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GENDER AND EDUCATION: SECONDARY SCHOOL INFLUENCES ON THE DEVELOPMENT OF GIRLS' CAREERS IN SCIENCE AT UNIVERSITY IN RWANDA

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Abstract

In Rwanda, young women lag behind men in terms of accessing opportunities in science. Gender stereotyping and the nature of the curriculum are among the many factors that discourage them from choosing to study science subjects in secondary school and subsequently, at university. This paper aims to explain why girls in Rwandan secondary schools are less likely to choose science subjects than their male counterparts.

Using an interdisciplinary qualitative methodology and drawing on both feminist theory and a case-study approach, this paper casts light on women's experiences in their quests to study science subjects in secondary schools and later at university. The study reveals several factors behind female students' subject selection in secondary school, including the influences of male students and the impact of sexist comments from teachers and in the curriculum itself. These findings fill important research gaps on the intersection between gender and science-related subjects in Rwandan secondary schools and other similar contexts.

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Introduction

Rwanda, a developing nation in Central East Africa, is characterised by the role science and technology play in its national development. It is a nation where the citizens recognise that national development, in terms of reducing poverty and creating wealth, hinges on the study of science and other similar disciplines (Mumporeze and Prieler, 2017). In response, citizens are encouraged to pursue careers in these fields. Having recognised that science plays an important role, the Rwandan government has created many policies to establish a solid science curriculum for all learners. In addition, the post-genocide government has put in place several policies intended to provide education to both young men and women. However, although Rwanda has legislated against sex discrimination in the education system, young women still lack access to educational opportunities, particularly related to science courses. The Girls Education Policy (the Republic of Rwanda, 2008:2) specifically directs that '[secondary schools] should be proactive in increasing enrolment of girls in courses in which they are under-represented'. In response to this policy, educational institutions are required to increase female enrolment and participation in secondary schools.

The secondary education science curriculum aims to provide high-quality science and technology education for all students in the country (Ministry of Education [MINEDUC] & Rwanda Education Board [REB], 2015). In all lower secondary schools, students study the same science disciplines, including biology, chemistry, mathematics, physics, and computer science. After completing lower secondary studies, they advance to the upper secondary level. At this level, students are required to choose from a wide range of subjects. At the upper secondary level, students specialise and are offered a combination of subjects such as physics, chemistry and biology (PCB), (mathematics, chemistry and biology (MCB), physics, economics and mathematics (PEM) or history, geography and literature (HGL).

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In 2018, there was a significant improvement in the number of students enroled in both lower and upper secondary schools, with 658,285 enroled students compared with 553, 739 in 2016 (MINEDUC Statistics Report, 2018:38). This surge in numbers in lower and upper secondary schools is consistent with the government's efforts to implement the nine-year and twelve-year basic education policies. The long-term objectives of Rwandan education policy have traditionally been to raise the general standard of education and promote educational equality. From 1994 onwards, the ministry of education and the ministry of gender and family promotion have all focused on the issue of women's careers and their advancement in science. According to the 2012 general population and housing census results, women make up 51.8% of the population, and males account for 48.2%[2].The high number of females reflects increased gender parity in secondary schools. Almost the same number of females and males attended secondary school as per the MINEDUC Statistics Report (2018).

Although enrolment figures tend to be similar for boys and girls in upper secondary schools, the gender gaps widen in terms of what these students study and their achievements (Masanja, 2010; Uworwabayeho, 2010). The stereotype of male scientists (Baker & Leary, 1995; Ellison & Swanson, 2018; Kelly,1981; Francis, 2000; Harraway, 1998; Harding, 1998; Mama, 2003; Whitehead, 2006;) and female homemakers (Abbott et al. 2010; Chodorow,1978; Nyangena, 2008) persists and becomes stronger as learners progress through the education system. This is evident in subject choices, as the proportion of boys in Rwandan upper secondary schools is highest in science subjects at 66.3%, while that of girls is lower, standing at approximately 51.6% (see MINEDUC Statistics Report, 2018:41). In addition, the gendering of education in Rwanda is culturally and historically significant (Huggins, 2010; Masanja, 2010; Uworwabayeho et al., 2010)**.** Among other issues, scholars have written about teachers dissuading girls from science (Kelly, 1985; Warrington & Young, 2000) and about the stereotypical ways in which girls and boys are educated as factors

[2] See, National Institute of Statistics of Rwanda [NISR] report (2014).

