to prepare the way for girls to enter occupations which are non-traditional for their sex.

Society should be made to realize that science is of value to girls' lives and a field in which women as well as men can experience great success. A greater awareness of the achievement of female scientists would serve to boost the self-confidence of girls. This could be done by making good use of media, films, television and journalists to publicize information on women in scientific fields.

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