Towards Science Education for all: Teacher Support for Female Pupils in the Zimbabwean Science Class

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ABSTRACT

This study sought to explore the challenges faced by female pupils studying sciences at high schools in Zimbabwe and the support they receive from their teachers. One hundred female pupils studying sciences at either Ordinary or Advanced level, and 10 science teachers from 10 selected secondary schools in one province in Zimbabwe, participated in the study. Questionnaires, focus group discussions and interviews were used to collect data. Descriptive statistics were used to analyse quantitative data while qualitative data were analysed manually according to themes. We found that female pupils encounter various gender based challenges in the learning of science, such as labelling of science as ‘masculine’ and stereotypes related to the abilities of girls. At the same time, teachers’ non-verbal actions, interaction, selection of pupils to study science, allocation of responsibilities and expectations for pupils in the science class were biased against female pupils. Teachers are encouraged to create conditions which may promote the involvement of girls in science, and not frighten them away from the subject.

Keywords: Challenges, female pupils, learning science, science education, teacher support.

BACKGROUND

Science education plays the significant role of a forerunner to the much needed technological and national development, given that science and technology are considered to be the catalyst for economic development and
improvement in individual and community well-being (Schiebinger, 2010). The 1999 Budapest Declaration ‘underlined the importance of science education for all’ (UNESCO, 2010:9) However, science and technology education is one area where the gender disparity in the education system is greatest in terms of participation, quality, content of interest and performance (UNESCO, 2010; Osborne, Simon and Tyler, 2009; Swedish Agency for Development Education (SADEV), 2010; Ombati and Ombati, 2012).

Zimbabwe has experienced a perpetuated disparity between males and females in both secondary and tertiary education. While there have been concerted efforts towards achieving gender parity in enrolment at all levels of the Zimbabwean education system, the achievement and completion rates have been biased in favour of males especially in the sciences. There is a low enrolment of women in universities, especially in the areas of mathematics and science (Millennium Development Goals report Zimbabwe, 2010). This could be a result of what has been noted by researchers that ‘girls and women have less confidence in their abilities than males do and that from early adolescence, girls show less interest in math or science careers’ (Halpern, Aronson, Reimer, Simpkins, Stor and Wentzel, 2007:6). According to Stromquist (2007:6), ‘formal schooling is a major agent in teaching and reinforcing cultural expectations for males and females’. The emphasis on gender parity in enrolment takes ‘little account of the diversity of contexts and conditions in which young girls and boys live and attend school or their gendered aspirations and experiences of schooling (Aikman and Unterhalter cited by Aikman and Rao, 2010:1).

Meaningful gender equality in education should result in ‘boys and girls experiencing the same advantages or disadvantages in attending school, receiving the same teaching methods, curricula, and academic orientation and producing equal learning achievement and subsequent life opportunities’ (Byamugisha, 2011:4). According to Aikman and Rao (2010:3), there is increasing interest in understanding the ways in which ‘teaching and learning strategies are gendered and...how these impact on the learning and social experience of schooling for girls’. Therefore this study sought to establish girls’ experiences of schooling and the nature of support they receive from their teachers in learning science subjects.

**Conceptual framework**

The gender neutral approach informs this research. This approach is also referred to as the ‘equality framework’ (Stromquist, 2007:10). The framework recognises that political or social forces external to science have created barriers to female participation, and it emphasises redress of these issues as a measure to improve female participation in science (Sinnes, 2006). It supports equal access for girls and women in education. (Schiebinger, 2010). Sinnes (2006:75) emphasises that ‘a central goal of this approach is to
give girls and boys the same opportunities and challenges...and science teachers should play an active role in the avoidance of treating males and females differently’. The teacher can make a difference if he or she assumes that girls can learn science, as this is likely to positively affect his/her approach to teaching girls and, expectations of what girls can achieve in the subject. Teachers may influence the beliefs and values that pupils hold about their capabilities in science subjects.

