Submitted on 20/01/2022 • Accepted on 30/08/2022
https://doi.org/10.28976/1984-2686rbpec2023u5780

Relations Between Gender and Science-Technology in Brazilian Science Teaching: What do Researches Say?

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Abstract

Through discourses constructed in historical, cultural and social contexts, women face difficulties regarding the insertion, permanence and ascension in the scientific-technological career. In this context, we aim to understand and analyze what is shown in research on gender issues and Science-Technology (ST) in science education in Brazil. To do so, we present a qualitative research, a state of the art, which had as corpus of analysis theses and dissertations present in the repository of the Brazilian Institute of Information in Science and Technology. Methodologically, we used the Textual Discourse Analysis, from which three categories emerged, namely: (1) The discourse of women's non-belonging in ST (2) The (in) visibility of female models who did/do ST and (3) Scientist-mothers and the multiplied workdays. We realize that the feminine gender faces stereotypes and prejudices that end up influencing its inclusion and path in ST. In the search for making ST visible and showing it as a possible career for the female gender, family, school, teachers, and the promotion of public policies of support and incentive are some of the essential means for this.

Keywords: scientist, woman, Science Teaching

Relações Entre Gênero e Ciência-Tecnologiano Ensino de Ciências Brasileiro: O que Dizem as Pesquisas?

Resumo

Por meio de discursos construídos em contextos históricos, culturais e sociais, as mulheres enfrentam dificuldades quanto a inserção, permanência e ascenção na carreira científico-tecnológica. Neste âmbito, objetivamos compreender e analisar o que se mostra em pesquisas sobre as questões de gênero e Ciência-Tecnologia (CT) no ensino de ciências do Brasil. Para tanto, apresentamos uma pesquisa de cunho qualitativo, um estado da arte, que teve como corpus de análise teses e dissertações presentes no repositório do Instituto Brasileiro de Informação em Ciência e Tecnologia. Metodologicamente, utilizamos a Análise Textual Discursiva, a partir da qual emergiram 3 categorias, a saber: (1) O discurso do não pertencimento da mulher na CT (2) A (in)visibilidade de modelos femininos que fizeram/fazem CT e (3) Mães-cientistas e as jornadas de trabalho multiplicadas. Percebemos que o gênero feminino enfrenta estereótipos e preconceitos que acabam por influenciar sua inclusão e trajetória na CT. Na busca por visibilizar e mostrar a CT como carreira possível para o gênero feminino, a família, a escola, as/os professoras/professores e a promoção de políticas públicas de apoio e incentivo são alguns dos meios essenciais para isso.

Palavras-chave: cientista, mulher, Ensino de Ciências

Introduction

Many were and still are the contributions of women to Science-Technology (ST), although their names were often not mentioned or their knowledge was not valued by the scientific-technological community. It happened because of the gender issues, which labeled and still label the female gender as less capable, and even as incapable, of producing ST alone, with the woman being seen as an auxiliary of the male gender.

Regarding science and technology, we agree with the premise that is unfeasible the separate treatment of what, historically, has been called "Science" and "Technology", considering that in spatial and atemporal terms they are increasingly closer. Even though there still are particularities regarding them, in many contexts, the term techno-science has been used, thus, technology as a social process is not just applied and neutral science (Dagnino, 2008, García et al., 1996).

About gender comprehension, Butler's theorization (2003) do not allow us to understand gender as a "property of the individuals", something fixed that refers only to "masculine" and "feminine", but as a complex constructions,

> If someone "is" a woman, this certainly is not everything that the person is; the term fails to be exhaustive, not because the predefined gender traits of the "person" transcend the specific paraphernalia of its gender, but because the gender has not always constituted itself coherently or consistently in different historical contexts, and because gender establishes intersections with racial, class, ethnic, sexual and regional modalities of identity constituted discursively. It results that it became possible to separate the notion of "gender" from political and cultural intersections in which it is invariably produced and maintained (Butler, 2003, p. 20).

This denaturalization of binary relationships, female/male, woman/man, passes through the deconstruction of the sex/gender dichotomy. For Butler (2003), "sex" is not just a natural fact, but a category socially built. Thus, "[...] instead of affirming that there is a subject/body "man" opposed to subject/body "woman", what there is are, in fact, subjects and bodies capable os expressing higher or lower levels of masculinity or femininity." (Vidor, 2021, p. 101).A certain absence of female references in this field does not mean that they did not exist, but rather that their names were covered up in the construction of scientific- technological knowledge, mainly by those of their fathers and husbands (Schiebinger, 2001), resulting in a false notion that this gender does not have the intellectual capacity to produce knowledge considered useful for human and social development.

In common sense, as pointed out by the results of the DAST (Draw a Scientist Test) proposed by Chambers (1983), the image of the scientist character is linked to the male gender. Moreover, he is old, has messy hair, wears glasses and an apron, and is almost always inside a laboratory performing experiments, as pointed out by Mariana Bolake Cavalli (2017). He is relieved of domestic chores and family responsibilities, having more time to devote to research.

This symbolic representation of the ST individual, historically built, contributes to the restriction of female access in this area, because family and domestic responsibilities are socially added. In this way, the female gender was associated with the private, motherhood, and caregiving, stereotypes and perceptions that mark the insertion and trajectory of women in ST.

However, Marta González García and Eulalia Pérez Sedeño (2002) indicate that one should no longer speak explicitly about the exclusion of women in academic and research centers today, since this genre is found well represented in teaching and research institutions. A disguised gender equality has been instituted in the field of ST, however, there are subtler and veiled mechanisms that maintain and legitimize the segregation of women.

Even in current times, barriers to the participation of women in issues related to the development of ST persist. Marta González García and Eulalia Pérez Sedeño (2002), as well as Betina Stefanello Lima (2013) point out two existing discrimination mechanisms: horizontal segregation and vertical segregation. The first refers to the reduced number of female figures in certain areas of scientific-technological activity, especially in exact sciences and engineering, which means that certain careers are more "feminine" than others, and some "feminized" jobs acquire less value. The second refers to the under-representation of scientists in positions of prestige and power, even in "feminine careers", and it is difficult to establish general criteria or norms used for this discrimination, because it occurs in a very subtle way. Thus, these discriminatory mechanisms present two crucial and distinct moments in the academic career: the choice of the area and the permanence and ascension in the profession.

As for the devaluation of careers when there is a greater female participation in some areas, there is, in some countries with recent industrialization and in others less developed than the traditionally advanced ones, a greater tendency of women in the Sciences, in general, and in Physics and Engineering, in particular. Although this seems to indicate an advance regarding gender issues in this field, it actually reveals "[...] the negative correlation between women's presence and status, remuneration and recognition of a given profession" (Velho & León, 1998, p. 313). In this vein, it is also possible to justify the devaluation of teaching, an occupation socially related to the female gender (Martins & Hoffmann, 2007).

Betina Stefanello Lima (2013) points to slow and even stagnant growth and, in general, indicates the existence of a "crystal labyrinth" that keeps women in positions of less prestige, power and responsibility in the field of ST, such as positions of deanship, direction, leadership, etc. About that, we can mention the Nobel Prize and the prize in Economic Sciences that points out the reduced number of women among the laureates. From 1901 to 2021, of the 975 people awarded, 58 are women[1].

