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# The Influence Of Gender Representations In Digital Resources: Perspectives For Science Education

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***Abstract***
*Analyzes on the interaction between science, technology and gender, although varied, converge towards a shared political aim: the defense that understanding science and technology requires consideration of the social context of the known individual. In this context, this study seeks to deepen the analysis of gender representations in digital resources in science teaching, aiming to deconstruct gender stereotypes, especially in the classroom. The importance of preparing students for the demands of contemporary society is highlighted, using digital tools to promote the interconnection between scientific knowledge and everyday life, enabling autonomous and critical participation in the formation of knowledge. The present study used a qualitative bibliographic review methodology, analyzing scientific works and articles from databases such as Scielo, Google Scholar and Scopus and incorporating theoretical contributions from authors such as Schienbinger (2001); García; Sedeño (2002); and Silva; Moraes (2023).*

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## I. Introduction

The contributions of women in science and technology, although numerous, have historically been undervalued due to gender stereotypes that relegate them to secondary roles. Studies on science, technology and gender converge to resist sexism and androcentrism in the scientific field, aligning themselves with a feminist political dimension that questions the historical exclusion of women (GARCIA; SEDEÑO, 2002).

However, it is important to emphasize that the lack of female references in this scenario does not indicate their nonexistence, but rather that their names were hidden/erased in the construction of scientific-technological knowledge, especially by those of their fathers and husbands, who are historical products of the society that formed them (SCHIENBINGER, 2001). This has resulted in a mistaken perception that the female gender lacks the intellectual capacity to generate knowledge considered relevant to human and social development.

The figure of the scientist is historically associated with the male, disconnected from domestic obligations, which limits women's access to science, which is often linked to the private sphere and care (CAVALLI, 2017). However, digital resources open up new opportunities, expanding possibilities in teaching and learning and in the inclusion of women in the area.

Therefore, seeking to deconstruct the stereotypical view of the female figure, especially in the classroom, this study aims to discuss the influence of gender representations in digital resources in science teaching. This study, through a qualitative bibliographic review, examined books and scientific articles from databases such as Scielo, Google Scholar and Scopus, with emphasis on authors such as Schienbinger (2001), García and Sedeño (2002) and Silva and Moraes (2023).

**The digital world in the science classroom**

With the advancement of technologies, it is crucial to reinterpret the role of these resources as facilitators of teaching and learning, enabling social interactions and supporting human development; thus, schools, faced with the demands arising from the digital age, need to prepare students to meet the needs of contemporary society (MOREIRA, 2007). According to Assmann (2000), the use of digital technologies in educational institutions is supported by the ability of these tools to "[...] intensify complex, interactive and transversal thinking, creating new opportunities for solidarity sensitivity within the very forms of knowledge".

In the context of science teaching, these technologies, mediated by the teacher, offer extremely important resources for connecting scientific knowledge and everyday life, promoting autonomous, educated, thoughtful and critical participation of students in the formation of knowledge. Students' ability to understand and express concepts in science, both orally and in writing, involves the construction of a language that goes beyond the mere

mastery of specific terms, measurements, units, and codes associated with school subjects. It is essential that students are able to interpret information presented in different ways and in different formats (DEL PINO; STRACK, 2012).

In science teaching, digital resources improve understanding of content and promote active student participation, especially when mediated by teaching (ALMEIDA, 2022). However, it is urgent to adopt educational models that address gaps such as the lack of representation in gender narratives and the limited integration of inclusive technologies. Still focused on traditional methods, teaching needs to deconstruct stereotypes and stimulate critical thinking, overcoming prejudices that see the media as a threat to subjectivity (ASSMANN, 2000).

According to Krasilchik (2004), it is essential to recognize the opportunities that digital resources offer to promote engaging, fun and interactive learning, which are important elements for expanding and diversifying knowledge, and to grant students a central role in their own learning process. However, school activities are often not integrated into students' daily lives, which compromises the effectiveness of scientific teaching. Therefore, integrating new technologies into educational methods – through teacher mediation – is essential to facilitate the development and improvement of knowledge, allowing students to develop skills and competencies that contribute to the creation of a caring, civic and scientifically educated society.

It is important to note that in the digital environment, students and teachers share the same goals, and that the desire to learn is intertwined with the desire to teach. This convergence is essential for both to provide learning experiences alluded to by the construction of scientific knowledge. The use of technology by teachers as an ally in understanding science in the classroom is an excellent strategy, allowing students to acquire the real ability to interpret and apply scientific knowledge.

