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ABSTRACT

Science education in Brazil faces the persistent challenge of meaningfully integrating the History of Science (HOS), particularly regarding the representation of the diversity of actors involved in the production of scientific knowledge. In this context, textbooks play a central role in shaping students' perceptions of the nature of science and its protagonists. This study analyzed the frequency and forms of representation of scientists in seven high school Physics textbook collections approved in the Brazilian National Textbook Program (PNLD) for the 2026–2029 cycle. The investigation combined a quantitative approach, based on counting mentions of scientists, with a qualitative analysis of how these figures are presented in the didactic materials. The results indicate a marked gender asymmetry, with a predominance of male scientists and a significantly reduced presence of women. A limited representation of Latin American women scientists was also observed, suggesting a double invisibility related both to gender and regional origin. Beyond the quantitative disparity, many women scientists appear only in brief biographical references or marginal mentions, without deeper integration into the conceptual explanations of physics presented in the textbooks. These findings indicate that textbooks still reproduce a predominantly male and limited narrative of scientific development. Considering the role of basic education in shaping scientific trajectories, expanding the diversity of references present in educational materials may contribute to strengthening scientific education and, more broadly, to supporting the consolidation of scientific and technological capacities relevant to regional development.

Keywords: Textbook; Regional Development; History of Science; Gender; Women in Science.

RESUMO

O ensino de Ciências no Brasil enfrenta o desafio persistente de integrar a História da Ciência (HC) de forma significativa, especialmente no que se refere à representação da diversidade de atores envolvidos na produção do conhecimento científico. Nesse contexto, os livros didáticos desempenham papel central na construção das percepções dos estudantes sobre a natureza da ciência e seus protagonistas. Este estudo analisou a frequência e as formas de representação de cientistas em sete coleções de livros didáticos de Física do Ensino Médio aprovadas no PNLD 2026–2029. A investigação combinou abordagem quantitativa, baseada na contagem de menções a cientistas, e análise qualitativa das formas de apresentação dessas personagens nos materiais didáticos. Os resultados indicam uma acentuada assimetria de gênero, com predominância de cientistas homens e presença significativamente reduzida de mulheres. Observou-se também uma representação limitada de cientistas latino-americanas, sugerindo uma dupla invisibilidade relacionada tanto ao gênero quanto à origem regional. Além da diferença quantitativa, muitas cientistas aparecem em menções pontuais ou biográficas, sem integração mais profunda às explicações conceituais da física. Esses resultados indicam que os livros didáticos ainda reproduzem uma narrativa científica predominantemente masculina e pouco diversa. Considerando o papel da educação básica na formação de trajetórias científicas, ampliar a diversidade de referências presentes nos materiais didáticos pode contribuir para fortalecer a formação científica e, em perspectiva mais ampla, favorecer a consolidação de capacidades científicas e tecnológicas relevantes para o desenvolvimento regional.

Palabra-chave: Livro Didático; Desenvolvimento regional; História da Ciência; Gênero; Mulheres na Ciência

INTRODUCTION

The underrepresentation of women in the production, development, and dissemination of scientific knowledge has emerged as a topic of growing interest within the academic community (Silva & Ribeiro, 2014; Grossi, Borja, & Lopes, 2016).

This gap has motivated numerous research groups to investigate both the historical participation of women in science and the persistent barriers they face in academic and scientific environments. Although the present study focuses on the Brazilian context, issues related to the visibility of women in science and scientific education at the basic education level resonate with broader discussions taking place across Latin American countries (Fernandes, 2018; Ibarra, 2021).

It is undeniable that socially constructed perceptions continue to undervalue women's intellectual abilities and professional competence, particularly in fields traditionally associated with men, such as the physical sciences and engineering (Cunha, 2021). Such distorted perceptions are manifested and reinforced in multiple social settings, including schools, universities, and, notably, educational textbooks (Amorim, 2017).

According to Ponte et al. (2025), the period of basic education plays a crucial role in human development, as it is during this stage that children and adolescents internalize the models and

concepts reproduced by society. In this context, schools constitute a strategic environment for fostering a positive sense of identity among girls by encouraging them to recognize themselves as equally capable as boys of pursuing any professional career or field of knowledge. Textbooks, as one of the main pedagogical resources available to teachers, exert considerable influence on this process of identity formation and perception.