The lack of representation of female researchers is also evident when examining the proportion of both genders among the members of the Brazilian Academy of Sciences (ABC in the Portuguese acronym), which, by the year 2018, had 994 members, including

1 https://www.nobelprize.org/prizes/facts/nobel-prize-facts/

deceased scientists. Of this total, 862 are men and 132 are women, representing 15.3% (Fabiano, 2018). Moreover, in its 105 years of existence (1916–2021), there has never been a woman president[2] , and the same occurs in the National Council for Scientific and Technological Development (CNPq in the Portuguese acronym)[3] in its 70 years of existence (1951–2021). And, if we go beyond the sciences, we realize that in Brazil we have only had one woman who became president. These data show us how much women are not being represented in our society, which makes us wonder why this happens. Some think that women are not capable of assuming positions of greater responsibility, some say that it is just a lack of interest, and others claim that they should not assume such positions because of motherhood, their responsibilities with the home and family. Thus, women are subjected to the impositions and judgments of a society that sees them as having a biological function of reproduction and belonging to the private world.

In this vein, textbooks have an important influence on the students' vision. Sometimes, imagetic representations of the feminine gender present in textbooks relate them to activities of caring for the home, family and children, making them scarce as the educational level advances (Garcías & Sedeño, 2002; Martins & Hoffmann, 2007). There are few texts present in the textbooks that address the role of women in the development of ST and promote activities for reflection on the reason for the scarce female participation in the scientific-technological field, as well as the social consequences of this (Occelli & Valeiras, 2013). Thus, it is noticeable the absence of female representation in activities related to ST, which can be mistakenly interpreted as a female inability to insertion and professional success in the field.

It is a fact that women have been part of the history of ST and their contributions to this field should not be overlooked. However, this shouldn't be something merely punctual, summed up in great deeds accomplished by them; there is also the need to remember the circumstances that made it possible for these women to stand out in this field, which is so hostile to the female presence, such as the increased opportunities for being daughters and/or wives of scientists, or being from the upper class. Otherwise, the models of women scientists presented to today's girls will refer to a figure with an unattainable genius (García & Sedeño, 2002), consequently demotivating them.

Many times, the textbooks serves as support for the teachers in their readings and class preparation, as well as for the students study (Neto & Fracalanza, 2003), assuming, thus, a role of great influence in pedagogical practices and in the teaching and learning process of subjects, as they produce senses, meanings, ways of living and being. Therefore, we believe that by not bringing examples of women scientists and not discussing gender issues in the construction of ST, textbooks end up silencing trajectories that could inspire/motivate young students. The scientists of tomorrow are in school today, so ST needs to be presented to girls from an early age as a possible path, pointing out here the importance of textbooks to address such issues.

2 http://www.abc.org.br/a-instituicao/sobreaabc/presidentes-e-diretorias/

3 http://centrodememoria.cnpq.br/Dirigentes.html

In this perspective, this research aims to understand and analyze the relationships between gender issues and ST in Brazilian science teaching, more specifically, to identify and problematize the results found by researchers in their analyses. To do so, we started from the problematic: what is shown in the dissertations and thesis available at the Brazilian Institute of Scientific and Technological Information (IBICT in the Portuguese acronym) about the relations between gender and ST?

Methodology

This investigation is a qualitative research (Bogdan & Biklen, 1994; Lüdcke & André, 1986) approach of the bibliographical type, which, according to Gil (2008), is developed from existing materials, having the advantage of allowing a broader research than if it were conducted directly. However, there may be losses when considering that the researcher does not have access to primary sources. Primary sources, for this research, are the jobs, subjects and practices that were investigated in dissertations and thesis, being that our research started from the researcher's look of the thesis or dissertation to the primary source. Thus, we conducted the state of the art, which seeks to answer "[...] besides the questions 'when', 'where' and 'who' produces research in a given period and place, those questions that refer to 'what' and 'how' of the works" (Ferreira, 2002, p. 265).

Starting from the investigated problematic and the research objectives, we accessed the theses and dissertations of the Brazilian Digital Library of Theses and Dissertations (BDTD in the Portuguese acronym) national catalog and, through an advanced search, performed in two moments, we started the exploration process. In the first moment, using the descriptors: "gender", "women" and "scientists", we found 43 results. In the second moment, we added to the descriptors the term "textbooks", finding 38 results. We emphasize that we used these terms in all fields and opted for all of them in the search correspondence.

Of the 43 results found in the first moment, after reading the abstract, 22 involved a discussion of gender issues in ST related to science teaching, such as practices developed in science classes, interviews, historical approach and analysis of women's reports linked to science teaching.

Regarding the 38 researches found in the second search, which was made aiming to check works about genre and ST in textbooks connected to Natural Science and its Technologies (NST) field, two of them involved this discussion, being disconsidered the researches that did not analyzed the textbooks from the mentioned field (Natural Science, Physics, Chemistry and Biology). The option to search the IBICT portal in two moments occurs because, in the first moment, we seek to know what is shown in research on gender and ST issues related to science teaching and, in the second moment, we focus on this issue in research that analyzed textbooks linked to the area of NST, seeking to understand what is shown in this material about this issue.

Regarding the choice of the IBICT portal, we justify it because the BDTD integrate and make available to users, in a single location, a national catalog of academic works, and the network has 126 Brazilian educational and research institutions providing data

to date, totaling 687,328 documents, including theses and dissertations. Thus, we inform that the portal was consulted on June 17, 2021, and research entered after this date is not included in the analysis.

It is noteworthy that the methodology of this research is based on the Textual Discourse Analysis (TDA) (Moraes & Galiazzi, 2006; Moraes & Galiazzi, 2007) in which we produce a new text from the descriptions and interpretation of the senses and meanings of a set of initial texts, considering our references and research objectives.

With the corpus4 already selected (Figure 1) and the methodological path defined, we set off to read the methodology, the results, and the considerations/conclusions of the research.

Figure 1

Brazilian research on gender and ST in science education

Year	Code	Title and Author	HEI[1]	T[2]
2007	A	Women in Science: representation or fiction (CRUZ)	USP	**T**
2007	B	Traces of female participation in the institutionalization of scientific practices in Brazil: Bertha Lutz and the Council for the Supervision of Artistic and Scientific Expeditions in Brazil (SOMBRIO)	UNICAMP	**D**
2009	C	Education and professionalization of women: Bertha Lutz's scientific and feminist trajectory at the National Museum of Rio de Janeiro (1919–1937) (SOUSA)	FIOCRUZ	**D**
2011	D	Being a scientist: tensions between gender and science (PEREIRA)	UFPel	**D**
2012	E	Women in science: voices, times, places and trajectories (SILVA)	FURG	**T**
2012	F	About women, laboratories and scientific work in the Land of Light (SANTOS)	UFC	**T**
2013	G	Biography as scientific dissemination: a discourse analysis of the collection "Great Brazilian scientists" (ORMANEZE)	UNICAMP	**D**
2014	H	Gender, Science and TV: Representations of Scientists in Jornal Nacional and Fantástico (PEDREIRA)	FIOCRUZ	**D**
2014	I	In search of the field: science, collections, gender, and other stories about women travelers in Brazil in the mid- twentieth century (SOMBRIO)	UNICAMP	**T**
2014	a	Natural Science Teaching, Textbooks and Images: Investigating Gender Representations (DIAS)	PUC-SP	**T**
2016	J	A teaching situation for a discussion of the gender issue in undergraduate biological sciences (CHIARI)	UEL	**D**

4 Term used by Moraes (2003), based on Bardin's conceptualization (1977). Corresponds to the works selected for analysis.

