

ENHANCING GENDER EQUALITY IN STEM HIGHER EDUCATION: EXAMPLES AND RESOURCES FOR GENDER-SENSITIVE PRACTICES

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Abstract: The gender gap in science, technology, engineering, and mathematics (STEM) higher education remains a persistent global issue that limits innovation and social progress. This paper explores the interrelated psychological, sociocultural, and institutional factors that contribute to gender disparities in certain STEM fields and discusses examples of practices that promote inclusion and equality. It also examines international and European frameworks that emphasize gender mainstreaming in education, research, and institutional policy. Special attention is given to approaches that foster self-efficacy, mentorship, and the visibility of female role models, as well as to pedagogical strategies that encourage a growth mindset and inclusive learning environments. The paper argues that achieving gender equality in STEM higher education requires coordinated efforts across individual, institutional, and societal levels.

Key Words: gender equality, gender-sensitive teaching practices, higher education, STEM education

1. INTRODUCTION

The persistent gender gap in science, technology, engineering, and mathematics (STEM) continues to constrain global innovation and economic development [1]. However, STEM cannot be viewed as a monolithic category from a gender perspective, since certain disciplines are considerably more successful in attracting and retaining women than others [2]. Gender disparity in certain STEM areas is not merely a matter of study choice at the university level but a broader social and psychological phenomenon, as the proportion of women employed in these fields remains low; moreover, when women do enter such professions, they often occupy lower positions and earn less than men [3].

In Serbia, women enroll in and complete almost all higher education programs in greater numbers than men, including most natural sciences, mathematics, and statistics. Still, in the fields of information and computer sciences, engineering, and construction, men constitute the vast majority [4]. A similar situation exists in the United States, where computer science, engineering, and physics continue to be studied predominantly by men [2].

Discussions about gender disparities in STEM fields have traditionally focused on the extent to which such differences are rooted in biological or sociocultural causes [4, 5]. Contemporary research, however, highlights the interaction of psychological, sociocultural, and institutional factors underlying gender disparities in STEM higher education.

2. PSYCHOLOGICAL, SOCIOCULTURAL, AND INSTITUTIONAL BARRIERS

Barriers to women's greater participation in academic STEM fields, especially in math-intensive ones, can be traced to factors that begin to operate well before higher education [2, 6].

Psychological factors include concepts such as stereotype threat, self-efficacy, and sense of belonging, whereas sociocultural and institutional factors encompass the influence of family, society, and media, as well as the lack of female role models, gender-biased curricula, teacher expectations, and insufficient systemic support. Collectively, these factors offer valuable insight into the persistence of the gender gap in STEM higher education.

Bian et al. [7] emphasized that common stereotypes associate high levels of intellectual ability more with men than with women. Such beliefs discourage women from pursuing many prestigious careers (particularly in STEM fields) and affect girls' interests as early as age six. At this age, girls begin to avoid activities described as being for the "really smart," and are less likely than boys to view females as brilliant or exceptionally intelligent [7].

The phenomenon of stereotype threat can influence the academic performance of female students at both pre-university and university levels. Simply being aware of negative stereotypes (for example, that girls or women are worse at mathematics or programming) may reduce their performance [8]. Importantly, stereotype threats affect not only achievement but also attitudes, motivation, self-confidence, and interest in STEM [9, 10]. Among female university students, gender-science stereotypes can weaken scientific identity and reduce interest in pursuing research careers [11]. Furthermore, the culture of STEM is frequently perceived as a hostile environment for women, although significant variation exists among disciplines in how strongly they are associated with masculine stereotypes. Cheryan et al. [2] identified three central features of this masculine culture:

1) stereotypes about the type of people in specific STEM fields (that often conflict with how many girls and women

see themselves);

2) negative stereotypes and perceived biases about the STEM fields themselves; and

3) a lack of female role models.

Empirical studies have shown that high-school girls and female undergraduates report lower levels of self-efficacy in computer science and physics, even when they achieve higher grades than their male peers. Fields that show large gender gaps in self-efficacy also tend to exhibit notable differences in the representation of men and women [2].

Socialization processes shape perceptions of what is considered “appropriate” for boys and girls. Gender schemas formed in the family and at school often limit both academic and professional choices [12]. Teachers also unconsciously communicate different expectations to boys and girls, reinforcing gendered patterns in perceived ability and career suitability for STEM studies [4, 13].