Beyond the issue of gender, the way science is portrayed in educational materials also shapes students' perceptions of where scientific knowledge is produced and who is responsible for its production. When scientific narratives are predominantly centered on researchers from specific historical and geographical contexts, other scientific trajectories—particularly those associated with peripheral regions of the global scientific system, such as Latin America—tend to remain less visible. This may influence how students perceive their own potential to participate in scientific research, with possible implications for local technological production and, consequently, regional development.

History of Science (HS) represents a powerful pedagogical tool for addressing this imbalance by enabling the reconstruction of narratives that recover the contributions of women scientists throughout history. By incorporating the life stories and scientific achievements of these pioneers into science teaching, educators can challenge the traditionally masculine image of science and foster greater identification between female students and scientific practice (Oliveira, 2019).

In this regard, examining the representation of women in science within educational materials also contributes to broader discussions concerning knowledge production, scientific education, and development in Latin America. By analyzing how textbooks portray the protagonists of science, it becomes possible to reflect on the symbolic references that shape the education of future generations of scientists and, consequently, on the social foundations of scientific production across different regions. Against this background, the present study was guided by the following research question: What is the level of representation of women scientists in high school Natural Sciences textbooks? Accordingly, the objective of this study was to quantify references to women scientists in comparison with those made to their male counterparts in the analyzed textbooks, while also promoting the visibility of the History of Science and encouraging reflection on the importance of a more diverse representation of science in educational processes that support scientific and technological development across different regions.

THEORETICAL FRAMEWORK

Understanding the History of Science (HS) and the Nature of Science (NOS) is essential for comprehensive and meaningful science education. Far from being merely an accumulation of facts and formulas, science is a dynamic human endeavor shaped by social, cultural, and historical contexts. Recognizing this complexity is fundamental to educating critical and engaged citizens who are capable of understanding the role of science in contemporary society.

According to Moura (2014), the Nature of Science (NOS) encompasses the set of elements related to the construction, establishment, and organization of scientific knowledge. These elements include both internal aspects, such as the scientific method and the relationship between theory and experimentation, and external factors, including the influence of social, cultural, religious, and political contexts on the acceptance or rejection of scientific ideas.

The integration of the History of Science (HS) into science education has been widely advocated as an effective means of promoting a deeper understanding of science (Matthews, 1995; Guerra, 2025).

Matthews (1995) argued that science education should not merely constitute training in science but should also promote learning about science. He emphasized that the History of Science possesses intrinsic educational value because it enables students to become familiar with significant episodes in the history of science and culture, such as the Scientific Revolution and Darwinism. Furthermore, the History of Science humanizes science by examining the lives and historical contexts of scientists, presenting them as real people whose work was shaped by the societies in which they lived.

Guerra (2025) reinforces this perspective by arguing that the History of Science can make science classes more intellectually stimulating and reflective, thereby fostering critical thinking and promoting a more comprehensive understanding of scientific knowledge.

According to Matthews (1995), the History of Science is also fundamental to teacher education, contributing to the development of a richer and more authentic epistemological understanding of science. As early as 1990, João Zanetic argued that physics should be understood as a social institution that has undergone profound transformations while simultaneously influencing multiple dimensions of social life, highlighting the socioeconomic and cultural role of science (Guerra, 2025).

It is important to emphasize that there is no single History of Science. Different historiographical perspectives, together with the questions they seek to answer, produce distinct narratives about the same historical episode. This plurality is essential for challenging the stereotypical and idealized image of science and scientists (Guerra, 2025).

According to Almerindo et al. (2020), a comprehensive approach to the History of Science reveals the need to confront the persistent underrepresentation and lack of recognition of women in science, a challenge that extends from Antiquity to the present day. Historically, women's contributions have frequently been silenced or minimized, while science has traditionally been portrayed as a predominantly masculine endeavor, as illustrated by studies employing the Draw-A-Scientist Test (DAST). This projective instrument is used to investigate how children and adolescents perceive the stereotypical image of a scientist.