Pierre Lévy (2007), a philosopher and information theorist, contributed to the understanding of technological transformations through his concept of cyberspace, which he describes as a virtual space where information is shared and processed collectively; arguing that cyberspace is much more than an extension of the physical world, being a new territory of interaction and learning.

Virtuality transcends the limits of time and space, expanding access to educational resources and connecting individuals globally (COSTA; CORDEIRO, 2019). Although access to technologies is still unequal, especially for women in vulnerable contexts, online platforms can reduce disparities and promote female empowerment in science teaching, as long as they are accompanied by inclusive policies (SILVA et al., 2022). This transformation challenges gender barriers and encourages the deconstruction of stereotypes in a field where women face discrimination (TEIXEIRA, 2010).

However, the integration of cyberspace into education is not without its challenges, since inequality in access to digital technologies can exacerbate existing educational disparities. Furthermore, the quality of resources available online varies significantly, requiring careful curation by educators, who must seek training to effectively use such digital tools, intending to achieve the success of this transition, and who, according to Heerdt (2019, p. 6), "needs to train teachers with gender dimensions".

**Female participation in the scientific field**

Historically, women have been deprived of the right to property and recognition for their inventions, with their male relatives being registered as responsible. Some, belonging to higher social classes, achieved a certain prominence due to the limited opportunities available. Despite significant advances, such as the admission of women to Oberlin University in 1837, the result of intense female struggles, the direct exclusion of women in academic institutions and research centers has been overcome. However, implicit mechanisms persist that maintain and legitimize subtle forms of gender segregation (GARCÍA; SEDEÑO, 2002).

According to the analysis by García and Sedeño (2002), two forms of discrimination can be identified: territorial and hierarchical. In the territorial approach, certain fields of scientific activity are attributed to women, implying, among other aspects, the association of certain professions and areas as more "feminine" and, consequently, perceived as of lesser importance or appreciation.

In the hierarchical approach, highly competent and talented female scientists are kept at lower levels in the hierarchy of the scientific community or face an invisible barrier, known as the "glass ceiling", which limits their professional advancement. Women find themselves excluded from informal communication circuits, which play a vital role in the development of ideas. These forms of discrimination are veiled and occur in a very subtle manner, making it challenging to establish parameters or general regulations to identify this type of segregation (GARCÍA; SEDEÑO, 2002). Regarding the so-called "glass roof", it is possible to discuss that:

[...] includes actions taken by institutions, co-workers, society and other agents involved in the composition of the context where scientific research takes place. [...] such actions are not blatant and are preserved through sexist behaviors that often go unnoticed by everyone involved. However, sometimes they do not! (SILVA *et al*, 2022, p. 89).

Gender stereotypes associate men with attributes such as rationality and autonomy, while they associate women with characteristics such as sensitivity and submission (NEVES, 2020), which are often seen as barriers

to scientific careers, where the valorization of qualities considered "masculine" predominates; in this context, men are considered "superior beings" to women (KELLER, 1991; GARCIA; SEDEÑO, 2002; FIGUEIREDO; SIMÕES NETO; SANTOS, 2019). Therefore, contemporary science still seeks to understand gender disparities in cognitive abilities, investigating genetic, hormonal and structural conditioning that perpetuates the idea that specific differences justify inequalities in scientific fields (GARCIA; SEDEÑO, 2002).

As argued by Tabak (2002), the invisibility and/or erasure of women in the scientific field is attributed to a series of cultural obstacles that have developed throughout the history of humanity. From this perspective, the author advocates for the need to promote the integration of women in science, but makes it clear that this integration is not cohesive, since the very structure of the Western scientific-technological institution is intrinsically sexist, as it was generated on particularly masculine values of superiority, domination and control. In this same panorama, Pereira; Loguercio (2019, p. 6) highlight that "it is important to make the female scientist subject visible not only in the fight for equal access, but also for respect for gender differences when such access becomes possible".

**Gender in science and technology education**

Analyses centered on feminism or, to simplify the discussion according to Scott (1990), studies related to gender, have the capacity to clarify crucial questions in the epistemological, methodological and even knowledge outcomes.