Figure 1

Brazilian research on gender and ST in science education (continuation)

Year	Code	Title and Author	HEI[1]	T[2]
2016	K	A pedagogical intervention in basic education with the potential to increase the visibility of women's scientific production (CORRÊA)	UEL	**T**
2017	L	Women in Science: investigating the development of a didactic sequence with basic education students (CAVALLI)	UNIOESTE	**D**
2017	M	Identity Crisis: Gender and Science in Superhero Comics (JUNIOR)	USP	**T**
2018	N	Being a woman in Natural Sciences and Mathematics (ROSENTHAL)	USP	**D**
2018	O	Gender and Science in Three Bodies of Mary (SANTOS)	UFRGS	**T**
2018	P	The perception and involvement of girls regarding natural sciences and investigative activities (ALMEIDA)	UFABC	**D**
2018	Q	Elisa Frota-Pessoa: the textualization of her (self) representations and gender issues in the sciences (LINHARES)	UFSC	**D**
2018	b	Education and citizenship: analysis of the textbook as a tool for the construction of proposals for Chemistry Teaching (ASSIS)	UFG	**D**
2019	R	Women in science: dialogue between scientists from Pernambuco's academics of agronomy, veterinary medicine and chemistry and the students of these courses at UFRPE (CONCEIÇÃO)	UFRGS	**T**
2019	S	The insertion of women in science: effect of a visibility device (PEREIRA)	UFRGS	**T**
2019	T	Analysis of the effects of a teaching proposal regarding the contribution of women to Science (BASILIO)	UNESP	**D**
2020	U	Trajectories of women in science education research in Northern Brazil (LIMA)	UNESP	**T**
2020	V	Between numbers and skirts: the trajectory of women professors of Exact Sciences at the Federal University of Maranhão (SILVA)	UFMA	**D**

Source: Hendges, 2021.

Notes. 1. HEI - Higher Education Institutions; 2. Type of academic work: D - Dissertation, T - Thesis.

The research analyzed were 11 theses and 13 dissertations from 2007 to 2020, with the highest occurrence year being 2018, with five researches. For identification purposes, we used as a code the letters of the alphabet, where the capital letters (A, B,... V) represent the research selected in the first search and the lower case letters (a, b) the research selected in the second search.

In the works that compose the corpus of this research, gender and ST issues related to the insertion, permanence and ascension of women in the scientific-technological field are analyzed, with the realization of pedagogical interventions, analysis of reports, historical approaches of scientist characters and the image of the scientist figure present in information and communication media, which includes here the textbook of NST, corpus of analysis of two researches, being a thesis and a dissertation.

We can highlight that the issues of gender and ST have been recently discussed, and, in textbooks linked to the area of NST, the discussions are incipient, with only two analyses carried out in the years 2014 and 2018.

Thus, continuing the research in the light of TDA, the first process began, the unitarization of the original texts, in which nuclei of meaning are removed and attributed, aiming "[...] to reach the elaboration of descriptive and interpretive texts, presenting the arguments pertinent to the researcher's understanding of the phenomena that he investigates" (Moraes & Galiazzi, 2007, pp. 50–51).

> More than just divisions or cutting, the units of analysis can be understood as highlighted elements of the texts, important facts that the researcher thinks that deserve being highlighted, in relation to the investigated phenomena. When understood like that, the units are necessarily connected to the whole (Moraes & Galiazzi, 2007, p. 115).

From this perspective, after the construction of the units of meaning (UM) that showed up in the process of fragmentation and deconstruction of the original texts when searching for the understandings about the issues of gender and ST present in the research, we began the second stage of analysis, called categorization.

In this process, relationships are established between the UM, to understand how these unitary elements can be brought together in the formation of more complex sets, the categories of analysis. To this end, we took a close look at each UM, through readings and re- readings, trying to understand and relate them, in the search for a meaning from the most recurrent terms. For Weiss (2005, p. 6),

> we deep the understanding when relating some parts or text meanings (words, concepts, metaphors, motives) with other texts and glimpsing the explicit and implicit dialogue that is established between these texts. It also deepens as diverse possibilities of relating some parts' arise (and/or meanings) of the text with other parts of itself.

It is noteworthy that the categories of this research emerged as the phenomena manifested themselves in the analyzed fragments, thus being classified as emerging categories. Furthermore, we point out that the same UM may include more than one category, to the extent that we perceive relationships, which justifies the number of selected UM being smaller than the sum of the UM that include the categories.

After the categorization, the process of communication and validation of the new emergent is performed, through the metatext, where the understandings reached in the previous steps about the investigated phenomenon are outlined in a systematized way, seeking quotes from the analyzed texts, as well as references of the field of study, gender and ST, which dialogue with the results found.

To Morais (2003),

> The produced categories by intuition originate through sudden inspirations, light insights that come to the researcher, through an intense impregnation in data related to the phenomena. They represent self-organized learning which are possible to the researcher from his/her intense involvement with the investigated phenomena. This process has its foundations in phenomenology approaching itself to what Restrepo (1998) calls abduction (p. 198, author's emphasis).

So, throughout the course of this article, we were based in theoretical frameworks to support the understandings and discussions we raised up, mainly regarding the categories that emerged from the US analysis. We justify that by the TDA theoretical-methodological framework. Below, we present the results of our analysis.

Results

In our research, from the analysis and understanding of the corpus, the unitarization process resulted in 485 UM. In the second stage, three categories emerged, which were named: (1) The discourse of women not belonging in ST (2) The (in)visibility of female models who do or did ST and (3) Mother-scientists and the multiplied workdays, which, contemplating the third and last stage of the TDA, will be discussed below, in the search for evidence of gender stereotypes and prejudices that end up influencing the inclusion and trajectory of the female gender in ST.

The Discourse of Non-Belonging of Women in ST

This category is composed of 276 UM that address constructed discourses about characteristics, behaviors and abilities said to be "masculine" and "feminine" and what this implies in ST, such as the belief of a female inability for the industry, the concentration of women in certain areas of knowledge and the non-occupation of them in management positions.

Built in historical, social and cultural contexts, discourses point to and aim to impose "appropriate" characteristics for female and male characters, thus defining the spaces that subjects can and should occupy in society. Historically, it has been instituted in the field of ST that female characters do not possess the ideal characteristics and

abilities for this branch, due to the "[...] naturalized dichotomous view that labels reason, objectivity, logical reasoning as 'masculine' and feeling, subjectivity, giving, caring as 'feminine' [...]" (E, 2012, pp. 107–108). In the same vein, textbooks tend to make representations of scientists as "[...] subjects devoid of affectivity, emotions, and subjectivity, and may suggest that these characteristics are a threat to their credibility [...]" (a, 2014, p. 98).

We point out here that we do not advocate having certain feminine characteristics and other masculine ones, otherwise we would be proposing a universal model of man and woman, but the discourses present in the context in which we are inserted/inserted (family, school, religion and society in general), aim to dictate/mold how we should be and act and, sometimes, we internalize this. In this way, "being a man", "being a woman" or all the nuances of "being" is to be in the midst of regulatory norms that are spread through multiple processes, strategies and cultural practices established initially by the family and then by the school, media, religion, among others, and that are able to normalize and naturalize conducts, positioning and behaviors, producing subjectivities (Morando et al., 2018; Magalhaes & Ribeiro, 2009).

