

COMPULSORY SCIENCE POLICY: ENHANCING GENDER EQUALITY IN EDUCATION? A CASE STUDY OF ACADEMIC ACHIEVEMENT IN UGANDA

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This paper communicates the results of a diagnostic evaluation of the performance of boys and girls in physical sciences at Ordinary level in Uganda after the adoption of the compulsory science policy. The objectives of the study were twofold: to examine the academic performance of boys and girls in the Uganda National Examinations from 2007 to 2010, and to highlight key factors that continue to influence the achievement of students, especially girls in sciences. Data was obtained from five co-educational secondary schools using documentary reviews, in-depth interviews and focus group discussions. The results revealed that the performance of both boys and girls have further declined after the implementation of the compulsory science policy. However, in comparison to the boys, girls in co-educational schools were still more likely to be among the poorest performers in sciences. This was attributed to a number of factors, key among them being girls' self-concept in sciences, and teachers' perception of girls' abilities in sciences. These findings reiterate the need to mainstream gender into both policy design and implementation.

KEYWORDS: Science Policy, Equity, Equality, Self-Concept, Academic Performance

INTRODUCTION

Since the last decade of the 20th Century, there has been an unprecedented

interest and expansion in science and technology world over (UN Millennium Project, 2006 cited in Asiimwe, 2007). As a result of this renaissance, many governments around the world have been struggling to improve their relative position in science and technology, majorly through policy reforms, and formulation of new policies. Key on the agenda of many such governments has been creating a critical mass of skilled scientists to act as a catalyst for the much desired economic growth and transformation of their countries.

In tandem with the above global processes, and backed by her vision of 'transforming the Ugandan society from a peasant to a modern and prosperous country', the government of Uganda identified science and technology as one of the key pillars of the 2010/11 -2014/15 National Development Plan (Republic of Uganda, 2010). This compelled the various sub-sectors of the economy to make reforms so as to be responsive to the new national plans. In view of this national outlook, the education sub-sector adopted the 'Compulsory Science' Policy' (CSP), which took effect in 2005. The policy made the basic sciences (mathematics, biology, chemistry and physics) compulsory in the secondary school curriculum for Ordinary Level (senior 1 to 4).

Before the CSP, only mathematics was compulsory. This lacuna in the curriculum was exploited by many secondary schools, particularly the private ones, who decided to abandon teaching the other science subjects which were not compulsory, especially physics and chemistry. Another notable trend was that in schools where all the basic sciences were offered at Ordinary level, most students, especially girls, avoided choosing options in the sciences (Mulemwa, 1999; Kwesiga, 2002). For a developing country like Uganda, the implementation of the CSP was therefore, a move in the right direction, as it sought to enhance the scientific human resource capacity in the country which is deemed to be fundamental for socio-economic transformation.

The need to expand the functional scientific capacity of all citizens is further underscored by the Declaration on Science and the use of Scientific Knowledge (paragraph 42, cited in UNESCO, 2000), where it succinctly states:

"Equal access to science is not only a social and ethical requirement for human development but also essential for realizing the full potential of scientific communities worldwide and for orienting scientific progress towards meeting the needs of humankind. The difficulties encountered by women, constituting over half of the world's population, in entering, pursuing and advancing in a career in the sciences and in participating in decision-making in science and technology should be addressed".

From the above quotation, and as argued by Lee & Fradd, 1998, it may be concluded that the sustainable development prospects of any country are intricately linked to the adoption and utilization of science and technology by all citizens. This argumentation echoes an important undertone of equality and equity, which have become critical values, in the changing face of the global

economy

CONCEPTUALIZING EQUALITY AND EQUITY IN EDUCATION

From the forerunning literature, it is imperative that some conceptual clarifications are made, particularly with regard to the concepts of equality and equity, as used in education discourse. It is not the intention of this paper though, to indulge in a comprehensive conceptual discussion of the two concepts, but rather to understand their practices within the context of social policy and gender (cultural attributes associated with being male and female).

