

Examining Gender in Higher Education



POLICY BRIEF 2

Participating and Succeeding in STEM subjects: a focus on Gender Dynamics

Initial Findings of the EGHE Network for Uganda, Kenya, Rwanda, The Gambia and the UK

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Overview

This policy brief deliberates on the findings of work carried out by EGHE network in relation to gendered participation in STEM programmes in HEIs in study countries. Patterns of under-representation in the area are outlined, as well as a discussion of and a range of potential issues that may contribute to these patterns, including:

- gender dynamics at primary and secondary level that inevitably impact on entry to HE in STEM areas
- access to appropriate role models in education and professional fields
- under-representation of female academic staff in STEM, particularly in more senior roles
- unconscious bias in selection procedures that can hinder girls' and women's progression in the spheres of education and work
- the intersection of factors such as socio-economic background, ethnicity, and disability with gender
- the effects of a masculinised 'academic culture' that may affect student experience and sense of belonging in HE and in future STEM careers

The study recommends several research components that need to be addressed with suitable empirical evidence - in particular the urgent need for disaggregated data on STEM entry and progression at HE in relation to gender, socio-economic background, age, caring commitments, ethnicity and disability - as well as policy recommendations such as gender-specific strategies, activities and events focusing on the 'bridge' from school to HE, and workshops on challenging essentialist views on gender 'appropriate' study/career paths.

Introduction

In the vast majority of 'developed' countries and those in transition, women are now in the majority as undergraduate students. However, in many countries, especially in sub-Saharan Africa, South, West and East Asia, men remain in the majority at undergraduate level. There remains an urgent need to address the participation of women in HE across the world and across subject areas (see UNESCO 2010) emphasised by the continued prioritisation of equal access in terms of gender to "affordable and quality technical, vocational and tertiary education, including university" in the Sustainable Development Goals (SDG 4.3).

A key aspect of gender equality in this area is equality in terms of subject choice, including the role gender norms, stereotypes and assumptions play in influencing potential students' choice whether



to study STEM subjects, and their success once at university in these fields should they decide to enter a STEM field. Globally, women represent less than a quarter of students on average in 'engineering, manufacturing and construction', and construction', and not much over a third in 'agriculture' and 'science' (UNESCO, 2008). In Sub-Saharan Africa, the highest proportion of women students are in 'humanities and arts' (47%), followed by 'health and welfare' (44%), 'social science, business and law' (42%) and then 'education' (39%). 'Engineering, manufacture and construction' is the subject field with the lowest proportion of women students in all world regions (ibid.). A longstanding, popular, and seemingly global discourse constructs girls and women as seemingly innately less able in relation to STEM subjects in comparison to boys/men (see e.g. Bombardieri, 2005). Moreover the scientific subjects most often pursued by women in higher education in many countries are those seen as 'gender appropriate', for example the social and biological sciences (Bebbington, 2002). Such perceptions infuse teacher and parental expectations, and influence a students' own self-perception as to their capabilities, enjoyment and interest in a particular line of study (Francis, 2000; UNESCO 2010; Archer et al., 2012).

As well as a concern with access and subject choice, it is crucial to explore issues relating to student experience once at university: for example the ways in which gendered norms and assumptions may influence academic curricula, policy and pedagogical practice, as well as potential inequalities of lived experience of students and staff. It is vital to explore in depth the complexities of academic culture, policy and practice in HE and the experience of staff and students, in order to effectively challenge existing inequities based on gender and other aspects of social identity/positioning, for STEM disciplines and beyond.

This briefing presents findings from a scoping exercise of current literature/ research currently conducted by members of the Examining Gender in Higher Education (EGHE) network on issues affecting women's participation and success in STEM subjects at HE level in network member countries.

METHODOLOGY

Funded by a grant from the UK's Economic and Social Research Council, the network involves a collaborative partnership between academic and activist colleagues with interdisciplinary expertise based in Rwanda, Uganda, The Gambia; Scotland, and the pan-African Forum for African Women Educationalists (FAWE).

Established in 2017 for 18 months, the goal of the network was to draw together academics and activists to share and build knowledge and expertise on key areas of concern in gender and higher education (HE) comparatively across a range of African countries as well as the UK; and to build the foundations for sustained work that will address key issues of pressing concern in the field. One key area of concern has already been identified: participation and success of women students at university in STEM subjects. This is a crucial focus area in relation to the goals of gender equality and social justice, and directly supports key priorities of network member countries in terms of economic and infrastructural development.