The clear justification of the importance of the gender category in Education research can be observed in the notable example of the two editions of the National Meeting of Research Centers and Groups Thinking Gender and Sciences; where both events were conceived by the Special Secretariat for Women's Policies (SPM), in partnership with government agencies, taking place, respectively, in 2006 and 2009. During the first meeting, a resulting document highlighted the need to develop and consolidate a field of knowledge related to gender relations, emphasizing the implementation and strengthening of policies to support research in this domain, in addition to also proposing the structuring and expansion of national and international exchange initiatives aimed at the development of research on gender relations, the present document was entitled as the II National Plan for Women's Policies, which is already in its third version (BRASIL, 2008, 2013) endorses the objectives of this proposal:

[...] the reduction of inequality between women and men and to confront prejudice and discrimination based on gender, ethnicity, race, social, religion, generation, sexual orientation, gender identity and against people with disabilities through the training of managers, education professionals and students at all levels and types of education (BRASIL, 2013, p. 23).

Initiatives aimed at female participation in Science and Technology highlight the need for equitable and gender-sensitive education, requiring teachers to be involved in debates and actions to reverse inequalities that manifest themselves in schools, whether in pedagogical practices or in the reproduction of outdated concepts about gender identities, perpetuating prejudices that influence the personal and professional choices of girls and young women.

As highlighted by Lima Júnior (2001), the educational environment, shaped in its entirety, responds to the demands of broad social systems, such as patriarchy and machismo, which perpetuate dominant and exploitative situations, influencing the performance of men and women in particular learning contexts.

In Science classes, metaphors and analogies, although useful for explaining concepts, often reproduce gender stereotypes. Keller (1991) emphasizes that metaphors such as the description of "nature" as something to be "dominated" associate active characteristics with the masculine and passive characteristics with the feminine, influencing scientific values and practices; these representations shape the perception of science and limit the identification and participation of women in the field.

In the specific context of Science Education, the National Curricular Parameter (PCN) states that students must develop skills such as understanding nature as a dynamic system, recognizing the transformative role of human beings in relation to other living beings and the environment, as well as perceiving Science as a historical and social process associated with economic, political and cultural elements (BRASIL, 1998).

The aforementioned objectives appear to be aligned with the systematization of Fourez (2003), who identified two distinct but complementary orientations present in Science courses: one aimed at educating scientists, specialized in areas such as Physics, Chemistry and Biology; the other focused on the civic conception, addressing environmental, technological, quality of life aspects, among others. In this context, the author argues that scientific education should manifest itself through humanistic characteristics, aiming at the capacity for insertion in a technical-scientific domain and the ability to employ science in the practice of deciphering one's world, making it less mysterious.

From the perspective of gender studies, there is the challenge of addressing the "reduction of inequalities" when the reference standards in the production of knowledge, exemplified in textbooks, are consistently represented by white men (SILVA, 2022). Therefore, some questions arise: how to promote female

interest and involvement in scientific careers in this scenario? How can we contribute to the gender-conscious training of teachers working in the scientific segment within this dynamic?

Schienbinger (2001) highlights the relevance of gender analytical tools for educational studies in science, pointing out the need to examine how pedagogical priorities and results are defined and their impact on classrooms. The author also suggests an analysis of institutional arrangements, exploring the female presence in educational centers and its relationship with the social context of the time. In addition, she proposes a decoding of languages and iconographic representations, observing the rhetoric in scientific texts and images, as well as the metaphors used. Finally, we emphasize the importance of reviewing the concepts of science, reflecting on how women are inserted in this scenario.

Complementing these analyses, Silva and Moraes (2023) provide practical examples of technological methodologies that integrate women's history into science teaching, promoting educational equity, such as applications such as Lessons In Herstory and Women Who Changed the World, which have rescued stories of scientists such as Marie Curie and Rosalind Franklin, expanding the gender debate in schools. While the first explores textbooks with predominantly male figures, the second offers an interactive approach in Portuguese. These digital resources are valuable tools for teachers, contributing to a more inclusive and awareness-raising education.

## II. Conclusion

This study proposed the deconstruction of gender stereotypes in science teaching, focusing on the influence of gender representations in digital resources, highlighting the absence of female references in the construction of scientific-technological knowledge, and reinforcing the need for educational models that fill these gaps and train educators in the use of technology. The analysis showed that the invisibility of women in science persists due to structural discrimination, highlighting the importance of pedagogical policies and practices that promote equity, such as reviewing metaphors, recognizing female scientists, and valuing their historical contributions. Thus, integrating gender perspectives into science teaching, combined with digital resources, represents a transformative approach for creating a more just and democratic society.

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