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influencing women's underrepresentation in the sciences (Acker & Oatley, 1993; Archer et al., 2017; Baker & Leary, 1995; Edewor, 2006; Aikman, Unterhalter & Challender, 2005; Nyagena, 2008; Mama, 2010; Uwineza, 2018).

The study investigates why young girls in Rwandan secondary schools are less likely to choose science subjects. It also suggests ways for different stakeholders to support girls in enroling in science subjects and attracting more females to the field of science at universities. Related to this study is the Rwandan government's policy emphasis on how science needs to be a priority subject, not only by closing the gender gap in terms of enrolment in science at secondary schools and universities but also to help young women to have equal access to career opportunities in science. In this regard, it is hoped that the findings of this study fill important research gaps on the intersection between gender and science-related subjects in Rwandan secondary schools.

Methodology

A qualitative methodology was used, drawn from both feminist theory and case-study approach, to investigate young women's experiences of studying science at secondary schools and later at university. Holliday (2007) points out that the qualitative approach allows researchers to understand and interpret phenomena in terms of the meanings participants bring to them. Moreover, the use of quantitative methods would have inhibited the participants from articulating their ideas; an interpretive case study approach was adopted as the more appropriate method (Denzin and Lincoln, 2000). Given that a case study can be used to explore or gain in-depth knowledge about the phenomenon being studied (Yin, 2009), the data were collected through semi-structured interviews and written diaries completed by participants between the 5th of September 2013 and the 10th of November 2014, to capture the voices of seven female university students.

Participants shared insights into their secondary school experiences of studying science subjects. The notion of voice, as articulated in this

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article, is embedded in feminist theory[3], which is concerned with 'understanding gender inequality' (Archer, 1987, p.421). In other words, in education, feminism aims to remove barriers that prevent females from reaching their full potential, whether such barriers are present in schools, individual psyche or discriminatory labour practices (Archer, 1987). As feminists are preoccupied with liberating women from all forms of oppression (Walters, 2005; Wise & Stanley, 1993), the use of a feminist approach in conducting studies such as the present one implies adopting techniques that discard oppression and domination of research subjects by enabling the subjects to express their first hand experiences. For this reason, though the author does not generally eschew the practice of a positivist mode of inquiry (Brooks & Hesse-Biber, 2007; Griffiths, 1995; Stanley and Wise, 1993) the use of qualitative methods of inquiry in this study allows for emphasis on the subjective construction of meaning by exploring the factors that discourage young women from studying science.

The study was carried out at the University of Rwanda, College of Science and Technology (URCST). The university is located in Kigali, the capital of Rwanda and the country's major urban centre; and was established in November 1997 as the first Rwandan government technological institute.The participants comprised a purposeful sample of young women studying science degree courses at university in engineering, biology, architecture and built environment. The participants were chosen due to studying a wide range of undergraduate science degree programmes, thereby enabling them to provide insights into what it feels like for females studying science subjects in high school. The participants' ages ranged from

[3] A renowned feminist scholar, bell hooks, defines feminism as 'the movement to end sexism, sexist exploitation and oppression' (Hooks**,** 2000, p. viii). Elsewhere, Walby (2011, p.3) states that feminism concerns itself with 'people and projects that pursue the goal of reducing gender inequality', whereas feminism, for Archer (1987), serves to address the question of female subordination to men: how this arose, why it is perpetuated and how it might be changed (p.421). In conceptualising feminist theory as a 'movement to end sexism', hooks (2000) highlights the progressive loss of young women in male dominated subjects - the perception of science contributing to women's underrepresentation in the sciences.

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20 to 26 years, with an average of 23 years. Semi-structured interviews with open-ended questions were the primary data source. The interviews were recorded using a tape recorder and transcribed verbatim. The research questions focused on subject preferences and attitudes about science subjects while in secondary school and on incidents of sexism that prevailed in school. In addition, participants were asked about the nature of challenges they encountered while studying science subjects at the secondary school level and how these may have impacted their subsequent career paths.

The data were collected from transcribed interviews and reviewed against existing relevant academic literature in order to identify emerging patterns and classify and organise the data into themes for analysis. The approach to the interpretation of the data was influenced by feminist principles as well as various overall themes being identified. Finally, individual direct quotes from the interviews were also earmarked to ensure the projection of the participants' voices in the findings.

