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How language can be used to promote gender equality in geoscience

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Gender inequality is detrimental to individuals and ultimately to organizations. Furthermore, addressing this issue will become more important to be eligible for research funds, as already occurs in Europe. Since language shapes the way we think, some simple changes in the words we use daily in geoscience and in other academic fields could promote gender equality. Journal editorial boards could adopt similar measures to foster such changes in the geoscience community.

KEYWORDS

science, policy, inclusivity, gender parity, gender differences, gender gap

1 Introduction

There is a well-known gap between men and women in sciences regarding work perspectives and the right to a safe workplace. Women are underrepresented and have fewer mentoring and career opportunities than men ([JEM Editorial Team, 2020](#)). There are problems and disadvantages during recruitment at work, difficulties in promotions, differences in salaries and in the support employees need. Women are usually associated with disciplines and jobs that are more related to the humanities than to the sciences, e.g., teaching, secretarial work, and health services, all of which typically have much lower wages than professions dominated by men. The Natural Science Foundation 2019 and UNESCO 2017 highlighted that STEM (Science, Technology, Engineering, Mathematics) jobs are mainly occupied by men. This might discourage young female researchers who would like to pursue this type of career, not to mention minority women ([Berhe et al., 2022](#)). When a woman decides to take on a job usually performed by a man, the salary decreases; even in jobs dominated by women, men are more likely to be promoted than women. Furthermore, the literature suggests that women are more likely to lose their jobs because they also are engaged in care work and are therefore considered less suitable for full-time work ([Howes et al., 2018](#)). This aspect of the gender disparity has been exacerbated during the COVID-19 pandemic because women often spend more time in the care activities of children at home in an attempt to balance and reorganize their jobs ([Minello, 2020](#)), considering that the possibility to be promoted depends on the quality and the quantity of the work done.

A “leaky pipeline” represents a known metaphor to indicate the desertion of careers by women, especially in the STEM field ([Liu et al., 2019](#)). This concept was born in 1990 ([Popp et al., 2019](#)) and it refers to all levels of a scientific career, from PhD to full professor, but it has been noted especially at the high ones ([Liu et al., 2019](#)). Women represent less than 30% of employment in the STEM field ([Almukhambetova et al., 2021](#)). Unlike men, for a woman to make a career in a scientific field is a real challenge even if the presence and participation of women in STEM activities entail vantages and benefit for the economic competitiveness as well

as contribute to the economic and professional parity (Almukhambetova et al., 2021; Sato et al., 2020). Too many times the problem of “leaky pipeline” is justified by the presence of family that a woman (for social convention) has to manage (Resmini, 2016).

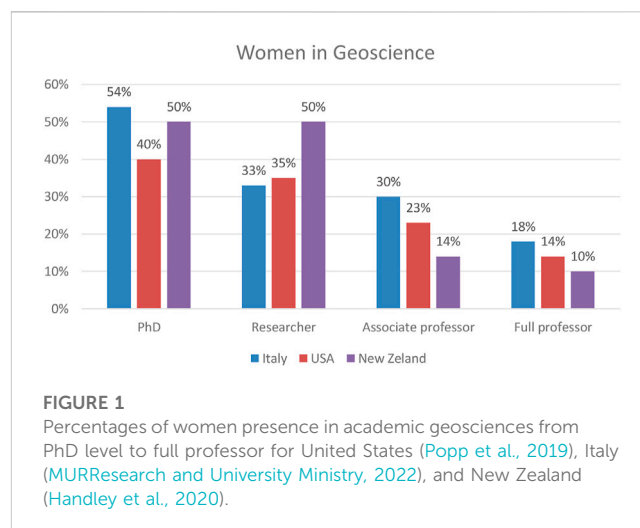
The aim of this paper is to focus on the gender gap within the geoscience academic community. In particular we will concentrate on language and how an inclusive vocabulary could be adopted to foster a change of perspective and mindset. The idea is to give readers a matter for reflection on a possible evolution of language in geosciences from current to gender-inclusive language and how it might be used also in the other fields. As a starting point, we provide a table with some examples of alternatives to gendered terms that illustrate the possibility and the importance of expressing the same concepts with a more equal approach. The adoption of similar solutions by journal editorial boards could contribute to a positive transformation within the community.