**Challenges encountered by female pupils while learning sciences**

Various research findings have consistently shown that girls have been performing significantly poorer than boys in science for a long time and diverse reasons have been attributed to this trend: lack of gender responsiveness among teachers (Omar, 2011; Ombati and Ombati, 2012); boys have more positive attitude towards science (Osborne et al, 2009); bias against sciences held by girls (Osborne et al, 2009; Halpern et al, 2007); and stereotyping of physical sciences as ‘masculine’ (Schiebinger, 2010). Gender inequality in education manifests itself in fields of study opted for, by boys and girls at institutions of higher learning, leading them to particular careers and employment. As a result, girls and women may end up in jobs in the service sector which are regarded as ‘feminine’ jobs.

In order to increase demand for girls' education, the value and relevance of education must be clear. The way in which girls, their families and teachers view education and content of the curriculum will be influenced by gender equality in wider society. Across the world, assumptions about what is appropriate for boys and girls to learn can undermine equality in learning. In many societies, it is assumed that girls are not good at mathematics and that boys cannot learn about the care of young children (Aikman and Unterhalter, 2007). Assumptions such as these, and the teaching that accompanies them, may reinforce gender inequalities, with girls being channeled into 'lower status' subjects. Despite women's increased access to schooling and extended years in education, 'it is gradually being recognized that promotion of gender equality in education goes beyond access’ (SADEV, 2010:8). Gender inequalities influence the teachers’ practices and attitudes, learning materials and content of the curriculum in schools (SADEV, 2010). As a result of some of these challenges, female pupils’ participation, achievement and interest in science subjects may be lower than that of their male counterparts.

**Teachers’ support to, and expectations of, female pupils studying sciences**

Organisations and groups can play a key role in the formation of girls’ identity as future scientists. Stromquist (2007:6) noted that formal schooling 'can also be seen as a site with considerable degrees of autonomy to produce new and progressive identities'. Teachers can identify promising girls and
encourage them to pursue science, influencing both girls’ self-image as competent achievers in science as well as their decisions regarding whether to pursue science careers. However, some studies have shown that some teachers treat boys and girls differently in ways that hamper personal, academic and professional growth among girls (Stromquist, 2007; Ifegbesan, 2010).

Where girls are assumed to be less able in science their performance, self assessment and interest in science are affected (Schiebinger, 2010). Social practices and forms of social discrimination within schools can act to exclude some children from schooling. Research findings show that classroom practices favour boys and teachers generally pay more attention and give more feedback to boys (SADEV, 2010:48). Both male and female teachers may have negative attitudes towards girls’ abilities to perform well in sciences and these may discourage girls from pursuing science related courses (Omar, 2011). Such attitudes could be responsible for the situation whereby ‘in many parts of Africa, girls receive a science education of lower quality than boys (UNESCO, 2010:54). Nevertheless, it is important to note that in the early stages of the school system there is generally no meaningful difference between girls and boys attitude toward science (Mohammad, Ebrahim, Anzan and Maryam, 2012; Osborne et al., 2009).

Teachers are significant role models who can communicate ‘multiple gendered messages through the curriculum’ (Stromquist, 2007). This denies female pupils and women, access to a wide choice of science-based fields (Schiebinger, 2010). One cannot help observe that female pupils need support from their teachers in learning science as ‘teachers are the key players in improving the learning of all our children in school (UNESCO, 2010:37). Thus, to encourage girls to study science subjects ‘careful attention must be paid to the environment in our classrooms as well as the workplaces and throughout our culture’ (Hill, Corbett and Rose, 2010:xvi).

There have been considerable studies in Zimbabwe on the role of the teacher in shaping pupils’ academic self concept in particular subjects whose findings have been availed in teacher training courses and to other educationists in the past two decades (Shabaya and Konadu-Agyemang, 2004; EGM, 2010; Mawere, 2013). However there appears to be a dearth of information on what teachers actually do in the form of encouraging or supporting the girl child in the Zimbabwean science class at present. This study focussed on the extent to which teachers are supportive of the female pupils’ bid to study sciences at secondary school.