Recognizing scientists such as Marie Curie, who despite her remarkable discoveries faced significant barriers, as well as Brazilian pioneers such as Nise da Silveira, Ruth Nussenzweig, and Celina Turchi, is essential for portraying science as a genuinely diverse and human enterprise (Almerindo et al., 2020). Such visibility not only helps correct historical injustices but also serves as an important source of inspiration, particularly for girls. By incorporating the history of women in science into science education, teaching contributes directly to fostering a more authentic understanding of the Nature of Science, in which diversity and inclusion are recognized as elements that enrich the construction of scientific knowledge.

Furthermore, increasing women's participation in science can also be understood in light of contemporary transformations in the relationships among science, education, and development. Studies on innovation and regional development indicate that universities have assumed an expanded role in contemporary societies, acting not only as producers of knowledge but also as institutions responsible for educating qualified human resources and fostering innovation and regional development processes (Monteiro et al., 2019). Within this context, scientific education beginning in basic education constitutes a fundamental stage in the development of academic trajectories that later consolidate within higher education institutions. Consequently, promoting a more diverse representation of science in educational materials may strengthen students' identification with scientific and technological careers, particularly among girls, thereby encouraging women's participation in knowledge production and, in the long term, reinforcing the scientific and technological capacities of different regions.

Brazil's National Common Curricular Base (BNCC) recognizes the importance of both the History of Science and the Nature of Science in scientific education by establishing that science teaching should extend beyond the transmission of concepts and formulas, promoting an understanding of science as a historically situated and socially constructed human endeavor. Within the area of Natural Sciences and Their Technologies, which integrates Biology, Physics, and Chemistry, the BNCC emphasizes the social, cultural, environmental, and historical contextualization of scientific knowledge and encourages the analysis of interactions among Science, Technology, Society, and the Environment (STSE). This approach promotes a broader understanding of science and its role in society. The document also highlights that school science education influences students' educational trajectories and their perceptions of scientific practice, thereby fostering greater interest in scientific and technological fields. In this context, the way science is represented in educational materials becomes particularly relevant, especially within the framework of the Brazilian National Textbook and Teaching Materials Program (PNLD), the country's principal public policy for the evaluation and distribution of school textbooks. Through its implementation, the PNLD contributes to incorporating historical contextualization into science education, promoting a more critical understanding of science, supporting the education of qualified human resources, and, more broadly, strengthening scientific and technological development (Brazil, 2018).

METHODOLOGY

The 2026 edition of the Brazilian National Textbook and Teaching Materials Program (PNLD) for high school Physics approved a total of nine textbook collections.

According to Call for Proposals No. 02/2024, which governs the PNLD for High School (2026–2029), the approval of Physics textbooks was based on the following criteria:

1. Pedagogical and Content Criteria

- - **Alignment with the BNCC**: The textbook must be fully aligned with the competencies and learning objectives established by Brazil's National Common Curricular Base (BNCC) for the Natural Sciences area.
- - **Conceptual Approach**: Physics concepts, laws, and theories must be presented accurately, within appropriate contexts, and in accordance with current scientific knowledge, avoiding the mere memorization of formulas without conceptual understanding.

• - **Contextualization**: The textbook should avoid relying exclusively on idealized situations. It must explicitly address the conditions and limitations of the physical models presented and clearly distinguish examples drawn from science fiction whenever such examples are used.

• - **Critical Thinking and Scientific Inquiry**: The textbook should encourage scientific investigation, hypothesis formulation, evidence-based argumentation, and the development of scientific reasoning and critical thinking.

2. Methodological Criteria

• - **Learning Activities**: The textbook should include a variety of learning activities, such as experiments, debates, research tasks, and problem-solving exercises, designed to promote students' active participation.

• - **Interdisciplinarity**: The textbook is expected to establish connections between Physics and other disciplines, including Biology, Chemistry, and Mathematics, as well as with Brazil's Contemporary Cross-Curricular Themes (TCTs), such as environmental education, consumer education, and technology.