2 Women in geoscience

According to Popp et al., 2019, between 1996 and 2015, the percentage of women enrolled in STEM courses in the United States climbed from 25%–30%–40%. However, as academic careers progress, these percentages fall to 5%–14% (in 1996 and in 2015, respectively) for full professors. In New Zealand in 2018 the percentage of women geoscience workforce was around 50% for PhD and researchers but decreased drastically to 10%–15% with the progression of the career to full professor (Handley et al., 2020; Figure 1). Analyzing the Italian data (MURResearch and University Ministry, 2022), it results that the proportion of female students enrolled in STEM courses remains stable between 2012 and 2022 (about 37% of all students). Focusing on the geoscience field, the attendance of women students from 2012 to 2022 has oscillated between 35% and 40% of all course participants, which is consistent with the average in STEM fields. From 2012 to 2022 an average of about 54% of Geoscience PhD students are female but, considering full professors only, just the 18% of them are women (MURResearch and University Ministry, 2022).

In any case, the data for all these three geographical areas, all referred to recent and partially overlapping years, highlight that the presence of women with respect to men in geoscience decreases gradually during the career progression, from PhD to full professor, dropping with a factor of three to five (Errore. L'origine riferimento non è stata trovata). Such shared trend confirms that gender disparity is an important and crucial and widespread issue, even in countries with Anglo-Saxon languages where a neutral form exists, as opposed to Romance languages where every noun is either masculine or feminine.

Fairchild et al., 2021 suggest that the fieldwork entailed by geosciences can be more associated to a men's domain, which could discourage women students. However, women who participated in outdoor activities demonstrated traits like “decision-making” and “cooperation”, confirming that female students/professors are equally suitable for the position (Fairchild et al., 2021), although these two traits are culturally associated with



men and women, respectively. If this disparity is mostly due to culture and perception, a needed change of paradigm necessarily passes through language.

3 Gender inclusive language

Language is one of the most important and powerful instruments of human beings in their societies. It is composed of different vocal signs and includes assumptions, social rules and cultural ideologies; it is both the first existing communication system and the preferred way to convey information, opinions and messages (Marotta & Monaco, 2016). Thus, language not only has the function of communicating information but is also a way of managing social order (Marotta & Monaco, 2016). It symbolizes the society in which it is used and can become a cost-effective instrument for both empowerment and discrimination. Using inclusive language should be one of the first steps in creating respect, dignity, and fairness among individuals (Taheri, 2020) to communicate in such a way that every single person feels represented and not excluded by society. In fact, language shapes the way we think and how we experience relationships with others (Boroditsky, 2011). The power of language, which is in everybody's hands at no cost, is not to be underestimated. Thus, as academics and scientists, it is our responsibility to use it properly to enact changes in the scientific community and to be promoters of positive changes in society.

People have been marginalized due to gender, age, disability, culture, ethnicity, socioeconomic status and more, and language in the form of derogatory terms or belittling are used to enforce such discrimination. However, the use of a non-discriminative language is not as straightforward as it may seem. For example, the term “diversity” itself is described by the (Oxford Language, 2020) Dictionary as the condition by which people consider themselves or are considered by others as being outside of assumed normality. Diversity represents a large concept which intrinsically includes other concepts like accessibility and inclusivity. Nevertheless, the term “diversity” implies a subordinate relation with reference to what is considered normal; yet, who decides what is normal?

TABLE 1 Suggestion for a gender-aware vocabulary of words commonly used in geosciences. *Joyce et al., 2021.

Non-inclusive words	Inclusive words
Businessmen	Businesspeople
Chairman	Chairperson, Coordinator, Chair
Committeeman	Committeeperson
Common man	Average person
Congressman	Legislator, congressional representative/member of congress
Dear Sir/Madam	To whom it may concern, Dear Mx, Dear Dr., Dear Prof., Dear Editor
Freshman	First-year student
he, she—him, her	They—them
Headmaster	Head
Layman's report	Layperson's report
Man	Person, individual
Man hours, man month	Work hours, work month, person hour, person month
Man to man	Face to face
Mankind	Humanity, people, humankind
Manmade	Anthropic/artificial
Manned	Piloted, crewed, staffed
Manpower	Human effort
Middleman	Middleperson
Mr, Mrs, Miss, Ms	Mx
Unmanned (as in unmanned aerial vehicle, UAV)	Unoccupied*, unpiloted, uncrewed
Weatherman	Meteorologist

Therefore, the very use of the term “diversity” might be used to discriminate, whereas “variety”, which represents one of the components of the diversity together with balance and disparity, meaning any subject that is distinguished by particular characteristics from others belonging to the same species, should be preferred (van Dam, 2019).

Because English represents the main language of science, it could contribute to helping both the field and scientific communities be more inclusive. It is considered one of the most gender-inclusive languages because most of the nouns are not gendered and, usually, they do not provide gender information, except for the third person singular pronoun (Hord, 2016). Language is always in continuous evolution; the “Old English” is different from the “Modern English” in several aspects, and the changes also involve the grammatical genders that have been replaced by a more neutral language (Bjornson, 2017), e.g., “Mx” instead of “Mr” or “Mrs”.