Scoping work was undertaken in the focus area of STEM and also more broadly on issues related to gender and higher education in member countries as part of the EGHE network's activities, in order to produce findings of relevance for policy makers and practitioners (both in providing the context in relation to multiple national contexts and to also provide a comparative perspective across countries), and to identify and develop further key areas for future research collaboration.

Team members employed review strategies appropriate to their fields of study and geographical contexts, employing a narrative literature review approach (Baumeister and Leary, 1997). Academic journal articles were surveyed relating to gender and HE that specifically focus on members' national contexts, and related material from further African countries, utilising search facilities such as the ERIC research database and the Taylor & Francis and SAGE journal websites. Because of the volume of material this review concentrates on articles published from 2000 onwards. In addition, some members have gathered relevant statistical and policy information from the HE institutions within which they work, and have provided reflections based on their own specific experience within HEIs in their countries.

From our initial review, a number of key areas of interest emerged, as follows:

1. Issues affecting **admission** into HE for women students, including those studying STEM subjects - including issues of support and encouragement, the importance of role models, and the influence of wider gendered expectations as to the appropriateness of certain subjects/ study for girls and women
2. Issues affecting women students' ability to **maintain** their studies, including issues of financial support and interaction with existing academic/institutional cultures
3. Issues affecting the success of **women graduates**, including **women academics** and their experience within existing academic/institutional cultures
4. The importance of looking at participation and success for **different groups** of women, for example differences relating to age, socio-economic status and geographical location
5. Patterns of similarity and difference **comparatively across countries**
6. A specific focus on these issues in relation to **women taking STEM subjects**

This policy briefing collates some of the main findings in relation to area 6: other areas are the focus of additional policy briefings in the series.

FINDINGS

In the sub-Saharan African countries under review, there is a consistent pattern of under-representation of women students entering HE institutions. UNESCO's (2017b) gender parity index for tertiary enrolment by country showed that a large proportion of sub-Saharan African countries fell below 0.8 GPI (where a score of 1.0 indicates parity and a score higher than 1 indicates women in a numerical majority). The figures for the African countries so far figuring in our scoping exercises are as follows:

The Gambia	0.45 (in 2014)
Ethiopia	0.48 (in 2014)
Tanzania	0.51 (in 2013)
Ghana	0.69 (in 2015)
Kenya	0.70 (in 2009)
Rwanda	0.78 (in 2015)
Uganda	0.78 (in 2014)

The picture is ostensibly different in Western Europe. UNESCO (2012) notes that whilst men formed the majority of undergraduates in this region in 1970, women are as of 2009 outnumbering men in HE - a situation shared with North America, Latin America and the Caribbean, and Central and Eastern Europe. UNESCO's gender parity index score for the UK in 2014 was 1.31.

For the current membership of the team please visit:
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Box 1: Patterns of entry to STEM subjects in HE by Gender

Consistent pattern of under-representation of women students entering HE in the sub-Saharan African review countries, including STEM.

In the UK there is a slight numerical majority of women students at undergraduate level overall, but women are under-represented in STEM areas, particularly in subjects such as computer science, engineering and technology.

Nevertheless, despite their overall numerical minority in the UK, more male students are enrolled in STEM subjects in this country than women (337,750 men and 327,535 women respectively – over half (53%) of the total number of male students choose to study STEM subjects, as opposed to 41% of the total number of female students (HESA, 2015). Gender disparities are largest in computer science and engineering and technology, where only 15% of undergraduate first degree students were female in 2014-5 (ECU, 2017).

For the African countries in our review, the under-representation of women is even further pronounced in STEM subject areas (see e.g. Morley et al. 2010, Johnson, 2011, Mbanjo and Nolan, 2017). For example, in Rwanda in 2016, male students outnumbered female students in science (13.5% against 8.1%) and engineering (11.2% versus 3.3%) (MINEDUC, 2016). In Kenya, statistics by CUE (2017) show that less than a third of the students enrolled in STEM subjects are female.

This agrees with Mangheni et al.'s (2010) findings which indicated that female students across African countries are concentrated in the humanities, social sciences, and health, with less than one third enrolled in science fields. In Uganda, the importance attributed to STEM has been shown in the 2005 decision to make STEM subjects compulsory up to ordinary level secondary school nationally, and at Public Universities 75% of government scholarships are reserved for STEM academic programmes. However there is no major investment in gender-specific interventions in Uganda at family, primary and elementary school level.

So what are the factors underlying such statistics? UNESCO (2012) notes that **national wealth** is a key factor in relation to women's participation in HE, both in STEM subjects and across other disciplinary areas. Women are more likely

to enrol at university in countries with relatively high income, and have lower participation in low income countries.