• - **Assessment**: The Teacher's Guide must provide clear guidance on student assessment processes, going beyond the simple evaluation of memorization.

3. Ethical and Citizenship Criteria

• - **Respect for Diversity**: The textbook must promote respect for diversity in all its forms, including cultural, ethnic, and gender diversity, and discourage all forms of prejudice and discrimination.

• - **Worldview**: The textbook should promote a worldview grounded in science, ethics, and citizenship, encouraging students to understand society and participate in it responsibly.

4. Editorial and Accessibility Criteria

• - **Graphic Quality**: The graphic design, including layout, illustrations, and infographics, must be clear, functional, and visually appealing, facilitating students' understanding of the content.

• - **Digital Resources**: Textbooks must be accompanied by digital resources (HTML5 or EPUB format) that complement the printed material, including videos, simulations, podcasts, and interactive infographics.

The inclusion criterion (IC) required that the textbook be exclusively dedicated to Physics, whereas the exclusion criteria (EC) eliminated textbooks devoted solely to interdisciplinary projects or to Natural Sciences as a whole rather than exclusively to Physics. After applying the inclusion and exclusion criteria, two textbooks were excluded, resulting in a final sample of seven textbooks. Information regarding the textbooks selected for analysis, including their titles and publishers, is presented in Table 1.

Table 1 | Physics Textbooks Included in the Study

IDENT.	TITLE	PUBLISHER
ID 1	MODERNA PLUS	MODERNA
ID 2	FÍSICA POR TODA PARTE	FTD
ID 3	IDENTIDADE	SARAIVA
ID 4	MODERNA SUPERAÇÃO	MODERNA
ID 5	DO SEU JEITO	ÁTICA
ID 6	CIÊNCIA VIVA	SCIPIONE
ID 7	FÍSICA 360º	FTD

Source: Prepared by the authors.

The methodological procedures were organized into four stages: (1) selection of the Physics textbooks included in the study; (2) identification of both women and men scientists mentioned in the textbooks; (3) identification of each woman scientist and the textbook chapter in which she is mentioned; and (4) analysis of the collected data. The search for women and men scientists was conducted by examining both the textual content and the illustrations contained in the selected textbooks.

The results were analyzed using both quantitative and qualitative approaches. The quantitative analysis consisted of tabulating the frequency with which women and men scientists were identified, with the findings presented in tables and graphs. The qualitative analysis involved describing the women scientists identified in the textbooks, characterizing both the women represented and their respective fields of expertise.

RESULTS AND DISCUSSION

The findings obtained from the analysis of the seven textbooks regarding the representation of the History of Science (HS) through references to women and men scientists are presented in Table 2, Figure 1, and in the qualitative descriptions of the women scientists identified in the textbooks, provided in Tables 3, 4, 5, 6, and 7.

Table 2 | Frequency of Scientists Identified in the Physics Textbooks

TEXTBOOK	MEN SCIENTISTS (HS REFERENCES)	WOMEN SCIENTISTS (HS REFERENCES)
ID 1	35	3
ID 2	82	13
ID 3	70	8
ID 4	77	2
ID 5	46	13
ID 6	50	7
ID 7	85	4

Source: Prepared by the authors.

The data analysis reveals a pronounced gender disparity in the historical representation of science within the textbooks analyzed. Of the 495 references to scientists identified across the seven textbooks, 445 refer to men, whereas only 50 refer to women. This corresponds to an overall ratio of 8.9 references to men for every reference to a woman scientist, indicating that women account for only 10.1% of all scientists mentioned.