In the scientific-technological community, built by valuing "masculine" characteristics, women may be led to believe that their behavioral traits are not appropriate for the good performance of the profession, as indicated by Léa Velho and Elena León (1998). We can observe this in the speech of one interviewee among the surveys analyzed, when she believes that, inserted in the ST she should stop behaving "like a housewife" and do everything that a man would do if he were in that position:

> Oh, delicate, sensitive, susceptible, whiny, that whole thing. I had a colleague that when she had a problem she would cry. She gave me a hard time [...] And I told her: you are here occupying the place of a man, you can't afford to behave like a housewife, you have to do everything that a man would do here in the sector. And I always acted like that. (Carolina) (E, 2012, p. 106).

It is possible to observe that in the attempt of a possible successful "fit" in the career, it is considered that women scientists must assume "[...] androcentric standards of doing science, as if these were universal rules for the scientific enterprise [...]" (D, 2011, p. 68), which leads us to believe that many women start to assume a masculine way of thinking and doing ST in an attempt to insert, remain and be successful in the profession. ST, to the extent that it does not consider gender differences "[...] imposes that women adapt to the prevailing model of science, which values full-time dedication, research productivity, competitive relationships, male characteristics and skills, among other aspects" (E, 2012, p. 123). Thus, obstacles to a greater female participation in ST occurs due to the power and domination relations implicit in research institutions, that value the "masculine model" of doing ST (Costa, 2006).

Through this androcentric and sexist bias that constitutes ST, gender representations limit male and female subjects to concentrate in certain areas, due to the fact that they are considered more "feminine" or "masculine", as evidenced in research E:

> [...] certain areas, such as the exact sciences, physics and engineering are not allowed for women, since they do not have the necessary skills and characteristics to work in these fields. Thus, it would be more logical for women to enter more "feminine" areas, more consistent with their gender condition, such as, for example, Pharmacy, Nursing and Humanities. (E, 2012, p. 71).

The idea that fields such as Physics and Engineering are more masculine, fact checked in practice when analizying the gender of CNPq's research productivity grantees (Guedes et al., 2015), refers to the notion that they "[...] require knowledge and skills in mathematics of which women are 'naturally' lacking" (E, 2012, pp. 119–120). Going against this, Marlucia, survey respondent F, comments that "[...] the fact that women are not as present in physics is due to the fact that they are not encouraged" (F, 2012, p. 136). This makes us reflect about the stimuli offered to young women, especially in the family and school context.

> The motivations for the professional choice were constituted by different discursive processes and social practices, sometimes of identification, sometimes of confrontation, in interactions with family members, with former teachers, in school experiences, in the interaction with certain cultural artifacts, such as toys and games (E, 2012, p. 120).

Regarding the motivations offered in the school context for the insertion in the ST field, it is important that teachers encourage boys and girls equally in all areas of knowledge, excluding gender stereotypes and prejudices in their speeches, such as the fact that there are supposed male and female skills, moreover, the textbooks need to insert women as actors in these spaces, valuing their participation in the construction of scientific-technological knowledge. In doing so, they should represent them in a way that does not naturalize a need for women to adapt to the male way of doing ST, such as the absence of feelings and vanity.

Sometimes, in an attempt to better adapt to areas that are said to be more "masculine", women may abandon modes socially associated with the feminine gender, because "[...] if we do not want, women, to have our work questioned, our competence called into question, our credibility at risk, what place can it possibly be necessary for us to assume? That of not- woman" (N, 2018, p. 88). "This is a strategy of abolishing, erasing the body. The erasure of the female body is also a way of not being disrespected by harassment [...]" (O, 2018, pp. 65–66), as observed in the trajectory of one of the women interviewed in L's research, in which, [...] not using certain feminine markers in order not to draw the attention of her peers constituted the strategies used by Lili to protect herself and be respected by her peers" (S, 2019, p. 39). In this sense, Londa Schiebinger (2001, p. 152) states that "[...] the abandonment of the trappings of 'femininity' is not only generally necessary for a woman to be taken seriously as a scientist, but it is often important also to avoid unwanted attention to her sexuality".

As we have been observing, several aspects hinder the path of women in ST, encountering barriers, sometimes subtle ones, with regard to insertion, permanence and ascension in the field. Regarding this last form of discrimination, we can observe that women suffer "[...] difficulty to occupy prominent positions [...]" (D, 2011, p. 59). Regarding this, there is a recurring discourse that this disadvantaged position of women in the field of ST occurs "[...] due to their low production rate" (F, 2012, pp. 183–184), however, for them to have a productivity symmetrical to that of male characters "[...] would require changes in the very structure of the scientific field, whose performative logic moves around an androcentric culture, where women tend to be inserted in less favored places" (F, 2012, p. 184).

The growing incorporation of women in scientific-technological activities in Brazil can be confirmed since 1997, among researchers and leaders of Research Groups registered on CNPq's Lattes platform (Leta, 2003). This increase in the insertion of women can also be verified by the analysis of the distribution of the different types of research fellowships granted by CNPq, with progress in increasing the number of women with research productivity grants in fields like Chemistry, Sanitary Engineering, Chemical Engineering, Biology and Health Sciences, as well as, in the field of Agricultural Sciences (Guedes et al., 2015). However, when we talk about the total number of scholarship holders in research productivity, destined to researchers who have high recognition between their pairs, most of them are destined to men , according to Moema Guedes, Nara Azevedo and Luiz Ferreira (2015).

Thus, we indicate that the presence of women doing ST has increased, but their recognition occurs in a slower and more arduous manner, finding it difficult to rise professionally and having salary inequalities in relation to men, according Lima et al. (2020). This lack of recognition was often evidenced in the history of ST, when in couples of scientists, "[...] despite working together and often as much as their husbands, recognition was credited only to men" (B, 2007, p. 59). This fact, somehow, has been propagating in biographies and memories that, at times, show women assuming roles of "[...] supporting, helpers, almost invisible, acting in the 'shadows of history' and knowledge [...]" (Costa, 2006, p. 456). This cover-up and the lack of knowledge causes the absence of female references in ST and indicates the existence of gender biases in the career.

ST is not neutral with respect to gender issues and this needs to be problematized in school, revealing that the values and characteristics socially attributed to the male gender are those valued in the production of knowledge and that gender inequalities exist and permeate the field of ST, hindering the insertion of female characters in certain areas of scientific- technological knowledge and resulting in their underrepresentation in management positions and research productivity fellowships (Leta, 2003). Regarding this issue, we agree that women scientists need to "[...] do more to earn the same credibility that a man earns with a little bit less effort (GRACE)" (N, 2018, p. 72).

> Currently, women occupy a prominent place in all professions, which does not mean the existence of gender, race, and class equality. Women suffer discrimination and are still considered unfit for many areas, among them science. [...] With each conquest of women in science, but not only in this field, it is possible to identify maneuvers of male domination and the permanence of mechanisms of inequality, built to put women at a disadvantage. (U, 2020, p. 158).

Awareness is needed about what it is to be a woman in ST. Being a woman in ST is different from being a man in ST. Therefore, there is a need to develop strategies for gender equity in this branch, offering "[...] training moments for education professionals, enriching their teaching knowledge, making them aware of gender issues and making them more critical [...]" (J, 2016, p. 125), to then adopt a position in an attempt to "[...] demystify the masculinized science that is presented to basic education students" (L, 2017, p. 84). It is also important that the "[...] incentive policies for all professionals in scientific and academic careers are reviewed. Awards for women, policies to remain in the career [...] recognition to women in the career, among other initiatives [...]" (N, 2018, p. 93).