Patterns of admission at tertiary level can only be understood with reference to **patterns at primary and secondary level**. Over the years global primary education enrolment rates have increased, for instance, from 52% in 1990 to 78% in 2010 in sub-Saharan Africa. However, in this region girls continue to lag behind boys particularly at secondary and tertiary levels (UNESCO, 2014).

Box 2: Factors Underlying the Statistics

- gender dynamics at primary and secondary level that inevitably impact on entry to HE in STEM areas
- access to appropriate role models in education and professional fields
- under-representation of female academic staff in STEM, particularly in more senior roles
- unconscious bias in selection procedures that can hinder girls' and women's progression in the spheres of education and work
- the intersection of factors such as socio-economic background, ethnicity, and disability with gender
- the effects of a masculinised 'academic culture' that may affect student experience and sense of belonging in HE and in future STEM careers

The degree to which girls and women have access to **female role models** has repeatedly been cited as a factor in both participation in HE overall and in relation to the study of STEM subjects in particular (e.g. Morley et al., 2009, 2010; Johnson, 2011; Lestrade, 2012; Plan, 2012; UNESCO, 2012; Atuahene and Owusu-Ansah, 2013; World Economic Forum, 2016). The argument for such role models relates to the challenges of prevalent socio-cultural stereotypes as to 'appropriate' and desirable activities, careers, or future goals for girls and women (World Economic Forum, 2016). Johnson's (2011) study in Tanzania concluded that women in rural areas have a harder time finding female role models because there are fewer women in positions of power or authority.

The numerical representation of female academics in STEM subjects remains a key issue in HE. UNESCO (2014) notes that despite the rising demand for STEM professionals, women continue to be under-represented in these fields, in all our review countries. For instance,

in Gambia Technical Training Institution (one of five national tertiary institutions), 87% of the staff are male. At Makerere University in Uganda, the proportion of female academics in STEM subjects ranges from 27% in the area of Agriculture and Environmental Sciences to 39% in the Natural Sciences and Mathematics. In Gambia Technical Training Institution (a Tertiary institution), with 37 staff in STEM area (computer, engineering, technical studies), there are only 5 females (13% female staff compared to 87% male staff).

An increase in the number of female teachers in secondary and further/higher education could play a major role in terms of changing perceptions as to what is achievable and desirable for girls and women, including conceptions as to the 'gender appropriateness' of STEM study. **Higher numbers of female teachers** have been shown to increase the rate of girls' enrolment and help sustain their participation in education (Plan, 2012).

A wide range of research and strategies are aiming to address issues relating to the **under-representation of girls and women in STEM** internationally. For example in the UK research by the Royal Society is focusing on issues such as **unconscious bias** that can affect girls and women's chances of progression and success in the spheres of education and work (see Frith, 2015) and also exploring the **intersection of factors such as socio-economic status, ethnicity and disability** with gender in relation to success in STEM (Royal Society, 2008).

Research in the UK also highlights the effects of a '**masculine**' **academic culture**, particularly in areas such as Engineering, which may affect student experience whilst at university and deter women from moving on to STEM careers (see e.g. Powell et al., 2004); and highlighting the importance of not **essentialising notions of gender difference**, and the 'genderedness' of science, even whilst aiming to combat them (Barnard et al., 2010).

POLICY RECOMMENDATIONS

- Gender-specific strategies in STEM subjects and beyond, that encourage and support participation from family, primary/elementary level, and especially through secondary education and the 'bridge' to HE. Examples include the collaborative curriculum revision and teacher training initiatives by teachers and activists for FEMSA (Female Education in Mathematics and Science in Africa, 1996-2000), 'science bootcamps' and teacher training initiatives currently organized by RAWISE (the Rwandan Association for Women in Science and Engineering) and work by FAWE on gender responsive pedagogy in STEM and ICT education in countries across sub-Saharan Africa
- Ways in which to challenge prevalent, essentialist sociocultural views on 'appropriate' activities and careers for girls and women, including but not only focusing on access to role models. Examples include school workshops run by FEMENG (Female Engineers) – a joint collaboration between undergraduate Engineering Students at the University of Rwanda and the University of Glasgow.
- Ways in which to also address issues relating to subtle issues such as 'unconscious bias', for example in selection procedures for educational and career appointments and awards, particularly in relation to STEM.
- An urgent need for disaggregated data in relation to gender, including STEM participation.
- An urgent need to audit the processes used in delivering STEM content, and documentation of best study practices by successful graduates.

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