Findings and Discussion

The main findings from the interviews with female students at the university related to young women's perceptions towards the study of science subjects at the secondary school level. These were obtained in response to the three research questions posed:

1) What is the choice of subjects available to students in Rwandan secondary schools?
2) How do male students influence female students' choice of science subjects in Rwandan secondary schools?
3) What are the expectations of teachers regarding what young girls and boys should study at the secondary school level?

The information obtained from participants therefore aimed to provide an understanding of the factors influencing the young girls' study choices, challenges that are associated with studying sciences as a girl and how gender and other social-cultural values have affected them in the pursuit of

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science careers through university. While various sub-themes were identified from the data analysis, the key and recurring themes that emerged from the interviews included: a) influences of male students; b) interest in science subjects: c) a biased curriculum; and d) sexist comments from the teachers. To ensure confidentiality and anonymity, fictional names were given to participants whose quotes are reported. The findings from the interviews I conducted are presented in the themes discussed below.

Interactions and attitudes from male students

The study established that male students had an influence on female students' choices to study science. Patriarchal tendencies prevalent in most African societies put male students in higher status positions when compared to their female counterparts. Studying with boys in the same class did not seem to boost girls' performance in science subjects, as the following views by Nelly, a female construction management student, and Judith, a biology student, suggest:

> *I wonder why you [Nelly] chose this subject [mathematics) leaving out subjects like religion, history [and] English, which are easy subjects for you, the girls. (Nelly, construction management student)*
>
> *It is crazy to me, but it is the norm; boys thinking about girls studying physics and mathematics. These conversations happened a lot when I was in senior three. (Christine, biology student)*

Nelly's and Christine's assertions indicate that some male students interpret science as 'not too good' for females. It is important to note that some male students see their female counterparts as people who do not have the intellectual capacity to study subjects that have been traditionally considered to be appropriate only for men. As she stated during our interview, Nelly thinks that some of her female colleagues did not choose science combinations in the upper secondary level because of the fear of failure and that such subjects were traditionally male fields.

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Interest in science

When asked about their interest in subjects during their lower and upper level secondary school studies, the girls' perceived science positively, and even expressed views that science was appropriate for their future career aspirations in engineering.

Brenda, an estate management and evaluation student, stated that:

> *I like Maths, but I am not so sure what I want to be in the future, but perhaps an engineer. Some of the girls in my class who aspire to be engineers, but find maths to be hard and are not up to the challenge to pursue it at university.*

Belinda, food science and technology student had this to say:

> *I like chemistry and maths, though I find maths difficult. I admire pilots, and I could be one. But, anyway, maths is hard, it's kind of a boy's subject. I do not know whether I will continue with the subject when I start my A levels. A friend of mine named Moses is helping me when we have lessons on geometry, algebra and probability.*

The above quotation by Brenda and Belinda acknowledged their interest in science subjects such as chemistry and maths but found such subjects to be difficult and perceived certain limitations on how they would perform in tests and given exams. These findings are in accordance with the study conducted in Rwanda by Irakoze et al. (2021) that focused explicitly on chemistry. It found that girls who studied chemistry at the lower level and, subsequently, at the upper level of secondary underperformed in the subject in national examinations compared to their male counterparts. Furthermore, the young girls reported and aligned mathematics with masculinity because it was a challenging subject. Relatedly, Uwineza et al. (2018) noted the inherent tension between women and maths. Female secondary school maths students were found to construe the subject as uncomplimentary to their roles as women. Specifically, young women in the study struggled to fit in and be recognised as competent mathematicians.

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Science curriculum

The curriculum was a theme that participants generally agreed was a factor that prohibits young girls from studying science. Brenda, a student of estate management and evaluation, remembered the following:

> *In secondary school, I remember some of the science materials we used in the class had illustrations of girls cooking, carrying babies on their backs and cleaning up. I think that meant that we should study subjects that aligned to such activities. In a way, that influenced us because some girls liked those roles and envisioned themselves working as nurses or in restaurants. But, for boys, it was different - they were depicted in more challenging roles as if to say girls could not make it.*

Janet, a water and environmental engineering student had the following to say:

> *In the physics textbooks, we rarely saw any pictures of women doing technical things, so the images in the books we use all indicated that physics was for men and that careers in science were unfulfiling for women.*

Janet's and Brenda's views expressed are consistent with feminist studies. In her study on gendered patterns of girls' participation in physics in Britain, Archer et al. (2017) revealed how the science curriculum promotes gender-appropriate behaviour of girls and boys and what they are expected to learn. This reinforces certain gender stereotypes about women's expected roles, thus impacting on their choices of subjects of study in school and, subsequently, at university. This finding concurs with Chege and Sifuna (2006), who argued in their work that the curriculum socialises female students into roles that will lead them into being homemakers. As children, females are expected to learn how to wash dishes, clean the house, fetch water and take care of the elderly. As they grow and go to school, these roles are concretised through the subjects they are expected to study.

