Reasons Girls Choose Agriculture or Other Science and Technology Programs in Swaziland

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Abstract

A descriptive-correlational study explored reasons for girls to choose agriculture or other science and technology programs at high school and tertiary levels. Findings revealed respondents’ reasons were: economic, personal, educational, family, and social. Negligible to low associations were found between background characteristics of respondents and their reasons to enroll in scientific programs. However, three background characteristics showed influence in the domain reasons for choice: place of birth, location of high school attended, and, type of school attended. A t-test analysis procedure of high school and tertiary girls’ reasons showed no significant differences. Additional information provided revealed girls aspired for careers in health fields and, applied sciences, including agriculture. Among the recommendations made were that, career guidance teachers should play a major role in showing girls how to choose subjects combination in high school which suits their aptitudes and, family members should encourage girls to take up scientific programs.

Keywords: Course, Program, Career-Choice, High School, Tertiary, Girls, Mathematics, Science, Technology

Introduction

Participation of girls in mathematics, science and, technology subjects (home economics and agriculture) at primary school level (grades 1 to 7) and, mathematics at secondary school level (grades 8 to 12) in Swaziland is similar with that of boys, mainly because both are compelled to take these subjects. However, participation of girls in agriculture and science in both secondary and tertiary levels (college or university) was low. Schools through streaming practices stereotyped participation of girls and boys in secondary school technology subjects. Female Education in Mathematics, Science and Technology in Africa (FEMSA) in a study published in 1999 found that, home economics was for girls and, woodwork, metalwork and technical drawing for boys only. Agriculture was open for both girls and boys, but girls were underrepresented all the time. The imbalanced trend continues to tertiary level. Only recently, that in Swaziland, few girls have attempted to join boys in non-traditionally-female science and technology fields, but not boys joining girls in traditionally-female fields. Tertiary level
statistics also show that, many girls who completed high school in a science stream opted not to go for a science program at tertiary level.

International, regional and national governmental declarations and actions were being put in place on improving the situation of women and girls (Southern African Development Community (SADC) 1997; 2001). Interventions were also mounted at the regional, national and community levels, by non-governmental organizations to promote girls participation in education, an area identified as key to promoting the situation of women in the developmental areas, in the long term. Squire (2003) reviewed strategies for enhancing women’s full participation in sustainable agricultural development and environmental conservation in sub-Saharan Africa, and, concluded among others that, a holistic and integrated approach is needed, including gender equality in access to educational opportunities and training programs for females.

Recently in Swaziland, UNESCO has placed emphasis on girls’ education under Education for All (EFA) campaign. UNICEF focused its efforts on removing gender bias in the primary school curriculum. The Forum for African Women Educationalists (FAWE) focused on the education of girls and women. The FEMSA project targeted mathematics, science and technology education of primary and secondary school girls. The African Child Literacy in Science and Technology (AFCLIST) project linked education context, including gender, with classroom science (Savage, Naidoo, & Fabiano, 2001).

Literature on description of factors generally influencing occupational choice and entry is abundant, and are on career planning, recognizing self-priorities, skills, and opportunities in careers (The Nottingham Trust University (NTU), 2002). However, empirical evidence on explaining and predicting reasons for girls to or not to enroll in science courses or programs is scanty, especially within the African context. The background to the foregoing can be attributed to the lack of concerted efforts in the past that targeted greater participation of girls in science and technology, which could have facilitated development of theories in the problem area.

In Africa, except in the northern region, descriptive studies between 1996 and 2001 were conducted by FEMSA national centers with both primary and secondary school boys and girls, on the problems girls face, the causes and solutions to the problems and, their coping strategies in studying science, for the purpose of mounting interventions in schools and communities. The similar problems that emerged were: the negative attitudes of girls toward science and, toward their intellectual capacity to do science; the perceived unimportance of science in their lives after school; special constraints and difficulties faced by girls; and, the greater involvement of girls in household chores. When boys and girls were probed more on the causes for these problems, causes given could be linked with “personal convictions” (Behutiye & Wagner, 1995); “economic support and opportunities” (NTU, 2002); “family background” (Afrassa, 1998; Howie & Pietersen, 2001); “educational and school system” (Cohn & Rossmiller, 1987; Lenga & Mwanycky, 2001; Riddel, 1997; Taylor & Vingevold, 1999); “school and classroom-related factors” (Howie, 2002); “socialization” (Daniel, 1995; FEMSA, 1999; Mitchell, 1995); and “peer group attitudes” (FEMSA, 1999; Howie & Wedepohl, 1997).