Statement of problem

In most secondary schools in Zimbabwe, many female pupils are participating in sciences at Ordinary level. However, the number of those participating in Advanced level sciences is significantly low. Female pupils may face particular challenges in studying sciences for which teacher support
is necessary. The main objective of the study was to establish the forms of teacher support availed to female pupils in the science class. The study had the following specific objectives:

1. Establish the challenges encountered by female pupils when learning science subjects at high school level.
2. Find out the forms of science teachers’ support for female pupils learning science subjects.

**METHODODOLOGY**

This descriptive study employed mixed methods to reveal the different dimensions, and enrich understanding of the issues being investigated (Gilbert, 2008). The researchers formulated the items that were included in the questionnaire and interviews, informed by the gender neutral approach and literature concerning the role of the teacher in providing same opportunities to both male and female pupils.

**Population and sample**

Ten schools high schools, in one province of Zimbabwe, were purposively sampled on the basis that they offered science subjects at both Ordinary and Advanced level. The population consisted of 1000 pupils studying science at either Ordinary level or Advanced level listed in the school attendance registers.

**Pupils**

The sample was selected through random sampling. Numbers were assigned for each female pupil in the main list at each of the participating schools. These numbers were written on pieces of paper and drawn from a box without replacing. The process was first done to select participants from the Ordinary level group of female pupils and then from the group that consisted of Advanced level sciences female pupils. The process was repeated at each one of the ten selected schools participating in the study until there was a sample of one hundred female pupils. This was considered to be fairly representative as Chikoko and Mhloyi (1995:81) state that, ‘in descriptive survey research a sample of 10 - 20 percent is often used.’

**Teachers**

Ten Advanced level science (Biology, Chemistry, Mathematics and Physics) teachers were purposively sampled to participate in the study. Only those science teachers with a minimum qualification of a science teaching degree and at least five years teaching experience were considered for selection. A
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teaching experience of five or more years was preferred because it was assumed that these teachers had acquired the relevant pedagogical and content knowledge to teach the subject. (Kent, Arnosky and Macmonagle, 2002).

Data collection instruments

Questionnaire for pupils
A self-administered questionnaire containing both closed and open-ended questions was used to collect data from the selected female pupils. In designing the questions the researchers were guided by the insights from gender neutral approach and literature on the topic as well as the demands of the research objectives. Inclusion of open-ended questions enabled respondents to express their views and understanding of issues and explain answers given to closed questions. A section of the questionnaire focused on challenges encountered by female pupils in the science learning process and another on the support and assistance given to female pupils in science learning.

Focus Group discussions
Two focus group discussions that engaged pupils in informal discussions on the research topic were conducted with pupils from both co-educational and single-sex secondary schools to avoid polarization and bias. The first group consisted of eight Ordinary level female pupils coded (1-8); and the other consisted of Advanced level sciences female pupils coded (9-16) who shared common interest in the topic under discussion. The participants were chosen randomly from the initial sample of 100 girls. The discussion between participants provided the researchers with an opportunity to hear issues which may not emerge from their interaction with the researchers alone. The participants debated on issues pertaining to the teachers’ support for female pupils in the science class reflecting on common experiences. Focus groups ‘encourage a range of responses which provide a greater understanding of attitudes, behavior, opinions or perceptions of participants on the research issues’ (Hennink, 2007:6). That is data is generated from multiple voices. Both researchers were not part of the teaching staff at any of the participating schools and, one of them was the moderator.

Semi-structured interviews with teachers
Ten (10) science teachers from the participating secondary schools were interviewed individually at their respective work places. The open-ended questions enable the interviewer to probe further, giving the interviewees a chance to qualify their responses (Dhliwayo and Keogh, 2002). The responses given during the interviews were recorded by means of both field notes and tape recording. The interviews were then transcribed, coded and ‘analyzed by hand’ according to emerging themes (Cresswell, 2012:239).
Trustworthiness

Triangulation through multiple methods of data collection and sources of information was intended to ensure the trustworthiness of the data (Flick, 2009). Interviews with teachers, the focus group discussions and the questionnaire may validate some of the information relating to the issues under study. Questionnaire, respondents were guaranteed anonymity such that they were free to give accurate and authentic information without fear of reprisals. In view of the measures taken during data collection, the data may be considered to be credible and dependable.