With this category, we indicate that there are obstacles to a greater female participation in ST and they happen because of the relations of power and domination presents implicitly in research institutions. These, value the "masculine model" of doing ST, which involves competitive relations between pairs and dedication full-time, closely related to the stereotypes socially defined as masculine (Costa, 2006). As one of the consequences to the feminine gender, many times it is needed to give up of any traditional female values, solely to prove their legitimacy as scientist (Keller, 2006).

As an example of these power and domination relation we mention Guedes et al. (2015), who point to a higher quantity of CNPq research productivity grants destined to the field of Exact and Earth Science and Earth Engineering, both traditionally male-dominated. With this, it is possible to infer, according to the authors mentioned, that the criteria political-institutional, that defines the field to where it is destined the higher number of research productivity grants, has produced unfavorable effects to women, since, to the field where the higher number of scholarships are destined is precisely where we find the lower number of women.

Although in the last decades there has been a growing participation of feminine genre in Brazilian institution, in which they are majority in higher education (Idoeta, 2019) and in master's and doctoral programs (Righetti & Gamba, 2021), if we analyze main professors and coordinators of important ST researches, they are minority (Leta, 2003; Righetti & Gamba, 2021), which highlights the barriers to feminine career rise.

ST is not neutral, it carries values and intentionalities that influence society and is also influenced by it (Santos & Auler, 2019). By valuing male characteristics and skills, science- technology careers sometimes become difficult for women. Discussing the gender stereotypes and prejudices present in this field, therefore, becomes fundamental, as they exist and need to be questioned within research institutions, in the media, at

school, and in society in general. Although research has pointed out such inequalities since 1980, there is no satisfactory incorporation of policies and programs to support and encourage women or discussions in academic environments (Lima et al., 2020). Thus, teachers assume an essential role and textbooks can provide support for this discussion.

The (In)visibility of Female Models who Make/Were ST

This category is composed of 117 UM that address the non-representativeness of female role models who have made and do ST. The historical studies about the participation of female characters in ST (García & Sedeño, 2002; Leta, 2003; Lima, 2013; Schiebinger, 2001; Velho & León, 1998) show that it is seen as a masculine construction. This issue is reaffirmed in the textbooks and in the media, as this category seeks to highlight.

In the textbooks, the man is mostly represented as the scientist character, as pointed out in the research investigated: "Male scientists were represented in more images than female scientists" (a, 2014, p. 93); "it was also observed the low representation [...] of women in scientific activities, which reinforces a culture focused on the male gender" (b, 2018, p. 119); "We reproduce this in the textbook. [...] In the normal, who appears as a scientist is always the man [...] the woman as a scientist becomes the unusual (Blanka)" (U, 2020, p. 148); "[...] the way we learn in schools, woman does not do Science, because we do not see women in the books we study (Aa20)" (K, 2016, p. 215).

Not only in the textbooks, the male image as a person who does ST is propagated in the media: "[...] there is a mental image of scientist, a social representation based on images conveyed by the media, reinforced by the internet, and that [...] most of the time does not link images of women to the production of scientific knowledge" (A, 2007, p. 43).

The majority presence of the man doing ST is also confirmed by Eliecília de Fátima Martins and Zara Hoffmann (2013), as well as, by Maricel Occelli and Nora Valeiras (2013), when dealing with the textbooks, which reinforces the invisibility of female models and the idea of women's inferiority about the production of scientific-technological knowledge. Sometimes, this fact is naturalized and not questioned by those who produce the textbooks: "The fact that women are little represented in scientific activities may also indicate that the social chain responsible for the production of these textbooks considers that these are masculine activities" (a, 2014, p. 100).

Regarding this, the National Book and Teaching Material Program (PNLD in the Portuguese acronym), designed to evaluate and make available materials to support educational practice in Brazil, indicates that the teaching works should provide, alongside other pedagogical and educational materials, an environment conducive to citizen training. For example, in the PNLD 2018, as an integral part of its pedagogical proposals, all works should propose approaches that promote the image of women by reinforcing their social protagonism, as well as, gender issues (Ministério da Educação, 2018).

If we observe the evaluation criteria of the textbook works of the PNLD 2018 notice, specifically the high school Physics collections, we will see that one of the indicators to be observed by the evaluators of the collections to say whether the work was recommended or not was related to them being "[...] free from stereotypes and prejudices of socioeconomic, regional, racial-ethnic, gender, sexual orientation, age, language, religion, disability condition, as well as any other form of discrimination or violation of human rights." (Ministério da Educação, 2018).

Despite banning discrimination, the edital does not present an eliminatory criterion that directs and obliges the publishers that produce the textbooks to produce in their texts and images a balanced representation between male and female characters. It can be said that the PNLD brought positive changes regarding the quality of the material that is used in public schools, however, we believe that more demands are needed and we point here to the issue of gender and its equitable representation in the textbooks, both in terms of number of characters and in the positions occupied by them, detaching themselves from representations linked to old stereotypes of our society.

As one of the researches analyzed points out, "Authors of books should give visibility and rethink the social insertion of women as scientists, since they are present in the construction of knowledge and scientific production as much as men" (a, 2014, p. 170). For Bandeira (2008, pp. 209–210), "[...] the absence of women and the respective silence around their presence in history and, by extension, in science history end up revealing, themselves, the hegemonic association between masculinity and scientific thought."

This can make us wonder if there are intentionalities in these excluding representations, after all, is the man's knowledge the only valid one? Are women not capable of producing knowledge? There are intentionalities in the process of curriculum definition, clearly male (Silva, 2005), marked by a close relationship with power and the interests of specific social groups that aim to train citizens to meet certain demands that are more "appropriate" to them (Goodson, 2007). In this sense, we can think about the place that is considered more "appropriate" for women. After all, what are the intentionalities for insisting that she remains in this underrepresentation in relation to men?

Whether in the mentions or in the images, women and men characters are mostly represented in stereotypical figures, following the characteristics socially attributed to the genders. Thus, textbooks "[...] by representing female and male subjects in stereotypical roles, they are reproducing social prejudices" (a, 2014, p. 96), which does not contribute to the construction of citizenship and social coexistence. Moreover, "the low visibility of female scientific production presented in textbooks may represent a lack of incentive for girls to pursue scientific careers" (T, 2019, p. 128).

The low representation of scientists women in textbooks indicates the presence of obstacles in the feminine history in ST. Although in Brazil, women are majority enrolled in master's and doctoral programs since 2004, with the exception of the areas called exact and engineering (Fabiano, 2018; Righetti & Gamba, 2021), in texts and images

that refers to ST presents in textbooks in the field of NST they are minority (Martins & Hoffmann, 2013; Occelli & Valeiras, 2013; Ferreira, 2020; Englelmann & Cunha, 2017). This little visibility, in moments of total invisibility, and the non-discussion of gender in ST in textbook does not contribute to the offer of incentives to the scientific profession for young women inserted in the school. Thus, even if they enter the scientific-technological career, though undergraduate, master's and doctoral courses, they are not reaching positions of prestige and power. One of the points to this can be the naturalization of the scientist professional as a masculine figure or because there is no discussions o gender during basic education, that makes it possible to encourage girls in the struggle to rise in the field.

