COMMENTARY

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SEX BALANCE IN ANATOMICAL RESEARCH AND EDUCATION

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The balance between representation of the sexes promotes an equitable and inclusive environment that encourages the expression of diverse perspectives and innovation while enabling a more comprehensive understanding of sex-specific aspects (Moodley et al., 2019) Historically, women have faced significant barriers in many sectors, especially the sciences, but have made significant contributions despite this (Moodley et al., 2019). Prominent female scientists such as Marie Curie, who won two Nobel Prizes for her work in physics and chemistry, and Rosalind Franklin, whose contributions were pivotal to discovering the DNA double helix, have paved the way for future generations. Jennifer Doudna and Emmanuelle Charpentier developed the CRISPR-Cas9 gene-editing technology, which has paved the way for further ground breaking advancements. However, despite these strides, achieving true sex balance in academia remains an ongoing effort, especially in Africa, requiring sustained commitment to equal opportunities, mentorship and support for women (Moodley et al., 2019; United Nations Economic Commission for Africa, 2020). The balance of the sexes in academia promotes a richer learning environment where varied experiences and viewpoints enhance critical thinking and creativity (Duarte et al., 2023). It also provides role models for both sexes, encouraging young people to pursue careers in fields where they see themselves represented (De Villarreal & Scotton, 2024). With a specific focus on Africa, our editorial explores the representation of male and female authors in research and scientific publishing, sex equality in academic positions in teaching anatomy, and sex balance in medical education.

Male & Female Author Representation in Research in Africa

Recent studies highlight significant sex disparities in research and education across Africa (Rathgeber, 2013; Sougou et al., 2022). For example, as an indicator of sex inequalities, only 11.6% of authors in research according to the African Development Review 2001-2010, and only 15.5%, according to the Eastern Africa Social Science Research Review were women (Rathgeber, 2013). As of 2016, the overall percentage of women's participation in STEM research remained unequal at 34% across the African continent (Sougou et al., 2022; United Nations Economic Commission for Africa, 2020). Countries such as Guinea have been reported only to have 6% female researchers in STEM, Ethiopia 7.6%, Mali 10.6%, and Côte d'Ivoire 16.5% (Dugbazah, 2022; Sougou et al., 2022). In comparison, it is reported that around 40% of researchers in South Africa and Uganda are females (Sougou et al., 2022). This disparity between

the sexes in authorship is further compounded by the fact that women are less likely to be lead authors, with institutions such as the University of Dar es Salaam and Makerere University having only one female lead author each between 2005 and 2010. Below is a table summarizing the percentage of publications with female authors in various African universities according to a study by Rathgeber (2013).

University	Country	Female Authorship (%)
University of Dar es Salaam	Tanzania	22.5
University of Ibadan	Nigeria	26.8
University of Botswana	Botswana	24.7
University of Ghana (Legon)	Ghana	21.1
University of Cape Coast	Ghana	11.6
University of Lagos	Nigeria	20.6
University of Jos	Nigeria	18.8
Obafemi Awolowo University	Nigeria	14.4
National University of Rwanda	Rwanda	10
University of Sierra Leone	Sierra Leone	25.5
University of Addis Ababa	Ethiopia	4.9
University of Nairobi	Kenya	19.7
Maseno University	Kenya	16.4
Moi University	Kenya	24.2
Egerton University	Kenya	20

Table 1: Percentage of publications showing female authors in social sciences in several African universities between 2005 and 2010.

According to UNESCO statistics, only 20.0% of Kenyan researchers in the medical sciences were women despite the impressive general record of scientific publications and research among Kenyans (UNESCO, 2015). Research by Parker et al. (2017) highlights that contemporary anatomy textbooks predominantly feature male images except in sex-specific sections, with stereotypical sexed emotions, roles, and settings being visualized (Parker et al., 2017). This lack of visual diversity extends to ethnicity, age, and body type as well. Empirical research has linked this sex bias in medical education with negative attitudes and behaviours in healthcare providers (Parker et al., 2017). Darici et al. (2022) found that while traditional German anatomy textbooks still exhibit significant sex biases, popular anatomy e-learning platforms present a more balanced representation, with a higher percentage of female images (Darici et al., 2023). This shift towards electronic learning platforms may offer new opportunities for reducing stereotypes in anatomy education. As such, opportunities are being created to integrate sex considerations at all stages of learning and research: from ideation and proposal to execution and dissemination. This approach, when paired with an intersectional perspective that considers factors such as age, or ancestry may lead to more robust outcomes.

Sex Equality in Academic Positions in Teaching Anatomy

Sex equality in academic positions remains a critical issue. Female academics often face challenges such as implicit bias, work-life balance issues, and a lack of mentorship (Llorens et al., 2021). The representation of women in academic positions in teaching anatomy is still limited. At one of the leading

Universities in East Africa, it was observed that only eight of the current 29 demonstrators teaching human anatomy are female. Similarly, at the same institution, only three out of 16 lecturers in human anatomy are female. This underrepresentation is not unique to East Africa but reflects a broader trend across African universities. Women are reported to occupy less than 25% of all academic positions in STEM fields across Africa (Sougou et al., 2022). Additionally, as per the UNESCO statistics the percentage of females holding academic positions in higher education institutions in Malawi is 25.6%, in Mozambique is 28.4%, and in Zimbabwe is 29.7 (UNESCO, 2024). This disparity is even more pronounced in higher academic ranks, where women are significantly underrepresented (Sougou et al., 2022). Increasing the number of female demonstrators and lecturers could provide role models for female students and promote a more balanced academic environment. A study by de Gendre et. al (2023) suggested that same-sex role models could be instrumental in enabling female students to overcome sex stereotypes and pursue a demanding career, such as medicine (de Gendre et al., 2023). A supportive and inclusive work environment is essential for retaining female academics long term. Institutions should offer flexible working hours, maternity leave, and other family-friendly policies to help women balance their professional and personal lives.

Student Sex Balance in Learning Anatomy

The sex balance among students learning anatomy in Africa, specifically in Kenya, is more equitable than faculty positions. As of 2021, the number of female students in Southern Africa enrolled in STEM subjects was 50% and 52% of the total number of students who graduated from doctoral and postdoctoral programs in the same year were females (UNESCO, 2024). These numbers could have risen since then, highlighting the encouraging progress made towards sex equity in the medical profession. Educational psychology research suggests that sex roles, influenced by social, physical, and academic factors, play a significant role in classroom dynamics. Teachers often interact with boys more frequently, respond differently to their contributions, and may unconsciously reinforce sex stereotypes (Gajda et al., 2022). Addressing these biases through inclusive teaching practices is essential for ensuring that all students, regardless of sex, have the opportunity to excel.

Conclusion

Achieving a balance between the sexes in anatomical research and education in Africa is crucial for the advancement of the field and the creation of inclusive academic environments. While progress has been made, there is still much work to be done. By continuing to support female academics, promoting sex equality in academic positions, and ensuring a balanced and inclusive experience for all students, we can move closer to a future where sex no longer dictates one's opportunities or achievements in the field of anatomy.

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