RESULTS AND DISCUSSION

Challenges faced by female pupils learning sciences at high school

Teacher practices in the classroom

Questionnaire-Closed questions

The respondents were asked questions on the challenges, which female pupils encounter when learning science at their schools. The respondents highlighted their opinion on different behaviours, which manifest in the science lessons and their responses are indicated in Table 1.

The majority of respondents (65%) highlighted that teachers emphasize to their pupils that sciences were difficult to female pupils. Most respondents (72%) indicated that female pupils are not given the opportunity to demonstrate or help with experiments and more than half of the respondents indicated that female pupils are engaged in fewer activities and experiences using a variety of apparatus. However pupils were equally divided on the issue of whether teachers picked on girls who raise their hands to answer questions.

<table>
<thead>
<tr>
<th>Table 1: Girls and the learning of sciences (N=100).</th>
<th>True (%)</th>
<th>False (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Teachers emphasize the difficulty of sciences to girls</td>
<td>65</td>
<td>35</td>
</tr>
<tr>
<td>B. Girls are chosen to give a demonstration or help with an experiment</td>
<td>38</td>
<td>72</td>
</tr>
<tr>
<td>C. Girls are less interested in sciences</td>
<td>75</td>
<td>25</td>
</tr>
<tr>
<td>D. Girls engage in fewer activities and experiences using a variety of apparatus</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>E. Teachers fail to see girls’ raised hands in the lessons</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>
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Focus group discussions
It was stated that though female pupils might have access to study sciences, the treatment offered to them was different from that given to the boys especially in the allocation of resources. Some female pupils highlighted that they have limited access to some of the textbooks and past examination papers.

A sentiment which was conveyed in the discussions was that female pupils are less interested in participating in sciences. It was noted from the discussion with the Ordinary level female pupils that subjects such as Mathematics, Physics and Chemistry at Advanced level are mostly regarded as ‘masculine’ subjects.

Fewer girls studying Advanced level sciences

Questionnaire- Closed questions
The respondents were asked to choose one of the possible reasons why fewer female pupils opt to study sciences at Advanced level. The responses are shown in Table 2.

<table>
<thead>
<tr>
<th>Reasons</th>
<th>(%)</th>
</tr>
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<tbody>
<tr>
<td>A. Lack of awareness about science careers e.g. in biotechnology, mining and engineering</td>
<td>10</td>
</tr>
<tr>
<td>B. Girls are less interested in science</td>
<td>30</td>
</tr>
<tr>
<td>C. Less attention given to girls during lessons</td>
<td>60</td>
</tr>
</tbody>
</table>

It can be noted that most respondents stated that less attention is given to female pupils during the science lessons.

Focus group discussions
Pupils were also asked why fewer girls than boys were studying science subjects. They pointed out that comments made by some science teachers in co-educational schools make female pupils feel unaccepted and less confident to approach teachers whenever they experience difficulties.
Teachers’ support to female pupils studying sciences

*Questionnaire: Closed questions*

The respondents were asked to identify some of the behaviours, which the science teachers manifest during the interaction with the female pupils in the science lessons as indicated in Table 3.

<table>
<thead>
<tr>
<th>Variables</th>
<th>True (%)</th>
<th>False (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Non-verbal teacher actions such as head nodding and encouraging smiles</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>B. Girls interrupted when answering by teachers</td>
<td>65</td>
<td>35</td>
</tr>
<tr>
<td>C. Teachers limit their interactions with girls to social, non-academic topics</td>
<td>59</td>
<td>41</td>
</tr>
<tr>
<td>D. Not all text – books are available for use by girls</td>
<td>63</td>
<td>37</td>
</tr>
</tbody>
</table>

Most respondents (60%) indicated that in the lessons, there are no non-verbal actions, which encourage the participation of girls in science activities. They stated that teachers do not nod their heads or give an encouraging smile in appreciation for an attempt made by a female pupil. The common view among the participants was that their teachers interrupt female pupils while they are answering questions. Many respondents (59%) pointed out that there was less interaction between the science teachers and the female pupils.