Thus, with the inadequate approach in the textbooks about gender issues in ST "[...] the elaboration of didactic sequences [...] that deal with the scientific making and the influence of political, historical, economic, cultural aspects and gender and diversity issues in its production, becomes relevant [...]" (C, 2009, p. 195). Moreover, "[...] texts in which female scientists have space to tell their trajectories, can be one of several ways to change or bring about representations different from those already present in our society" (Q, 2018, p. 114).

Therefore, we point out that for female scientific-technological production to have visibility, one of the necessary points is to show women's production in textbooks. After all, "If the media, school, books talked about women scientists telling their stories, girls would have role models of women scientists they could mirror themselves and the chances of them becoming interested in these careers would increase" (N, 2018, p. 92).

Thus, striving for this female representation is one way to ensure a more equal society and, to the extent that they believe more in themselves, motivate girls and women to pursue their studies in the ST field.

Scientist-Mothers and the Multiplied Workdays

In this category, composed of 102 UM, we discuss the difficulties encountered by many women in the scientific-technological field, due to cultural and social responsibilities associated with the female gender. Thus, issues such as the conciliation between academic work and family life, greater or sole responsibility for daughters/son and domestic chores, are raised as an additional difficulty for these characters to remain and progress in the ST.

The entry of women into the ST has not detached them from the responsibilities essentially attributed to the female gender. Motherhood, caring for their offspring, domestic and family responsibilities are still demanded of women, sometimes seen as an obligation, and this reflects on their scientific-technological careers.

We can observe from the transcribed statements of the scientists interviewed in surveys D, U and R, as well as, from the writing of scientist Marie Curie, through the historical rescue performed in survey O, that women encounter difficulties related to the traditional responsibilities attributed to their gender: "you have to know how to

reconcile [...] it is difficult, it is not easy. There is a time when you are a mother, wife, there is a time when you are a teacher, there is a time when you are a researcher, you have to know how to divide it (Isadora)" (D, 2011, p. 70); "[...] do not doubt that it is always more difficult to be a researcher, woman, married with child [...] (Blanka)" (U, 2020, p. 150); "[...] when we take care of our children we don't have time to do as much research as we want, there is no way, there is no point [...]. — Juliana" (R, 2019, p. 63); "Taking care of our house and our little Irene, without giving up my scientific work, became a serious problem. (Curie, 1923, p. 80, our translation)" (O, 2018, p. 47).

When we observe the excerpt from the speech of the interviewee in research D: "There's a time when you are a mother, a wife, there's a time when you are a teacher, there's a time when you are a researcher, you have to know how to divide (Isadora)" (D, 2011, p. 70), we can highlight that she uses the term "know how to divide", which may highlight that the woman should know how to "separate things". It is important to raise the issue that one does not stop "being a mother" while conducting research, as well as, one does not stop "being a researcher" while being in the private environment, taking care of offspring and family. The same is true for the male characters who, also, do not stop "being fathers", having responsibilities in the family, even with fewer social and cultural demands than those imposed on the female gender. Therefore, we believe that one should not assume a discourse of adaptation to the androcentric system of ST that values male characteristics, because "being a scientist", "being a woman" and "being a mother" are inseparable.

Thus, when opting for the ST, women come into conflict with the responsibilities of their home and academy (gym), as pointed out by Velho (2006, p. XV):

> Once made the option for a scientific career, the woman faces the motherhood conflict, attention and obligation to the family vis-a-vis, the demands of academic life. Some succumb and choose family, others, academy, and a number decide to combine the two. Some of these last ones, it is not necessary to say how mush they have to do to handle not just the multiple household chores, but also to live with a conscience that is doubly guilty: for not dedicating more time to the children and for not being so productive as someone would expect.

Sometimes, female characters need to make choices when entering the field of sciences, such as the act of questioning themselves about motherhood (Velho, 2006; Lima, 2013), as the interviewees in surveys D and E did: "You end up having to make a choice, either children or science (Simone)" (D, 2011, p. 74); "[...] I always found it kind of absurd that you have to choose not to have children. Either you are a scientist or you have children. If you decide to do both things you will suffer twice as much. (Sianiak)" (E, 2012, p. 113), an issue that, in our point of view, hardly comes into discussion when one is a scientist and decides to "be a father". Thus, motherhood is assumed as a negative factor in the scientific-technological career, which influences the insertion, permanence and full development of the female gender in this branch. Regarding this issue, the Parent in Science project, composed of a group of female and male characters

who have led to concrete changes in the Brazilian scientific-technological scenario, bringing motherhood to the center of the discussion, conducted an online survey in 2017 with 1182 Brazilian female professors, finding the impact of motherhood on the rate of scientific-technological publications, with a drastic drop until the daughter/son's 4 years old, which negatively influences the career. Moreover, the lack of support for motherhood generates, in many cases, mental health problems, such as depression and anxiety, as pointed out by Aline Gatto Boueri and Carolina de Assis (2018).

In this way, we point out the need to give visibility to maternity in the institutions of production of ST. Thus, affirmative actions are very important, necessary and urgent for the creation of an environment that is welcoming and has equal gender conditions. Among some, we highlight the actions proposed by the Parent in Science initiative. This group considers that funding agencies and higher education institutions should consider maternity leave as a career break, creating strategies to circumvent its negative effect on the evaluation of female scientific-technological productivity. To this end, they proposed in 2018 the inclusion of maternity leave in the Brazilian database of the Lattes curriculum, as indicated by Fernanda Staniscuaski et al. (2021), a fact that came to fruition on April 15 of the year 2021 (Ministério da Ciência, Tecnologia e Inovações, 2021).

It is noteworthy that this maternity leave should be considered in funding edicts, selection, competitions, scholarships, etc., granting special conditions in the evaluation of productivity for women with daughters/children (Staniscuaski et al., 2021). Also, in this sense, basic guarantees of support for maternity deserve special attention, such as daycare centers at work and study places, extension of project and scholarship terms, specific working day policies and remuneration for female and male characters who are in a "caregiver" position (Aquino, 2006; Lima et al., 2020; Staniscuaski et al., 2021).

As we have observed, women can present suffering in the course of their careers, which can relate both to the extra efforts that the scientist characters will have to make to remain and gain ascension in their careers, reconciling the care of the daughters/daughters, the family, the home, which makes "[...] they have to be a kind of 'super human beings', because they have to answer, in a satisfactory way, all these demands so present in contemporaneity" (F, 2012, p. 125), as to the suffering related to the feeling of guilt for the fact of having to make choices related to the sons/daughters (when they choose to have them), as we can evidence: "[...] I noticed in the narratives of scientists who sought to reconcile their profession with motherhood a feeling of guilt for not having dedicated themselves more to their children [...]" (E, 2012, p. 123); "The 'feeling of guilt' — so often observed in women who, as mothers, have to leave home to continue their professional life — at certain moments affected Irlys" (F, 2012, p. 124).

The feeling of guilt can affect mother-scientists, caused by the force of the social discourse that aims to impose how to be and act as a mother, which can result in the internalization of the discourse by them, leading them to believe that, by not going according to the established ideal, they are not a good mother, this can "[...] mean

something that entails psychic costs not supported by many who try to build a scientific career" (F, 2012, p. 130).