Thus, a need arose to explore specific reasons and explanations for girls’ participation in agriculture, science and technology courses or programs, in order to gain insights on possible approaches that worked for girls that may be used to maximize their participation in the national scientific and technological capacity building. The specific research question for the study is, what are the reasons and
possible explanations and predictions for girls to choose agriculture or other science and technology courses in high school or programs at tertiary level?

**Purpose and Objectives**

The study sought to determine the reasons for girls to choose agriculture or other science and technology programs in high school and tertiary levels. The specific objectives of the study were to:

1. Describe reasons for girls to choose agriculture or other science and technology programs;
2. Describe the relationship between background characteristics of respondents and their reasons for choosing agriculture or other science and technology programs;
3. Explore explanatory and predictive reasons for girls to choose agriculture or other science and technology programs; and,
4. Determine whether significant differences existed in reasons for girls to choose agriculture or other science and technology programs.

**Methodology**

The study was descriptive-correlational. The target population for the study was graduating female students enrolled in high school ($N = 272$) and tertiary institutions ($N = 198$), during 2002 calendar year. The high school girls were in the final year (Grade 12) in core science courses in purposively selected high schools. The science core courses were offered either as three stand-alone subjects of Physics, Chemistry and Biology; or, two science subjects of Physical Science (Physics and Chemistry) with Biology, together with other complementing subjects. The tertiary girls were also in the final year (fourth year in the university or second year in the technology college) in the purposively-selected institutions: a faculty/college that offered degree programs in agriculture in the University of Swaziland; a faculty/college that offered a double science major in the University of Swaziland; and, a technology college that offered associate degree in engineering, the Swaziland College of Technology. Sampling error was not a threat to external validity, since a census of all female students was conducted. Checking for duplication of, and finalizing, the names of students in the class lists, provided by the class teachers or registrar’s office of each school or institution controlled selection error.

The questionnaire consisted of three sections: Section A comprised of a list of 28 reasons developed through a review of literature and suggestions in the validated instruments on reasons for girls to choose agriculture or other science and technology programs organized under seven grouped reasons or domains. Respondents were asked to rate each of the reasons using a six-point Likert-type scale, to measure agreement to each of the reasons for girls to choose agriculture or other science and technology programs. The scale ranged from 1 to 6, with 1=strongly disagree, 2=disagree, 3=slightly disagree, 4=slightly agree, 5=agree, and 6=strongly agree. Section B requested high school respondents to provide additional information regarding their tertiary program aspirations and, both groups of respondents to make suggestions on how high school girls may be encouraged to enter sciences. Section C requested respondents to provide their background characteristics.

The face and content validity of the instrument were established using three individuals who have held a position in an organization promoting girls’ education. A pilot study was conducted with an intact class in a high school that offered science courses and, another intact class in an agricultural college. Cronbach’s alpha reliability coefficients were computed, and ranged from .64 to .78, for the domains, with an overall of .80 for high school girls’ instrument, and .80 for tertiary girls’ instrument.
Two data collection procedures were followed in the study. For the respondents from the University of Swaziland and the Swaziland College of Technology, questionnaires were personally delivered and collected two weeks later. For the respondents from high schools, class teachers were requested to administer the questionnaires during study time, and were collected two weeks later. Non-response errors were controlled, by following up non-respondents until all returned the filled questionnaire. A 100% response rate was achieved. Data collected were analyzed using descriptive statistics, correlations and, multiple regression procedures. The populations in the study, namely, high school and tertiary girls were treated as samples in time, and therefore, inferential statistics were applied.