*Focus group discussion*

The female pupils also gave some weight to the view that, one reason female pupils do not advance in sciences may be teachers’ attitudes in their interaction with girls. One pupil asserted that there is lack of recognition by some teachers that female pupils can succeed in science related fields:

There are barriers. There are teachers who are stopping girls in their science tracks. The expectations of what girls can do and achieve in science are too low. For example, an ‘O’ level girl who showed real aptitude for science was told by an ‘O’ level science teacher that she would never have a chance to pursue sciences at ‘A’ level. *(Pupil 12)*

*Interviews*

The science teachers noted that the ever-increasing cases of improper association between mostly male teachers and female pupils make it difficult
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for them to have consultations, as science teachers in most secondary schools work from the preparation rooms in the laboratories. These offices and the preparation rooms in the laboratories are considered out of bounds for female pupils. There are strict rules and regulations, which control the interactions between teachers and female pupils at various secondary schools.

Selection of subjects to study at Advanced level

Questionnaire - Open question

For female pupils to pursue sciences at Advanced level there are different people who can either, encourage or discourage them. Apart from female pupils having a say regarding the path which they want to follow at Advanced level, decisions can be made by other people on their behalf. The respondents identified how male and female pupils usually end up studying sciences at Advanced level as indicated in Table 4.

Table 4: Selection of pupils into sciences at Advanced level (N=100).

<table>
<thead>
<tr>
<th>Mechanism of selection</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Teachers select pupils to study</td>
<td>54</td>
</tr>
<tr>
<td>B. Pupils select the subjects on their own</td>
<td>10</td>
</tr>
<tr>
<td>C. Parents decide the subjects for their children</td>
<td>32</td>
</tr>
<tr>
<td>D. Any other (e.g. relatives)</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

In most secondary school offering sciences at Advanced level the selection of pupils is based on merit. Slightly more than half of the respondents (54%) identified teachers as the ones who select pupils to study sciences at Advanced level. However, very few respondents (10%) noted that pupils themselves have the opportunity to select science subjects to study at Advanced level. To a large extent teachers and parents (86%), make the decisions for the pupils.

Focus group discussion

In the focus group discussion with Ordinary level pupils it emerged that girls are interested in science. However, they criticised the way the pupils are allocated to specialized science subjects at Ordinary level. The girls asserted that they want to do subjects such as Physical Science but there are a limited number of pupils who may join this class and the teachers decide who should enrol for what subject. Under such conditions most of the pupils just learn Integrated Science which is a compulsory subject although this effectively
eliminates the opportunity to learn sciences at Advanced level. Physical science is a pre-requisite for studying science subjects at Advanced level.

It was pointed out that in most co-educational secondary schools; the highest number of pupils participating in Physics is that of boys and this makes the female pupils feel as if Physics is not for them. A pupil explained:

Here at our school in the upper sixth Physics class, I am the only female pupil ... but the going is tough as one has to master the content which has a lot of mathematical calculations. Given another option to select a new combination at ‘A’ level, I will definitely opt for the arts subjects where there are other girls. (Pupil 11)

Interview

Nearly all (80%), of the teachers had reservations concerning the competence of female pupils in Advanced level sciences, thereby preferring to work with a few female pupils.

Career guidance in science related occupations

The respondents were asked to identify some activities being done at their schools by their science teachers as a way of increasing their knowledge base in as far as the sciences and science related career are concerned.