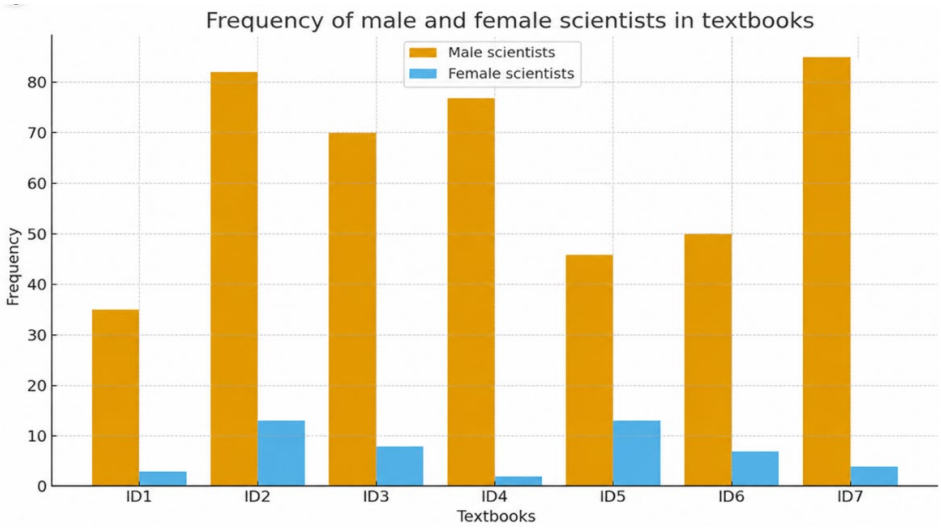


Figure 1. *Gender Distribution of Scientists Represented in the Physics Textbooks*

The disparity in representation is consistent across all seven textbooks, although the magnitude of the difference varies considerably.

Greatest disparity: Textbook ID4 exhibits the largest imbalance, with 77 references to men and only 2 references to women, corresponding to a ratio of 38.5:1. This textbook also presents the lowest proportional representation of women scientists (2.53%).

Smallest disparity: Textbook ID5 shows the smallest imbalance, with 46 references to men and 13 references to women, resulting in a ratio of 3.54:1. Consequently, this textbook has the highest proportional representation of women scientists (22.03%).

The predominance of male figures in the presentation of the History of Science (HS) suggests a distorted and incomplete portrayal of both the History of Science and the Nature of Science (NOS), perpetuating the invisibility of women's contributions. On average, the textbooks contain 63.57 references to men scientists per book, compared with only 7.14 references to women scientists.

The findings demonstrate that women scientists remain significantly underrepresented in the textbooks analyzed. Although the primary objective of this study is to identify this disparity in representation, its implications extend to broader educational and social contexts. Educational research suggests that the symbolic references embedded in educational materials influence how students perceive different fields of knowledge and the professional careers associated with them.

In this context, the limited visibility of women in the history of science may reduce students' identification, particularly that of girls, with scientific and technological careers. Considering that the development of qualified human resources in science and technology is fundamental to innovation and scientific production, this dynamic may also have broader implications for the scientific and technological capacities of different regions.

The qualitative analysis of references to women scientists in the textbooks is presented by disciplinary area in Tables 3, 4, 5, 6, and 7.

Table 3 | Women Scientists – Astronomy

Woman Scientist	Description of Contribution	References (Textbook and Pages)
Annie Jump Cannon	**Astronomy.** Developed the stellar classification system.	ID 2 (p. 19)
Caroline Herschel	**Astronomy.** Discovered numerous galaxies, nebulae, stars, and a comet.	ID 2 (p. 116)
Henrietta Swan Leavitt	Proposed a method for calculating stellar distances that was fundamental to the early evidence supporting the expansion of the Universe. Her principal contribution was establishing the relationship between a star's apparent brightness and its distance from Earth.	ID 5 (p. 314, 315, 316, 317)
Nancy Grace Roman	First woman to lead NASA's Astronomy Division and regarded as the driving force behind the Hubble Space Telescope.	ID 5 (p. 308)
Samantha Cristoforetti	Astronaut with the European Space Agency aboard the International Space Station (2022).	ID 1 (p. 104)

Table 3 highlights the contributions of five remarkable women in the field of Astronomy. Annie Jump Cannon is recognized for developing the stellar classification system that organizes stars according to their characteristics. Caroline Herschel is noted for her discovery of numerous galaxies, nebulae, stars, and a comet, establishing herself as a pioneering figure in astronomical observation. Henrietta Swan Leavitt developed a fundamental method for calculating stellar distances, which played a crucial role in advancing the understanding of the expansion of the Universe. Nancy Grace Roman was the first woman to lead NASA's Astronomy Division and is widely regarded as the driving force behind the Hubble Space Telescope. Finally, Samantha Cristoforetti is presented as an astronaut with the European Space Agency (ESA). Among the scientists listed in this table, Henrietta Swan Leavitt is the most frequently referenced, appearing on four different pages of Textbook ID5.