In most policy debates and research literature, the two terms are often presented as synonyms, particularly when used in merely semantic terms. The Oxford English Dictionary for example, defines equality as “the condition of having equal dignity, rank, power, ability, achievement or privileges with others”, and equity as “the quality of being fair; impartial or even-handed”. According to Hutmacher (2001 cited in Harrera, 2007), the semantic similarity in the conceptual perspectives on equity and equality serves to acknowledge the interdependent relation existing between the two concepts, and hence justifies their synonymous use in some writings.

Some philosophers however argue that, the terms 'educational equality' and 'equity' are moral terms, which can only be defined by reference to ones moral understandings (Harry, 2009). This perspective would in essence imply that the two terms cannot have a universal definition. Despite the apparent conceptual complexity of the two terms, the functional understanding of the term 'equity' as used in this paper largely draws from the insights given by UNESCO (2000). The literature herein advances that equity can be understood from two main dimensions: the first concerns overall provision (access, which can also be viewed as equal opportunity); and the second has to do with provision for more marginalized groups (fairness). From the UNESCO (2000) perspective, the practical implication would be that a social policy committed to equity must as a necessity encompass both access, and concern for the marginalized groups, which in the case of this study are the girls within the co-educational context. Further elaborating on this, Harry (2009) posits:

“Adopting a principle of educational equity commits you to giving a fairly priority, in state and district-level policy, in the policies and design of your school's instructional mission, and in your own practice, to raising the prospects for achievement of the low achievers, while giving you appropriate room to give some weight to improving the achievement of other students, and to compromise with the barriers that will be placed in the way of improving low-end achievement”.

The assumption behind the organization of the contemporary inherited Western formal education system is based on the principle of equitable space for teaching and learning. Research has however, shown that teaching and

learning that goes on in many co-educational classrooms tends to promote inequitable participation of students (Akankwasa, 1997; Assie-Lumumba, 2001). An equitable education, Hambrick (2006) argues, is that where every student has access to challenging and meaningful academic learning, facilitated by high teacher expectations and strong support for all. In a classroom situation, this does not necessarily imply that every student should receive the same amount of instruction. Rather, the principle of equity recognizes that students have different needs and that these differences should be identified and addressed. This calls for appropriate accommodation, learning opportunities, high expectations, and adequate resources and support so that outcomes for every student are equitable.

THE COMPULSORY SCIENCE AND GOVERNMENT SUPPORT STRATEGIES

Given that before CSP science education was largely neglected in the secondary school curriculum, the enactment of the policy necessitated that government puts in place elaborate support strategies to ensure its successful implementation. Following the pronouncement of the policy, the government, through the Ministry of Education and Sports (MoES), and the technical assistance from the government of Japan, through Japan International Corporation Agency (JICA), established the Secondary Science and Mathematics Teacher's (SESEMAT) programme. The SESEMAT programme was developed to enhance the quality of teaching and learning science and mathematics through In-service Education (INSET), primarily targeting secondary science and mathematics teachers. A key anticipated outcome of the programme was improved teaching and learning of sciences and mathematics, and this was in turn expected to boost performance in those subjects. To date, through SESEMAT a number of District Teacher Trainers (DTTs) have been trained, and the DTTs have in turn trained a significant number of Science and Mathematics teachers at District level through out Uganda (SESEMAT, 2008).

In addition to SESEMAT, a number of other government interventions were also made in a bid to facilitate the implementation of the policy in schools. These included among others, recruiting more science teachers, building and/or renovating laboratories, and supplying equipment, chemicals and textbooks to secondary schools. Apart from MoES, the Uganda National Council for Science and Technology (UNCST) has also been very supportive in promoting science and technology in secondary schools. The Council, which is a government agency mandated to facilitate and coordinate the development and implementation of policies and strategies for integrating Science and Technology into the national development process, has come with a 'Role Model' strategy for secondary schools. This strategy is implemented through a pool of successful scientists who visit different secondary schools on a yearly basis, usually before the terminal national examinations. During the visits, the

scientists interact with students, staff and administrators of the schools on matters related to school mathematics and sciences. The assumption behind this strategy is that the physical presence of the working scientists can act as a source of inspiration for the students, and motivate them to embrace and achieve highly in mathematics and sciences.