### Findings
Objective one was to describe reasons for girls to choose agriculture or other science and technology programs. The overall reasons for girls to choose agriculture or other science and technology programs, as shown in Table 1, were found to be the following, in mean rank order: 

1. Economic ($M = 4.73; SD = 1.33$); 
2. Personal ($M = 4.49; SD = .89$); 
3. Educational ($M = 4.37; SD = .68$); 
4. Family ($M = 4.31; SD = 1.87$); and, 
5. Social ($M = 4.15; SD = .85$). 

On the whole, respondents only slightly agreed with school reasons ($M = 3.99; SD = .97$) and peer pressure reasons ($M = 3.69; SD = 1.18$). The same trend of mean responses is observable for both groups. Of worth noting is that, the high school group varied highly ($SD = 2.22$) in the family reasons, that is, respondents tended to disagree with regard the items in this domain.

<table>
<thead>
<tr>
<th>Grouped reasons</th>
<th>Tertiary ($N = 198$)</th>
<th>High Schools ($N = 272$)</th>
<th>Total ($N = 470$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic</td>
<td>$M = 4.65$/$SD = 1.29$</td>
<td>$M = 4.79$/$SD = 1.35$</td>
<td>$M = 4.73$/$SD = 1.33$</td>
</tr>
<tr>
<td>Personal</td>
<td>$M = 4.47$/$SD = .94$</td>
<td>$M = 4.51$/$SD = 1.38$</td>
<td>$M = 4.49$/$SD = .89$</td>
</tr>
<tr>
<td>Educational</td>
<td>$M = 4.33$/$SD = .71$</td>
<td>$M = 4.41$/$SD = .66$</td>
<td>$M = 4.37$/$SD = .68$</td>
</tr>
<tr>
<td>Family</td>
<td>$M = 4.15$/$SD = 1.21$</td>
<td>$M = 4.43$/$SD = 2.22$</td>
<td>$M = 4.31$/$SD = 1.87$</td>
</tr>
<tr>
<td>Social</td>
<td>$M = 4.09$/$SD = .84$</td>
<td>$M = 4.19$/$SD = .85$</td>
<td>$M = 4.15$/$SD = .85$</td>
</tr>
<tr>
<td>School</td>
<td>$M = 3.84$/$SD = 1.08$</td>
<td>$M = 4.09$/$SD = .88$</td>
<td>$M = 3.99$/$SD = .97$</td>
</tr>
<tr>
<td>Peer pressure</td>
<td>$M = 3.77$/$SD = 1.16$</td>
<td>$M = 3.63$/$SD = 1.20$</td>
<td>$M = 3.69$/$SD = 1.18$</td>
</tr>
<tr>
<td>Overall</td>
<td>$M = 4.14$/$SD = .61$</td>
<td>$M = 4.26$/$SD = .61$</td>
<td>$M = 4.21$/$SD = .62$</td>
</tr>
</tbody>
</table>

**Note.** Rating scale: 1 = strongly disagree; 2 = slightly disagree; 3 = disagree; 4 = slightly agree; 5 = agree; 6 = strongly agree.

Objective two was to describe the relationship between background characteristics of respondents and their reasons for choosing agriculture or other science and technology programs. The characteristics of the study sample were established at first. Fifty-eight percent of the respondents were at high school, while the rest at tertiary level. Among high school girls, 47% were in a single sex schools while 53% were in a co-educational schools. 95% were residing in urban areas, and 53% were in a government school, with 47% in mission schools. About 81% of the respondents were born in urban areas, 87% studied in urban primary and, 93% studied in urban high schools. Adjectives and ranges developed by Davis (1971) were used to...
describe the magnitude of relationships. The analysis used Spearman rank order and point bi-serial correlation coefficients, to describe the strength of associations.

The inter-correlations existed and ranged from negligible (.01 to .09) to low (.10 to .29). Therefore, each background characteristic was tested as explanatory variable to reasons for choice. Further analysis of inter-correlations among background characteristics indicated low degree of multi-co linearity (correlations of -.01 to .61). The inter-correlations analysis was necessary for the subsequent multiple regression analysis. High magnitude of multi-co linearity (correlations of .80 and above) requires grouping of background characteristics to narrow down the number of related background characteristics.