Table 4 | Women Scientists – Chemistry

Woman Scientist	Description of Contribution	References (Textbook and Pages)
Cecilia Payne	Discovered the chemical composition and physical state of stars.	ID 5 (p. 316, 522)
Cecília Helena Rayne-Gaposchkin	Chemist, botanist, and astronomer. A central figure in advancing the understanding of the internal dynamics of stars.	ID 3 (p. 184)
Irène Joliot-Curie	**Chemistry.** Together with her husband, she discovered a method for producing artificial radioactivity, a breakthrough that earned the couple the **1935 Nobel Prize in Chemistry**.	ID 4 (p. 342)
Jane Haldimand Marcet	**Chemistry.** Author of *Conversations on Chemistry*, which helped popularize scientific knowledge and consolidate the concept of caloric. She was also a pioneer in advocating women's access to scientific education during the nineteenth century.	ID 5 (p. 181,182)
Rosalind Elsie Franklin	**Chemistry.** Developed the technique that enabled the determination of the molecular structure of DNA and RNA.	ID 3 (p. 279)

Table 4 presents five women scientists whose contributions have significantly advanced Chemistry and related fields. Cecilia Payne-Gaposchkin is recognized for discovering the chemical composition and physical state of stars, becoming a central figure in understanding the internal dynamics of these celestial bodies. In collaboration with her husband, Irène Joliot-Curie was responsible for the discovery of artificial radioactivity, an achievement that earned the couple the 1935 Nobel Prize in Chemistry. Jane Haldimand Marcet gained prominence through her book Conversations on Chemistry, which helped popularize scientific knowledge and consolidate the concept of caloric. She was also a pioneer in advocating women's access to science during the nineteenth century. Rosalind Elsie Franklin is recognized for developing the technique that proved essential for determining the molecular structure of DNA and RNA. Among the scientists presented in this table, Cecilia Payne-Gaposchkin is the most frequently referenced, appearing on two pages of Textbook ID5.

Table 5 | Women Scientists – Physics

Woman Scientist	Description of Contribution	References (Textbook and Pages)
Anne L'Huillier	**Physics.** Awarded the **2023 Nobel Prize in Physics**.	ID 3 (p. 15)
Carla Carvalho	Professor and Ph.D. in Nuclear Physics. Conducts research on the radiocarbon dating of rock art.	ID 6 (p. 235)
Elisa Frota Pessoa	Graduated in Physics during the 1940s.	ID 6 (p. 16, 485)
Émilie Du Châtelet	**Mathematics and Physics.** Advocate for women's rights, particularly intellectual freedom. Made significant contributions to Mathematics and Physics, including work that advanced the understanding of the energy of motion.	ID 7 (pg. 8, 78, 118)
Ida Noddack	Physics and Chemistry.	ID 2 (p. 279)
Katherine Johnson	African American physicist and mathematician at NASA during the 1960s.	ID 5 (p. 317)
Lise Meitner	**Physics.** Together with other scientists, demonstrated through experimental research that nuclear fission was possible.	ID 2 (p. 279); ID 5 (p. 432, 433); ID 7 (p. 418)
Margaret Lindsay Huggins	**Astrophysics.** Together with her husband, pioneered the use of spectroscopy in astronomy.	ID 2 (p. 162)
Maria Telkes	**Biophysics.** Pioneer in solar energy research.	ID 2 (p. 160)
Marie Curie	**Physics.** Coined the term *radioactivity* and conducted pioneering investigations of the phenomenon. Awarded the **1903 Nobel Prize in Physics**. Co-discoverer of the chemical elements **polonium** and **radium**.	ID 1 (p. 345, 346, 362); ID 3 (p. 422, 435); ID 4 (p. 338); ID 5 (p. 428, 544); ID 6 (p. 227, 228, 229, 517, 518); ID 7 (p. 423)
Naomi Oreskes	Conducts research in geophysics and environmental issues, including global warming and the **History of Science (HS)**.	ID 5 (p. 199, 507)
Sarah Frances Whiting	**Physics and Astronomy.** Founder of the first undergraduate Physics laboratory for women in the United States.	ID 2 (p. 19)
Shirley Ann Jackson	**Physics.** First African American woman to earn a doctorate from the **Massachusetts Institute of Technology (MIT)**.	ID 3 (p. 415)