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Regarding Brenda's statement, her female friends had internalised notions of motherhood through what they had witnessed in the school curriculum and their family homes. This view is also discussed by Mweru Mwingi (2008) in her work on girls' participation in scientific fields in Kenya. Mwingi notes that 'when girls reflect[ed] on the schools' covert message on science subjects, school messages […were] covertly [discouraging]. Girls get the message, withdraw from participation in learning and consequently underachieve in sciences' (p.91).

Sexist views of teachers

In their work on gender identities and education, Llyods and Duveen (1992), note that teachers are usually aware of sexism and how this contributes to the gendering of subjects. Teachers are expected to avoid sexist language or activities that influence members of a particular sex group. The teaching methods and attitudes of teachers have a significant effect on the delivery of the science curriculum to the students. The insensitivity in the science curriculum is attributed to teachers' ways and the use of masculine concepts (Archer et al., 2017). All girls and boys are happy to come to school and enjoy the experience of learning. This was clearly stated by Claudine, a female biology student who said she enjoyed biology and chemistry lessons while in her senior two. However, when she was in senior three, she lost interest in the subjects because of the teacher:

> *I really liked studying biology and chemistry and was getting good marks in these subjects, but my teacher, somehow, did not believe in me. It is like he thought I would not go beyond my senior three studies. I do not know why. Maybe it is because people are used to seeing girls at home, looking after their younger sisters and brothers.*

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Judith, also a biology student shared Claudine's views:

> *I liked science subjects as compared to the arts because I wanted to gain knowledge of the physical aspects of the world. The only science subject I disliked was maths [meaning mathematics] because I was failing that subject. I really knew what I wanted to be in the future, but I remember during one of our chemistry lessons, the teacher asked us who we thought of as mathematicians or biologists. I remember drawing a picture of a man. I think he [the teacher] should have been able to advise us against such stereotyped images. Even when we had to carry out some experiments in the laboratory, the teacher would tell me to sit with the boys so they could help me. I was not too fond of that. (Judith, biology student)*

Once again, Janet, a water and environmental engineering student said that:

> *When I was in secondary school [form two], I got the highest mark in physics, and the teacher said, 'How come it is the girl with the highest mark?' It was a kind of a joke, but somehow it affects you because it is as if a girl should fail more than the boys in science subjects (Janet, water and environmental engineering student)*

The above views expressed by female students represent some of the teaching factors perpetuating the narrative that girls are not 'smart and intelligent' and are most likely to study different subjects from boys (Archer et al., 2012; Brush, 1991; Harding, 1998). The assumption of teachers that males are better in science subjects makes it difficult for females to advance in science careers. These accounts are consistent with those Aikman, Unterhalter and Challender (2005) reported in a study of secondary school teachers in Mozambique. They discovered that teachers (mainly male teachers) preferred to teach boys because they were seen as the brightest and more capable of learning than the girls. Therefore, it may be that male

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students are more encouraged to excel in science subjects than their female counterparts (Francis, 2000).

Conclusions

The research questions posed during the interviews with female students at the University of Rwanda, College of Education were related to their perception of studying science subjects at the secondary school level. The findings revealed several factors that help determine female students' subject selection after completing lower secondary school studies. The interviews demonstrated that school interest in science, the influence of male students, the curriculum, and the teacher's role impacted the girls' decisions about the choice of secondary school subjects and, subsequently, their university-level decisions. According to their teachers, although there is a general awareness among the girls on the importance of science subjects, boys are more likely to study science past their lower secondary studies and later at university. This idea points to secondary education as one of the powerful platforms through which gender stereotypes are concretised. To address the issue of the role of the curriculum and how it affects the education of boys and girls, teachers should be educated to promote gender equality and gender equitable-pedagogical practices. Additionally, teachers should be encouraged to help students who are unsure of their future studies or career paths. In addition, the government of Rwanda should be proactive in increasing the enrolment of girls in the courses in which they are under-represented. The best way to achieve this is by directing schools to engage in positive discriminative measures.

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