On the whole, since the pronouncement of the CSP, it is evident that the government has put in tremendous effort and resources to support its implementation in secondary schools. With this 'bee hive' like support activities since 2005, the logical expectation would be improved structures and facilities for teaching and learning sciences in secondary schools, and consequently improved performance in mathematics and sciences. In view of this, the purpose and scope of this paper was therefore, to give an overview of the performance of students in the physical sciences (physics and chemistry) both before and after the CSP. Performance in this case was used as an indicator, which according to Meuret (2001 cited in Herrera, 2007) is important for configuring particular inequalities “so that it can be properly evaluated or discussed...” Students’ performance before the policy is given in figure 1.

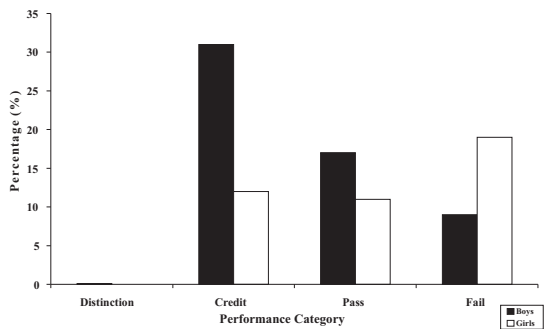


Figure 1. Students’ Performance in Physics from 2001 to 2003

(Source: Asimwe, 2007)

The data in Figure 1 was derived from a total number of 275 students (160 boys and 115 girls). As explicitly shown in the figure, from 2001 to 2003, no girl got a distinction in physics. A total of 33 girls (12.0%) obtained credits compared to 86 boys (31.0%); another 30 girls (11.0%) obtained passes compared to 48 boys (17.0%), and the majority of the girls (52), an equivalent of 19.0% failed compared to 25 boys (9.0%).

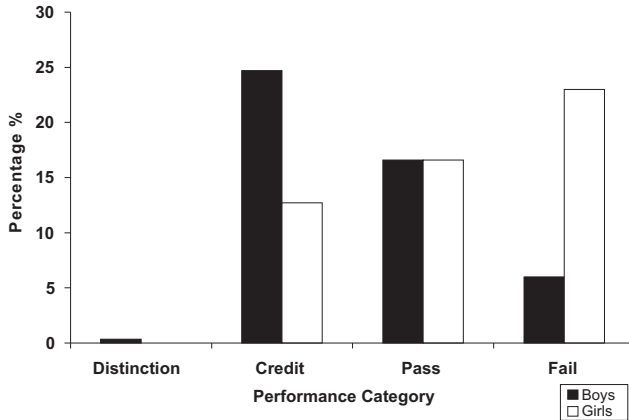


Figure 2. Students Performance in Chemistry from 2001 to 2003

(Source: Asimwe, 2007)

The number of students whose records were presented in Figure 2 totalled to 235, subdivided into 112 boys and 123 girls. As in the case of physics, no girl got a distinction in chemistry in the three years under study. Thirty girls (12.7 %) obtained credits compared to 58 boys (24.7%); an equal number of girls and boys (39) equivalent to 16.6% obtained passes. The majority, 54 girls (23.0%) failed compared to 14 boys (6.0%).

Given that before 2005 physics and chemistry were optional subjects, the expectation was that students who registered for the two subjects were strictly those who progressively had a high assessment record in two subjects. Ultimately, one would have expected a fairly comparable performance between the boys and girls. The results in the above two Figures however, portray some wide gender disparities in the national examinations, with the boys achieving higher grades in the two subjects.

With the numerous education interventions that have characterized the country since 2005, it was therefore, the desire of the author to track the changes in the pattern of students' performance, particularly in physics and chemistry. Assessment, especially at national level was considered a crucial determinant of the extent to which the CSP is achieving both high academic standards and educational equity.

METHODOLOGY

The study was conducted in former Bushenyi District, in the South-western region of Uganda. Purposive sampling was used to select two out of five counties which were then part of the district. Five government co-educational secondary schools out of a total of nine schools participated in the study.