Sonja Ashauer	**Physics.** First Brazilian woman to earn a Ph.D. in Physics.	ID 2 (p. 19); ID 6 (p. 16)
Sônia Guimarães	Conducts research on semiconductors, focusing on improving the conversion of light energy into electrical energy and developing thinner and more efficient semiconductor materials.	ID 5 (p. 337, 526)
Vivian Miranda	Brazilian physicist and transgender cosmologist. Her research focuses on the formation and evolution of the Universe, particularly dark matter and dark energy.	ID 5 (p. 308)
Yolande Monteux	First woman to graduate in Physics in Brazil (University of São Paulo, 1937); pioneer in the study of cosmic rays.	ID 6 (p. 16)

Table 5 is the most comprehensive, presenting a broad range of women who made significant contributions to Physics. Among them are Anne L'Huillier, recipient of the 2023 Nobel Prize in Physics, and the Brazilian physicist Elisa Frota Pessoa, who graduated in Physics during the 1940s. The mathematician and physicist Émilie du Châtelet is recognized for her contributions to the understanding of the energy of motion, as well as for her advocacy of women's intellectual freedom. The table also includes Lise Meitner, whose work contributed to establishing the possibility of nuclear fission, and the iconic Marie Curie, a pioneer in radioactivity research and co-discoverer of the chemical elements polonium and radium. Among the scientists presented in this table, Marie Curie is the most frequently referenced, appearing in seven different textbooks and totaling ten citations.

Figure 2, the famous photograph of the Fifth Solvay Conference, held in Brussels in 1927, captures a defining moment in the history of quantum physics by bringing together twenty-nine of the era's most distinguished scientists, including Albert Einstein and Niels Bohr. At the center of this extraordinary gathering, the presence of Marie Curie is both unique and striking: she is the only woman in the photograph. As the only person to have received Nobel Prizes in two different scientific disciplines, Physics and Chemistry, her participation attests to her unparalleled status in the history of science. At the same time, her solitary presence in the photograph serves as a powerful symbol of the gender inequality that characterized the scientific community of the time, highlighting the exceptional nature of her achievements within a field overwhelmingly dominated by men and underscoring the historical struggle for the recognition of women's contributions to science.



Figure 2. The Fifth Solvay Conference (1927)

Table 6. | Women Scientists – Mathematics

Woman Scientist	Description of Contribution	References (Textbook and Pages)
Ada Lovelace	**Mathematics.** Widely regarded as the world's first computer programmer.	ID 2 (p. 377)
Dorothy Vaughan	Mathematics.	ID 3 (p. 35) e ID 5 (pg. 292, 317)
Grace Murray Hopper	**Mathematics.** Pioneer in the development of programming languages.	ID 2 (p. 377)
Hipátia de Alexandria	Philosopher and professor of Astronomy and Mathematics in fourth-century Alexandria.	ID 6 (p. 22)
Katherine Johnson	**Mathematics and Physics.** Worked at NASA and played a crucial role in the U.S. space program.	ID 3 (p. 35)
Katie Bouman	Developed the algorithm used to produce the first image of a black hole.	ID 6 (p. 153, 154, 506)
Maria Cunitz	**Mathematics and Astronomy.** Authored a book containing simplified and updated astronomical tables that contributed to the dissemination of Keplerian astronomy.	ID 2 (p. 42)
Mary Jackson	**Mathematics and Engineering.** African American aerospace engineer at NASA during the 1960s.	ID 3 (p. 35), ID 5 (p. 317)

