Reflections on Physics Output from Senior Secondary Schools in Botswana

Sisai Mpuchane, Maggie Tshebo, and Debbie Shushu

University of Botswana

Botswana is one of 14 Southern African Development Cooperation countries. It has developed rapidly during 39 years of independence and has a GDP of $3917 per person (2001). The population is approximately 1.8 million. Like many neighboring countries, it has a high prevalence of HIV/AIDS, so many resources are diverted from development to HIV/AIDS relief. The pandemic has reduced available human resources: the need for well trained science and technology personnel is critical.

Botswana currently has one university, the University of Botswana (UB) that enrolls 15,425 students (13,104 full time and 2321 part time for 2004). Women comprise 50% of the enrollment but only 25% and 13% of the students in the Faculties of Science and Engineering and Technology, respectively. There are plans to establish a second university, which will focus on science and technology. Currently, many students who qualify for tertiary education but cannot gain entry into UB are sent to tertiary institutions outside Botswana, mainly through government sponsorship. The Faculty of Science currently has enrolled 1384 students, 25% of them women. Of 646 students who are registered for physics (years 1–4), 148 are female (23%). The dropout rate is also high among females (57 of 148 year-1 females [39%]).

According to Thabang Macholo of the Ministry of Education, who analyzed primary school exit results in 2003, 41,056 students took the examinations, 51% of them girls. Girls maintained their superiority in performance compared with boys across the five subjects (science, social science, mathematics, English, and Setswana).

Ministry of Education data also show that of the nearly 36,000 students with Junior Certificate results in 2001–2003, the percentage with grades A–C in mathematics rose from 22.7% in 2001 to 23.5% in 2003. In integrated science, the percentage with A–C grades increased from 24.8% to 26.3%. This is an indication of the pool that can cope with senior secondary science and mathematics material. While the results show a gradual increase in the number of learners that attain A–C grades, there is much room for improvement. The analysis also indicated that female students in mathematics had a marginally better pass rate than that of males (23.5% compared with 23.2%), while in integrated science boys did better than girls (27.8% compared with 24.7%). These candidates feed the numerous senior secondary schools that offer the Botswana General Certificate of Secondary Education (BGCSE).

At the BGCSE level, mathematics is compulsory and students select from three science combinations: Pure Sciences (physics, biology, and chemistry = 3 science credits); Double Award (2/3 physics, 2/3 biology, and 2/3 chemistry = 2 science credits); and (3) Single Award (1/3 physics, 1/3 biology, and 1/3 chemistry = 1 science credit). In 2004, 23,481 candidates took the examinations. Of these, 9440 were registered for single awards, 6829 for double awards, and just over 2540 registered for the Pure Sciences curriculum. This distribution has been consistent throughout 1999–2004, and in 2003/04 the overall performance indicates that more boys than girls achieve A–C grades (Figure 1).

Male students have enrolled in greater numbers than girls in physics, chemistry, and biology since 2000. For the same period, boys also outperformed girls in physics (Figure 2), chemistry, and biology. Mathematics test results during 2003 and 2004 reveal that male students outperform female students in achieving A–C grades.

What are the reasons for the sudden dip in performance of girls once they reach the senior secondary level? Why are there few female students in the Faculty of Sciences and Engineering? Why are there few female role models for science careers in the country? With many female students opting for the Single Awards in science, what prospects do they have for a career in the sciences? With a new university of science and technology being developed, what prospects do students with Single Award and Double Award backgrounds have for becoming top-class scientists? What is being done to remedy the situation?
A UB Women-in-Science team recently visited several schools throughout the country to encourage girls to pursue science programs and to find out why they do not apply for science at the university. Typical answers were: lack of encouragement at home and at school; not comfortable working with equipment; lack of a strong background in science; lack of role models in science careers; science programs are too long; and wanting to start a family while young.

Our major concern is that a large number of female students enroll for Single and Double Awards rather than Pure Science. Clearly, students enrolled in Pure Science (mostly males) have a better chance of success at the university. Students with Single Awards (many females) are also not admissible into the UB science program Yet when students were asked why they opted for a program that would deny them entry into tertiary-level science programs, they said that they had not been made aware of that fact.

To address the problem of misinformation or lack of information, our team, with the help of the Education for Development and Democracy Initiative (EDDI) of the United States Agency for International Development (USAID), UB, and the Ministry of Education Careers and Guidance Unit, has done the following:

- Organized a Science/Agriculture and Engineering Clinic for secondary school girls.
- Produced five booklets on science careers and one to help parents encourage daughters in science.
- Prepared an inventory of Botswana women scientists.
- Visited many schools to meet with students.
- Convened an international conference to network on strategies to address this concern.
- Organized study visits to centers also working on gender inequity in science participation.
- Organized a job-shadowing activity and a mentoring program.

Botswana, like many other countries, needs to address the concerns about gender inequity in participation in science. We have started many activities and hope to see them making a difference.