Primary data was collected from three sources: documentary review, with a particular focus on Uganda National Examinations Board (UNEb) results; In-depth Interviews (IDI) conducted with 10 science teachers and Focus Group Discussions (FGDs) held with the senior four female students. Secondary data obtained through review of unpublished and published materials, as well as previous research reports were also used to supplement field data. All numerical data were expressed in frequency counts, and analyzed descriptively using percentages and bar graphs. In other cases, live voices of the participants were imported in the write up through verbatim excerpts from IDI and FGDs.

RESULTS OF THE STUDY

Findings from the documentary review are presented in this section.

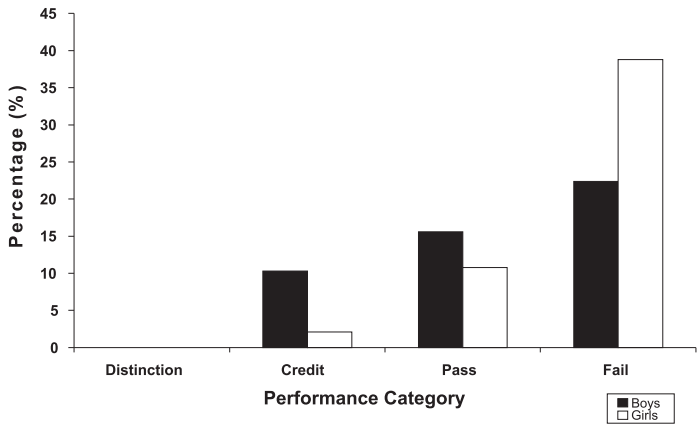


Figure 3. Students Performance in Physics from 2007 to 2010

(Source: Field data)

Figure 3 presents data obtained from a total number of 835 students, out of whom 403 were boys and 432 girls. The data shows that between 2007 and 2010, no student had obtained a distinction in physics. A total of 86 boys (10.3%) got credits compared to 18 girls (2.1%); 130 boys (15.6%) obtained passes compared to 90 girls (10.8%), and the majority of both boys (187), and girls (324), an equivalent of 22.4% and 38.8% respectively failed physics.

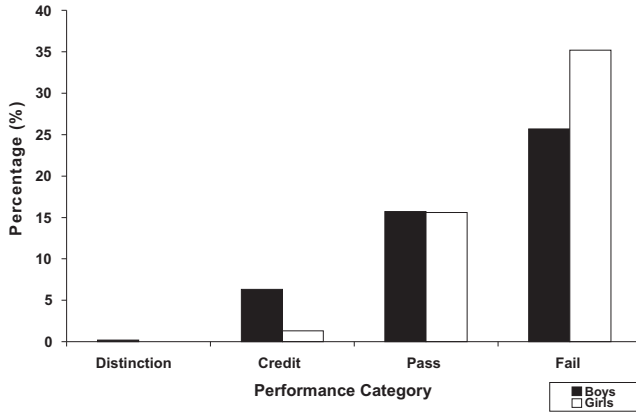


Figure 4. Students Performance in Chemistry from 2007 to 2010

(Source: Field data)

In chemistry as presented in Figure 4, out of a total number of 864 students (414 boys and 450 girls), 2 boys (0.2%) obtained distinctions in the four years under study. Another 55 boys (6.3%) got credits compared to 11 girls (1.3%); an almost equal number of students, i.e. 136 boys (15.7%) and 135 girls (15.6%) obtained passes, and as was the case with physics, the majority of students, i.e. 222 boys (25.7%) and 304 girls (35.2%) failed chemistry.

Findings from Focus Group Discussions

When asked why girls seemed to be performing poorer than the boys, the female student respondents identified the following reasons in order of ranking:

- Girls fear sciences
- Lack of confidence, especially in mixed sex classrooms
- Lack of understanding of the subjects
- Inadequate science teaching-learning facilities in schools

FINDINGS FROM IN-DEPTH INTERVIEWS

On their part, the science teachers who participated in the study identified the following factors as key in influencing girls' success in sciences:

- Girls' Attitudes Towards Sciences: Elaborating on this, one female participant noted that "in mixed-sex schools, when a boy consistently performs highly in a certain subject and a girl consistently performs poorly in the same subject, the girl tends to get discouraged and ends up pulling out of that subject".