Since 2015, Sweden has adopted the neutral form of pronouns, and these terms have also been incorporated into the Swedish Academy Glossary (Tavits & Perez, 2019). Sweden is the first country that has added and applied a neutral form to the language (Senden et al., 2015). In some languages in which the neutral form does not exist, the symbol “ə” (schwa, characterized by a mid-central vowel sound, is sometimes used instead of the feminine and masculine desinences. However, the full adoption

of this grapheme/phoneme would mean a radical and probably unfeasible transformation of all Romance languages, without any certainty that this would have beneficial results, as shown in countries like United States and New Zealand whose language uses the neutral form; furthermore, it would create problems of accessibility, especially because schwa it is not supported by screen readers or the Braille language for people with visual impairment. If the content is not accessible to everyone, it cannot be considered inclusive. Indeed, in the geoscience community, there are still many words used daily in scientific papers, project drafts, meetings, and conferences that refer only to the male gender. An actionable recommendation is to disseminate and implement an inclusive glossary that should become part of a shared language (Table 1) to be used as a possible starting point to make language and articles/works more inclusive at least in this field as a way to begin to address the issue and be able to make our contribution in its development and implementation. Note that the existence of the neutral form in the English language does not mean that many terms are gendered.

4 Discussion

Instead of the leaky pipeline, a hostile obstacle course has been suggested as a metaphor for the lack of diversity in the geosciences,

as documented in many countries (Bernard & Cooperdock, 2018), reflecting the various hurdles in the lives and careers of underrepresented groups. This situation implies an active, albeit possibly unconscious, role of the whole scientific community (Berhe et al., 2022). This representation suggests that such obstacles, just as they have been created, can also be removed; however, such an action is not only in the hands of people with power. Easy, yet significant, changes can be advanced by any of us, starting with the language we use to write our own papers. Since the power of words is sometimes underrated, such actions may be dismissed as meaningless; therefore, it is important that the use of an inclusive language begins with men. In fact, this is not just a problem for women, but should be seen as a problem for everyone and it is crucial that men fully acknowledge the issue in order to try to lessen and avoid it (Popp et al., 2019; Flood and Russel, 2017). After all, it is a mathematical fact that collections of individuals with diverse tools outperform collections of high “ability” individuals at problem-solving and predictive tasks and, therefore, that organizations with diverse employees often perform best (Page, 2007).

To help and safeguard women, institutional, sociological, and legal changes are required in many countries. Without these changes it will be more difficult and longer to achieve gender equality in geoscience and STEM fields. The responsibility and commitment of leaders in establishing gender inclusive workplaces is the first step on the road to long-lasting transformation in gender equality. For example, in Australasia there have been numerous programs targeted at enhancing gender parity in these sectors and leadership positions (Handley et al., 2020).

To turn into actionable recommendations what risks to be just vague considerations, two SMART (Specific, Measurable, Achievable, Realistic, Time-bound) actions are suggested as follows. First, journals’ editorial boards could adopt a policy described in their guidelines for authors where the adoption of a non-gendered lexicon, similar to the one proposed here (Table 1) is a requirement for publication. A procedure to scan and delete gendered language from the text could also be implemented.

Another action could be to implement the same measures during project proposals evaluations of calls at all levels, from local to national or international calls, in order to be eligible for financing. Confirming the importance of this issue to international policies, the European Commission has recently launched the New European Bauhaus, an interdisciplinary activity to address complex societal problems, thanks to collaboration among citizens, experts, researchers, and institutions. It is based on three main pillars: sustainability, aesthetics, and inclusion (European Commission, 2021). Moreover, Horizon Europe, the European Union’s main

funding program for research and innovation, has made gender equality a pivotal point for any research proposal. In fact, public bodies and research organizations applying for funds are required to have a Gender Equality Plan (GEP); this practical strategy consists of a set of actions to promote gender equality through cultural and institutional change in the organizations themselves (European Commission, 2022).

Appealing to a relatively small community of people–geoscientists–can hopefully facilitate the usage of a non-gendered vocabulary. Gender equality is important for sciences and societies and using a language that puts people on an equal level could be a first step to work together and join forces in the same direction with an even greater efficacy and strength.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

Author contributions

EI conceptualized the work. ON, EI, VT worked on the organization of the paper and polished the original idea. ON and EI wrote the paper. VT contributed to the international state-of-the-art. AB acquired, analyzed, and interpreted the statistical data about the male/female presence in the Earth Science field. All the authors revised the final draft.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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