<table>
<thead>
<tr>
<th>Table 5: Teachers’ assistance in career choice (N=100).</th>
<th>True (%)</th>
<th>False (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Invite role models to talk about their career and academic preparation.</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>B. Encourage participation and make girls aware of out-of-school activities in science</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>C. Organize tours to universities, colleges and science related industries</td>
<td>30</td>
<td>70</td>
</tr>
</tbody>
</table>

Many pupils (60%) stated that schools do not invite role models to talk about their career and academic preparation. Most respondents (75%) highlighted that there was no encouragement from teachers for female pupils to participate in science related activities out of school. Very few participants indicated that schools organize educational tours to the universities and colleges.
DISCUSSION

With reference to the equality framework, it is assumed that males and females have an equal ability to engage in science. As such, the teacher’s role in promoting gender equity in science education is to avoid treating males and females differently. From the findings it can be noted that although some girls have access to study science at Ordinary level where this is compulsory, they stated that they have less interest in science. It is not clear whether this is a result of innate low capabilities in the subject or unfavourable interaction patterns and teacher practices in the classroom. There are indications that the instances where teachers give girls who raise their hands, an opportunity to answer questions are more or less the same as when they do not give them this opportunity. Thus one could say that in this respect, there are some teachers who provide similar opportunities to boys and girls.

Nevertheless, the findings show that allocation of resources, engaging in activities using a variety of apparatus and opportunities to lead a demonstration, were generally biased against the girls. The pupils pointed out that they have limited access to certain textbooks and past examination papers for revision purposes. The interactions between pupils and teachers in the classroom also do not appear to be encouraging girls to participate in the learning of science. A considerable number of participants said that there are more interruptions of girls while they are answering questions and that the teachers engage in more social, rather than academic, conversations with them. The reason for this could be that teachers do not seem to recognise that girls can also succeed in science as stressed in the focus group discussions. Given that teachers emphasised that they do not encourage female pupils to come for consultation after lesson time, limited teacher-female pupil interaction during the lesson may be placing girls at a disadvantage since boys may consult the teacher when there is need to do so after the lesson. With teachers exhibiting these behaviours it appears there is limited support given to female pupils in the learning of science.

Findings of the study from the questionnaire and focus group discussion show that teachers emphasise the difficulty of science subjects to girls. In the interviews, the teachers explained that they would rather have a few girls in the science class because they have reservations concerning girls’ competence. In the Zimbabwean education system, a lot of emphasis is placed on national examination pass rates as reflective of the teacher’s competence and the quality of education offered by any particular school. In a way, when teachers prefer more boys in the science class, it could be taken as lack of confidence in girls’ ability to succeed in the sciences and also a way of ensuring that they attain high pass rates in their subjects. Teachers seem to start the selection of pupils to study Advanced level science at Ordinary level, by not giving all pupils the opportunity to study particular science subjects to enable them to take up sciences at Advanced level.
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It would appear both pupils and teachers regard science as a masculine subject. This is shown by teachers’ emphasis of the difficulty of science subjects to girls, preference for fewer female pupils in the class, and allocation of fewer resources to females. From the focus group discussions, pupils reiterated that Advanced level sciences had fewer girls and that it was better to study arts or commercial subjects. However subjects that are considered masculine lead to better paying jobs compared to ‘feminine’ subjects, consequently girls are disadvantaged on the job market.

Generally, career guidance concerning science careers is low in these schools. This places both male and female pupils at a disadvantage as they lack awareness of the possible career paths in contemporary society.

CONCLUSION

According to the gender neutral approach to science education, science teachers should actively work to change the educational factors that hinder girls’ participation in science (Sinnes, 2006). However in this study, the findings indicate that there is some bias against girls in the teachers’ practices and interaction patterns. There is need for teachers to promote gender equality in science education in terms of participation, quality, interest and performance. This is one of the teachers’ key responsibilities which should permeate through their teaching and interaction with pupils.

REFERENCES

Teacher Support for Female Pupils in the Zimbabwean Science Class


Vimbai Sharon Matswetu and Pinias Chikuvadze

Current challenges in basic science education. Paris: UNESCO.