We realize that currently, women are already able to be present in many spheres of the scientific-technological market (Idoeta, 2019), but the responsibilities imposed on them, commented earlier, can hinder, limit and impede their trajectory within this branch, since, "[...] often prevent them from traveling to congresses, taking courses outside the country, being all day at the university, having time to read, write in their homes" (F, 2012, p. 125). Regarding this, we reaffirm that it is necessary to advocate the adoption of public policies to support scientist- mothers.

In textbooks, the linking of women and girls to house, family and childcare activities is often present (Martins & Hoffmann, 2007) and "[...] by representing women, almost exclusively, as mothers [...] textbooks may be hierarchizing and devaluing female work" (a, 2014, p. 115). Such fact may contribute to reproduction "[...] to function as a strategy to control women's social action and participation and exclude them from the construction of science" (a, 2014, p. 106), since, through the imagery and written discourses, the notion is imposed that women are the primary responsible for such care, being the career of the female character that must be sacrificed for the sake of family cohesion.

Thus, we evidence that the female path in the ST is hindered when the scientist becomes a mother and is the primary responsible for the care of the offspring, home and family, having to "handle" these responsibilities and the productivity required by research institutions, which needs to be re-evaluated, since everyone should not be expected to have the same productivity.

The responsibility with the home and the daughters/son is culturally and socially imposed in the family, school, textbooks, and society in general. Discussing the theme of gender and ST is necessary in the educational environment, as it makes it possible to deconstruct the vision of a purely masculine ST (Hendges & Santos, 2020). Textbooks that link the female figure to private work and rarely as a person who develops ST, reaffirm and continue to propagate stereotypical and excluding discourses, being necessary to combat them in this material.

Conclusions

Despite the transformations by which Brazilian society passed, regarding women in ST, they still face obstacles to insertion, permanence and career advancement. Throughout the exploratory process proposed in this research, we analyzed 24 thesis and dissertations related to gender issues in the scientific-technological field connected to science teaching.

These researches were the result of pedagogical interventions, analysis of reports, historical approaches of scientific figures and the representation present in information and communication media about women in ST, which includes here the textbooks' NST. We can highlight that the gender issues and ST have been recently discussed, and in textbooks connected to NST area they are found incipient, with only two studies.

In this article we aim to investigate the relation between gender issues and ST in Brazilian science teaching. In order to do so, we pass through three categories emergent, in which we identify and problematize the results found by researchers when investigating gender issues in science teaching.

The results showed that ST, which values the "masculine model" of thinking and producing knowledge, as competitive, high productivity and full time dedication, continues to have implications for women's lives and careers. Among the ones we highlight in the categories is the concentration of women in certain areas, such as education and others related to care. These areas are considered by society as more consistent with the attributions imposed on the female gender, such as motherhood, home and family care. As for motherhood, the same can justify the barriers to female career rise, since it is seen as a barrier to success in a field that requires full-time dedication and high productivity.

Sometimes, attempts to adapt for insertion, permanence and rise in the ST field are adopted by women, mainly regarding fields where there is masculine predominance, as exact sciences. Thus, women can be taken to opt, for example, between career and motherhood, a choice that usually does not occur when a man decides to "be a father" and scientist. The results also indicated that there is an (in)visibility of female models what made and make ST, being practically absent in the representations present in textbooks and in the media, what can lead to demotivation of women in this area. Showing ST in textbooks as a possible career to feminine gender, detaching from traditional stereotyped roles assigned to women and providing models and discussions about gender in ST, with the reasons behind the general invisibility of works and lives of scientists women, they are fundamental to encourage girls in the basic education context.

We understand that ST is not masculine, but structured and presented as. By affirming this, we refer to the presence of women in the industry, but they go through structural barriers during their trajectory. As a way to positively circumvent this issue, we indicate that it is necessary to give visibility to women in the textbooks and in the media, showing them as an integral part of the scientific-technological development and motivating the insertion of this gender in ST, by problematizing gender stereotypes and prejudices. Considering the textbook as a resource widely used by teachers, the authors of this material need to include speeches and representations of female participation and trajectory in the ST, showing this path as possible for girls inserted in school. Moreover, policies to support and encourage women in scientific-technological careers need to be adopted.

In view of the above, we hope that the discussions raised have contributed to reflection about the incentives that have been offered to girls and women to follow in the field of science and technology, indicating the need for changes in this scenario.

Bibliographic References

Aquino, E. M. L. (2006). Gênero e ciência no Brasil: contribuições para pensar a ação política na busca da equidade. In *Pensando gênero e ciência* (pp. 11–24). Encontro Nacional de Núcleos e Grupos de Pesquisas/Secretaria Especial de Políticas para as Mulheres. http://livros01.livrosgratis.com.br/br000014.pdf

Bandeira, L. (2008). A contribuição da crítica feminista à ciência. *Revista Estudos Feministas*, *16*(1), 207–228. https://doi.org/10.1590/S0104-026X2008000100020

Bardin, L. (1977). *Análise de Conteúdo*. Edições 70.

Bogdan, R., & Biklen, S. (1994). *Investigação qualitativa em educação: uma introdução à teoria e aos métodos*. Porto Editora.

Boueri, A. G., & Assis, C. (20 de Junho, 2018). *Sem considerar maternidade, ciência brasileira ainda penaliza mulheres*. Gênero e Número. https://www.generonumero.media/reportagens/sem-considerar-maternidade-ciencia-brasileira-ainda-penaliza-mulheres/

Butler, J. (2003). *Problemas de gênero: feminismo e subversão da identidade*. Civilização Brasileira.

Cavalli, M. B. (2017). *A mulher na ciência: investigação do desenvolvimento de uma sequência didática com alunos da educação básica* (Dissertação de Mestrado, Universidade Estadual do Oeste do Paraná, Cascavel, Paraná). Biblioteca Digital de Teses e Dissertações — Unioeste. http://tede.unioeste.br/bitstream/tede/3373/5/Mariana_Bolake2017.pdf

Chambers, D. W. (1983). Stereotypic images of the scientist: The Draw- A – Scientist Test. *Science Education*, *67*(2), 255–265. https://doi.org/10.1002/sce.3730670213

Costa, M. C. (2006). Ainda somos poucas: exclusão e invisibilidade na ciência. *Cadernos Pagu*, (27), 455–459. https://doi.org/10.1590/S0104-83332006000200018

Dagnino, R. (2008). *Neutralidade da ciência e determinismo tecnológico: um debate sobre a tecnociência*. Unicamp.

Engelmann, G. L., & Cunha, M. B. da. (2017). *Algumas percepções sobre cientistas em livros didáticos de química*. XI Encontro Nacional de Pesquisa em Educação em Ciências (ENPEC), Florianópolis, Santa Catarina.

Fabiano, C. (11 de Março, 2018). *Mulheres têm 20% das bolsas de pesquisa científica em exatas no Brasil*. G1. https://g1.globo.com/educacao/noticia/mulheres-tem-20-das-bolsas-de-pesquisa-cientifica-em-exatas-no-brasil.ghtml

Ferreira, N. S. A. (2002). As pesquisas denominadas "estado da arte". *Educação & Sociedade*, ano XXIII, (79), 257–272. https://doi.org/10.1590/S0101-73302002000300013

Ferreira, A. P. P. (2020). *As mulheres da ciência: uma análise dos livros didáticos de Biologia aprovados no PNLD 2012, 2015 e 2018* (Dissertação de Mestrado, Universidade Federal de Uberlândia, Uberlândia, Minas Gerais). Repositório Institucional UFU. http://repositorio.ufu.br/bitstream/123456789/30354/1/MulheresCienciaAnalise.pdf

García, M. I. G., Cerezo, J. A. L., & López, J. L. L. (1996). *Ciencia, Tecnologia Y Sociedad: una introducción al estudio social de la Ciência y la tecnología*. Tecnos.