- **Girls are Naturally Less Gifted in Sciences:** A striking remark in support of this reason was given by a female respondent who said, “Girls were not good at calculating and thinking...the brains of the girls are lower than the one of boys”.
- **The Abstract Nature of the Subjects:** To further clarify on this, the respondents noted: “sciences become difficult at “O” level because most of them are abstract and so students do not comprehend what you are teaching”.
- **Lack of Laboratories and Science Equipment:** All IDI respondents admitted that although the Ministry of Education and Sports had tried to provide facilities for teaching sciences in support of the CSP, they considered what had so far been done as 'a drop in the ocean'.

DISCUSSION AND CONCLUSION

From the data in Figures 3 and 4, two major features are evident: first, the performance of both boys and girls in physics and chemistry appears to have further declined after the introduction of the CSP. Secondly, in comparison to the boys, girls in co-educational schools are still more likely to be amongst the poorest performers in both physics and chemistry. This raises a gender concern, and the evidence as shown in Figures 1, 2, 3, and 4 imply that girls in coeducational schools constitute 'students at risk' in sciences, with particular reference to physics and chemistry. This scenario means that the scientific potential of half the country's human resource may continue to be significantly underdeveloped. This therefore suggests that unless a deliberate effort is made to reverse this trend, the CSP may provide another gateway for further alienating girls from sciences.

One major question that may be asked in view of the findings of this study is: why do the boys in co-educational schools consistently perform better than girls in subjects like physics and chemistry despite studying in the same classroom? Responses from the FGDs and IDI seem to suggest that there are some gender specific factors affecting the performance of girls in co-educational schools. Key among such factors is fear and lack of confidence, which ultimately result into low self-concept of girls in sciences. It is important to note that students' who lack confidence in a subject easily give up the subject at the earliest opportunity, or if such subjects are compulsory, they may not put in enough effort to overcome the challenges encountered during the teaching and learning process. This calls for a deliberate effort to be made to address these issues, which appears, to specific to girls in co-educational settings.

Responses from IDI further points to the fact that this already fragile situation could be aggravated by teachers who still hold stereotypical

attitudes towards girls' abilities in sciences. This implies that the strategy used by science teachers in co-educational schools in the teaching-learning process tends to empower the boys much more than the girls, thus creating different experiences for the two groups of students. Uganda being a patriarchal society, teachers' perceptions of males and females, especially within a co-educational context become crucial for their relations with students, and consequently for students' academic outcome. Gender-based expectations often results into the 'Pygmalion effect' or more commonly known as the 'Teacher-Expectancy effect'. This refers to situations in which students perform better than other students simply because they are expected to do so.

The concept of the teacher-expectancy effect often operates in such a way that once teachers form certain expectations of students, they communicate these expectations with various cues; to which students tend to respond. The result is that the original expectation of the teacher becomes true or is fulfilled (Karabel & Halsey, 1977). This in effect suggests that among other factors, a teacher's attitude is critical for achieving gender equity in coeducational schools.

Responses from FGDs and IDI both revealed that the science teaching-learning facilities in most secondary schools, is still inadequate, and this affected not only the quality of teaching but also understanding. However in the light of the focus and findings of this study, the author maintains that whereas ensuring that schools have adequate science teaching-learning resources is unquestionably important for meaningful teaching and learning, a social policy capable of reducing the current gender gap in science achievement must focus on challenging traditional gender stereotypes in science education. This reinforces argument that unless gender is mainstreamed into policy statements and all programmes designed to support the implementation of such policies; a general policy per se may not provide sufficient conditions for eliminating gender disparities in sciences.

From the results of this study, it is evident that despite the various government interventions in secondary schools following the introduction of the compulsory science policy, overall, student's performance in sciences, especially physics and chemistry, has remained dismal. In comparison to the boys however, girls' in co-educational schools still constitute a disadvantaged group in science subjects. This puts to test the principle of equity and dictates a need to establish support systems for girls in order to build their self-confidence in sciences. This calls for the incorporation of gender concerns into the design and implementation strategies of the CSP and other educational interventions.

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