Objective three was to explore explanatory reasons for girls to choose agriculture or other science and technology programs. A forward stepwise variable entry and removal procedure was used, which examines the variable in the block at each step for entry or removal. In all domains/reasons, including the overall domain/reason, except with educational domain/reason, three variables repeatedly explained choice. Place of birth, contributed 6.9% of the variance in the dependent variable. The background characteristic location of high school attended, explained 1.4% of the variance, while, school type by sex explained .9%.

Table 2

Regression of Reasons for Choice of Program with Background Characteristics of Respondents (n = 470) (Stepwise)

<table>
<thead>
<tr>
<th>Variable</th>
<th>$R^2$</th>
<th>$R^2_{\text{change}}$ Change</th>
<th>$SE_B$</th>
<th>$t$-value</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significant X on Overall Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Place of birth$^1$</td>
<td>.069</td>
<td>.069</td>
<td>-.297</td>
<td>.080</td>
<td>-.359</td>
</tr>
<tr>
<td>Location of high school attended$^2$</td>
<td>.083</td>
<td>.014</td>
<td>-.348</td>
<td>.124</td>
<td>-.279</td>
</tr>
<tr>
<td>School type by sex$^3$</td>
<td>.092</td>
<td>.009</td>
<td>.158</td>
<td>.073</td>
<td>.17</td>
</tr>
<tr>
<td>Constant: 4.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. $^1$Place of birth: 0 = rural (n = 91); 1 = urban (n = 379). $^2$0 = rural (n = 32); 1 = urban (n = 438). $^3$0 = co-ed (n = 144); 1 = single sex (n = 128).

High School Girls’ Tertiary Programs Aspirations

High school girls were asked to indicate which tertiary program they wished to pursue upon completing high school. Almost half (n = 100) of the 215 responding students aspired to enter health sciences: Medicine (n = 73), Nursing (n = 9), Pharmacy (n = 9), Environmental Science (n = 7) and, Dentistry (n = 2). Seventy-seven of the respondents aspired for applied sciences, with 38% (n = 29) wishing to take up a program in Agriculture, 18% (n = 14) in Home Economics, 13% (n = 10) in Computer Science, and, 9% (n = 7) in Information Technology. Seventeen (22%)
of the seventy-seven aspired for other applied sciences, fifteen of whom, in engineering fields and two, in mathematics. The remaining respondents \((n = 38)\) aspired to enter non-science programs.

**Suggestions on How High School Girls May Be Encouraged to Enter Science Courses or Programs**

Combined high school and tertiary girls who gave suggestions totaled 407. The most important to mention are the following. One hundred and twenty students \((29\%)\) suggested that career guidance teachers should play a major role in showing girls how to choose subjects combination which will suit their aptitudes, while 98 \((24\%)\) stated that family members should encourage girls to take up scientific programs. Seventy-one students \((17\%)\) suggested that English Language should be discarded as an overall passing subject, as the present system closes opportunities in the sciences for students who receive excellent grades in mathematics and sciences, according to the respondents. Fifty-one respondents \((12.5\%)\) suggested that the government scholarship board should make a provision in the quota to sponsor students on an equal basis in the science and technology programs. The other 67 students \((17\%)\) had suggestions regarding: science being made compulsory in secondary curriculum \((7\%)\); science teachers providing extra help to students \((5\%)\); parents and teachers discouraging thoughts that science programs are difficult \((2\%)\); gender equality being emphasized \((1\%)\); education ministry closely monitoring science programs \((1\%)\); and, students who are already taking up science courses or programs serving as role models to younger students \((1\%)\).