García, M. I. G., & Sedeño, P. E. (2002). Ciencia, Tecnología y Género. *Revista Iberoamericana CTS-I*, (2), 1–19. https://digital.csic.es/handle/10261/9488

Gil, A. C. (2008), *Métodos e técnicas de pesquisa social*. Atlas.

Goodson, I. (2007). Currículo, narrativa e o futuro social. *Revista Brasileira de Educação*, *2*(35), 241–252. https://doi.org/10.1590/S1413-24782007000200005

Guedes, M. de C., Azevedo, N., & Ferreira, L. O. (2015). A produtividade científica tem sexo? Um estudo sobre bolsistas de produtividade do CNPq. *Cadernos Pagu*, (45), 367–399. https://doi.org/10.1590/18094449201500450367

Hendges, A. P. B., & Santos, R. A. dos. (2020). As Mulheres nas Dissertações e Teses Produzidas no Brasil. In *Educação científca, tecnológica e inclusiva* (pp. 99–106). Ilustração.

Idoeta, P. A. (10 de Setembro, 2019). *Mulheres são maioria nas universidades brasileiras, mas têm mais dificuldades em encontrar emprego*. BBC News Brasil 10. https://www.bbc.com/portuguese/geral-49639664

Keller, E. F. (2006). Qual foi o impacto do feminismo na ciência? *Cadernos Pagu*, (27), 13–34. https://doi.org/10.1590/S0104-83332006000200003

Leta, J. (2003). As mulheres na ciência brasileira: crescimento, contrastes e um perfil de sucesso. *Estudos Avançados*, *17*(49), 271–284. https://doi.org/10.1590/S0103-40142003000300016

Lima, B. S. (2013). O labirinto de cristal: as trajetórias das cientistas na Física. *Estudos Feministas*, *21*(3), 883–903. https://doi.org/10.1590/S0104-026X2013000300007

Lima, M. M. T., Feltrin, R. B., & Souza, G. (2020). Brecha de género en la ciencia en tiempos del COVID-19: una visión general de Brasil. *REDES – Revista de Estudios Sociales de la Ciencia y la Tecnología*, *26*(51). https://revistaredes.unq.edu.ar/index.php/redes/article/view/49

Lüdke, M., & André, M. E. D. (1986). *Pesquisa em educação: abordagens qualitativas*. E.P.U.

Magalhães, J. C., & Ribeiro, P. R. C. (2009). As neurociências ensinando modos de ser homem e mulher em revistas de divulgação científica. *Revista Electrónica de Enseñanza de las Ciencias*, *8*(2), 692–710. http://reec.uvigo.es/volumenes/volumen8/ART17_Vol8_N2.pdf

Martins, E. F., & Hoffmann, Z. (2007). Os papéis de gênero nos livros didáticos de ciencias. *Revista Ensaio*, *9*(1), 132–151. https://doi.org/10.1590/1983-21172007090109

Ministério da Educação (2018). *Guia Digital – PNLD 2018*. https://www.fnde.gov.br/pnld-2018/

Ministério da Ciência, Tecnologia e Inovações (2021). *Conselho Nacional de Desenvolvimento Científico e Tecnológico*. https://www.gov.br/cnpq/pt-br/assuntos/noticias/cnpq-em-acao/cnpq-anuncia-inclusao-do-campo-licenca-maternidade-no-curriculo-lattes

Moraes, R., & Galiazzi, M. C. (2007). *Análise Textual Discursiva*. UNIJUÍ.

Moraes, R (2003). Uma tempestade de luz: a compreensão possibilitada pela análise textual discursive. *Ciência & Educação*, *9*(2), 191–211. https://doi.org/10.1590/S1516-73132003000200004

Morando, A., Loguercio, R. Q., & Silva, A. F. (2018). Fêmea a mulher: a construção de um sujeito naturalizável. Revista Electrónica de Enseñanza de las Ciencias, 17(3), 522–539. http://reec.uvigo.es/volumenes/volumen17/REEC_17_3_1_ex1356.pdf

Neto, J. M., & Fracalanza, H. (2003). O livro didático de ciências: problemas e soluções. *Ciência & Educação*, *9*(2), 147–157. https://doi.org/10.1590/S1516-73132003000200001

Occelli, M., & Valeiras, N. (2013). Los libros de texto de ciencias como objeto de investigación: una revisión bibliográfica. *Revista Electrónica de Enseñanza de las Ciencias*, *31*(2), 133–152. https://raco.cat/index.php/Ensenanza/article/view/285774

Righetti, S., & Gamba, E. (12 de Março, 2021). *Na pós-graduação, mulheres são maioria entre estudantes, mas minoria entre docentes*. Folha de São Paulo. https://www1.folha.uol.com.br/educacao/2021/03/na-pos-graduacao-mulheres-sao-maioria-entre-estudantes-mas-minoria-entre-docentes.shtml

Santos, R. A., & Auler, D. (2019). Práticas educativas CTS: busca de uma participação social para além da avaliação de impactos da Ciência-Tecnologia na Sociedade. *Ciência & Educação*, *25*(2), 485–503. https://doi.org/10.1590/1516-731320190020013

Schiebinger, L. (2001). *O feminismo mudou a ciência?* EDUSC.

Staniscuaski, F., Zandonà, E., Reichert, F., Soletti, R. C., Oliveira, L., Ricachenevsky, F. K., Tamajusuku, A. S. K., Kmetzsch, L., Schwartz, I. V. D., Werneck, F. P., Ludwif, Z. M. C., Lima, E. F., Infanger, C., Neumann, A., Brandão, A., Wiggers, G. A., Seixas, A., & Mello-Carpes, P. B. (2021). Maternity in the Brazilian CV Lattes: when will it become a reality? *Anais da Academia Brasileira de Ciências*, *93*(1), 1–4. https://doi.org/10.1590/0001-3765202120201370

Silva, T. T. (2005). *Documentos de identidade: uma introdução* às *teorias do currículo*. Autêntica.

Velho, L., & León, E. (1998). A construção social da produção científica por mulheres. *Cadernos Pagu*, (10), 309–344. https://periodicos.sbu.unicamp.br/ojs/index.php/cadpagu/article/view/4631474

Velho, L. (2006). Prefácio. In L. W. Santos, E. Y. Ichikawa, & D. F. Cargano (orgs.), *Ciência, Tecnologia e Gênero: desvelando o feminino na construção do conhecimento* (pp. xiii-xviii). IAPAR.

Vidor, C. de B. (2021). *A constituição performativa de identidades na pesquisa em ensino de física: uma perspectiva pós-estruturalista a partir da filosofia política feminista de Judith Butler* (Tese de Doutorado, Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul). Repositório Digital — LUME. https://lume.ufrgs.br/handle/10183/232844

Weiss, E. (2005). Hermenéutica crítica, uma reflexión metodológica, sociológica y epistemológica. *Paideia: revista de la UPN*, 1(1), 7–15.

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Disclosure statement

No potential conflict of interest was reported by the authors.

Compliance with Ethical Standards

The authors declare this study was conducted following ethical principles.