Ultimately, the phenomenon known as the *leaky pipeline* illustrates the gradual decrease of women along educational and career pathways in STEM, with each successive stage marked by a declining proportion of women remaining in the field [14].

3. EXAMPLES AND RESOURCES FOR GENDER-SENSITIVE PRACTICES

It is essential to enhance girls’ self-confidence, self-efficacy, and self-perception, enabling them to choose university study programs aligned with their own aspirations (rather than being influenced by social pressures and stereotypes) and develop sufficient resilience to remain in STEM fields once they enter them [14].

Many countries have implemented targeted measures to address gender-based bias in STEM, such as providing girls with tailored textbooks (for example, in mathematics), additional programming courses, and opportunities for networking and collaboration [15].

The choice of teaching methods, the way content is presented, and the manner in which students’ abilities are assessed can significantly influence the self-confidence and sense of belonging of female pupils and students [11, 16]. For example, self-evaluation, social support, and visible female role models in STEM contribute to reducing the effects of stereotype threat. In addition, a growth mindset (which emphasizes the potential for developing abilities), as well as value affirmation, can enhance students’ confidence, academic performance, and self-efficacy [17, 18]. Furthermore, mentoring programs are often identified as a key instrument for empowering women in STEM [19].

Integrating gender-sensitive support practices in STEM higher education has become a central focus of current research, policy development, and institutional innovation. Numerous guides, reports, and toolkits provide frameworks and practical examples for fostering gender equality in higher education and research environments.

Universities and higher education institutions play a crucial role in shaping the academic climate and promoting gender equality. The current European Commission’s *She Figures* report [20] emphasizes the importance of gender mainstreaming across science, research, and innovation. It highlights the need to incorporate a gender perspective into curricula, evaluation processes, funding, and institutional governance. The report also advocates for promoting gender balance in leadership and decision-making roles within higher education and research sectors [20]. In addition, the United Nations *HeForShe* initiative provides resources and action plans for addressing gender discrimination on university campuses and fostering inclusive environments that engage both students and faculty members in promoting equality [21].

Incorporating gender-sensitive approaches in higher education requires institutional commitment supported by clear guidelines, evaluation tools, and continuous professional development. At the European level, several initiatives provide practical frameworks for this purpose.

The NESET report “Addressing the gender gap in STEM education across educational levels” [22] highlights the need for coordinated actions across individual (e.g., self-efficacy), contextual (family and the broader societal context), and institutional (barriers at the level of educational institutions such as non-gender-inclusive curricula, stereotypes, and a lack of female role models in STEM) factors. It also recommends measures such as mentorship programs, gender-neutral and inclusive teaching methods, and initiatives that engage girls in STEM through hands-on, real-world projects. Additionally, innovative pedagogical approaches, including problem-based learning and interdisciplinary teaching, show promise in increasing girls’ interest and confidence in STEM fields.

The *STEMGenderIN* Guide [23] proposes a three-dimensional model for integrating gender sensitivity in STEM education (at the levels of school practices, STEM curriculum, and classroom practices). In addition, the guide provides an overview of resources, tools, and practices developed through similar projects.

The *GARCIA* Toolkit [24] offers concrete recommendations, practical steps, and checklists for integrating a gender-sensitive approach in research and teaching.

Improving gender equality in STEM higher education requires both pedagogical innovation and institutional change. Embedding gender sensitivity into planning, curricula, and evaluation practices enhances not only equity but also the overall quality and innovation capacity of higher education institutions.

4. CONCLUSION

The gender gap in STEM higher education is not the result of biological differences in ability but rather a complex interplay of psychological, sociocultural, and institutional factors. A broader examination reveals that barriers to entering certain STEM fields remain considerably higher for women than for men. Furthermore, the underrepresentation of women in some STEM disciplines (such as computer science, engineering, and physics) begins before higher education; therefore, the entire educational trajectory must be considered when addressing the factors that contribute to this imbalance.

Even small changes in educational practice, such as introducing self-evaluation, mentoring programs, visible female role models, and the promotion of a growth mindset, can have effects in reducing stereotype threats and narrowing the gender gap in STEM. Overcoming gender disparities in STEM higher education requires an integrated approach, and numerous useful frameworks and guides already exist to support such efforts. Promoting gender equality in STEM higher education is not only a matter of fairness but also a prerequisite for building a more innovative, empathetic, and sustainable society.

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