**Conclusions and Implications**

Respondents identified five reasons for enrolling in science programs: economic, personal, educational, family and social. Girls believed that, they would pursue science courses if financial assistance and jobs were available. Personal views of science as a positive field for a career were believed to have influenced girls to take up sciences. Science and technology streams in high school were open to girls, but instructional materials content, approaches, teachers’ attitudes, gender equity quality in schools, were viewed influencing girls’ choice of science as a course. Therefore, challenges are posed to the National Curriculum Centre of Swaziland to ensure gender unbiased content and approaches in pupil and teacher materials through their normal evaluation of materials, and also through research. Teacher training institutions in science and technology should examine their courses and programmes and identify needed gender sensitive content and approaches. The administrators and guidance counsellors in schools are encouraged to ensure gender unbiased practices in the schools, especially in streaming and guiding students in career paths. Opportunities for research in guidance and counseling are also indicative, especially in the area of gender and career choice. Exposure to science fields through family members and significant others in science careers boost girls’ choice of science for a course. The society and parents’ attitudes toward girls being able to attempt science were believed facilitating or limiting girls’ choice of science as a program of study. Therefore, the family is the basic unit where socialization to science and technology may be promoted.

When background characteristics were tested as explanatory variables to reasons for choice of program, three background characteristics showed some importance: place of birth; location of high school attended; and, type of school attended. Girls’ immediate environment,
such as their place of birth exerts some influence on their aspirations. The beta coefficients showed that a rural classification resulted in a -.29 decrease in the dependent variable score. Similarly, girls from a rural school, choose science and technology less ($\beta = -.0348$) than their urban counterparts. The foregoing can be explained by the greatly varying environment and availability of facilities in the schools in promoting or limiting the interests in the courses offered, especially science, that need special laboratories and equipment. Lastly, girls from co-educational schools choose science and technology less. A higher beta coefficient (.015) accompanied the single sex classification. The last finding confirmed that of FEMSA Swaziland (1999), which showed that, girls in a single-sex school exhibit fewer inhibitions in learning as compared with girls who are in a co-educational school.

The education level where girls were at, did not pose as a variable associated with their reasons for choosing agriculture or other science and technology programs. The findings indicate that the reasons in high school about what programs they would like to pursue persist up until tertiary level.

Girls’ tertiary program aspirations reflect the nurturing nature of females. These programs are medicine, nursing, pharmacy, environmental science, dentistry, agriculture and home economics, with the exception of computer science and information technology and, engineering. However, computer science and information technology might be associated with growing importance of these fields (Amarteifo, 2001). Engineering and mathematics were found in other studies (Awacango, 2001) as potential programs for girls, when aptitudes are developed in the early educational levels. It is worth noting that, some girls aspired for non-science programs, even though they were already in a science stream. Why girls identified capable in science in high school would like to deviate at tertiary level, is an important question that may need exploration.

Career guidance teachers are urged to play a major role in showing girls how to choose subjects combination that suits their aptitudes and, how to conquer their fears of the non-traditionally-female programs. The Educational Testing, Guidance and Psychological Services (ETGPS) department of the Ministry of Education do a lot of activities in the schools already in the form of aptitude testing and career guidance based on aptitude test result. However, school-based career guidance and counseling teachers need to be given more skills in guiding girls how to develop their aptitudes, to realize a career matching their aptitudes, and how to eliminate competing influences, from the time they enter secondary school. Family members were believed to have some considerable influence in encouraging girls to take up scientific programs, and therefore, need to be encouraged to play a significant role.

The educational system policy of obtaining a passing grade in English Language as a pre-requisite to graduate in high school, is being questioned for its validity by the respondents, since the relevant subjects alone, like mathematics and sciences, were found by other studies as indicators of success in the science tertiary programs (Erinosho, 2001). Most tertiary programs require a credit pass in English as entrance requirement. The Faculty of Agriculture requires a pass or better in English for entry, but provides pre-requisite academic communication skills courses for first years, to better prepare them in agribusiness communication. In terms of scholarship provision in Swaziland, the Ministry of Education is already considering science and technology as priority fields for scholarship grants purposes at tertiary levels. However, it is in high school where girls may be further encouraged to take the science and technology path, by possibly providing affirmative bursary to girls who show aptitudes to succeed.
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