Table 6 highlights women who made significant contributions to Mathematics, as well as to the fields of computer science and engineering. Ada Lovelace is widely regarded as the world's first computer programmer and a pioneering figure in the development of computing. Dorothy Vaughan and Katherine Johnson are presented as African American mathematicians who worked at NASA during the 1960s and played crucial roles in the U.S. space program. Grace Murray Hopper is recognized as a pioneer in the development of programming languages. Hypatia of Alexandria is identified as a philosopher and professor of Astronomy and Mathematics in the fourth century. The table also includes Katie Bouman, who developed the algorithm used to produce the first image of a black hole, and Mary Jackson, an African American aerospace engineer at NASA. Among the scientists presented in this table, Dorothy Vaughan and Mary Jackson are the most frequently referenced, each appearing on two pages of Textbook ID5 and one page of Textbook ID3.

Table 7 | Women Scientists – Other Fields

Woman Scientist	Description of Contribution	References (Textbook and Pages)
Annie Jump Cannon	Catalogued approximately **250,000 stars** and developed the first stellar classification system based on stellar temperature.	ID 5 (p. 316)
Gladys West	Led the development of the **Global Positioning System (GPS)** during the 1980s.	ID 1 (p. 338, 339)
Hedy Lamarr	Actress and inventor. Developed a communication device designed to interfere with Nazi radar systems, laying the foundation for frequency-hopping technology.	ID 2 (p. 155)
Inge Lehmann	**Geodesy and Seismology.** Demonstrated that the Earth's interior consists of a solid inner core surrounded by a liquid outer core.	ID 2 (p. 90)
Rebecca Gowland	**Bioarchaeology.** Co-author of a study that revealed the harsh working conditions endured by child laborers in nineteenth-century England.	ID 7 (p. 167)

Table 7 groups women scientists from a variety of disciplines, including Engineering, Geodesy, and Bioarchaeology. Gladys West is recognized for her leading role in the development of the Global Positioning System (GPS) during the 1980s. Hedy Lamarr, an actress and inventor, is remembered for developing a communication device designed to interfere with Nazi radar systems, a technological innovation that later became the foundation for frequency-hopping technology. Inge Lehmann, a geodesist and seismologist, demonstrated that the Earth's interior consists of a solid inner core surrounded by a liquid outer core. Finally, Rebecca Gowland, a bioarchaeologist, is cited for her research revealing the working conditions of child laborers in nineteenth-century England. Among the scientists presented in this table, Gladys West is the most frequently referenced, appearing on two pages of Textbook ID1.

It is also noteworthy that, among the relatively small number of women scientists represented in the textbooks, only a limited number are Latin American researchers. This finding suggests that the invisibility of women in the history of science presented in these educational materials is accompanied by a similarly limited regional representation.

This asymmetry extends beyond symbolic representation and may also influence the scientific references available to students during basic education. Since textbooks constitute one of the primary means through which scientific knowledge is mediated in schools, the predominance of male figures in the history of science tends to reinforce the perception of scientific activity as predominantly male. Such a pattern may reduce students' identification, particularly that of girls, with academic pathways in science. More broadly, this limited diversity of scientific role models may affect the development of qualified human resources in science and technology, a factor frequently associated with strengthening the scientific and technological capacities that underpin innovation and regional development.

Across Latin America, a variety of public policies have been implemented to address gender inequalities in science and the highly qualified workforce. In Brazil, initiatives such as the Girls and Women in Exact Sciences, Engineering, and Computing Program, funded by the National Council for Scientific and Technological Development (CNPq) (Brazil, 2023), seek to encourage students' interest in scientific careers from the earliest stages of formal education. In Chile, the National Policy for Gender Equality in Science, Technology, Knowledge, and Innovation (Chile, 2024) establishes institutional

guidelines aimed at reducing gender inequalities within the national scientific system. Similarly, in Argentina, policies coordinated by the Ministry of Women, Gender and Diversity have sought to expand women's participation in scientific and technological fields (Argentina, 2020). Complementing these initiatives, regulatory instruments such as the Mexican Standard NMX-R-025-SCFI-2015 on Equality in the Workplace and Non-Discrimination (Mexico, 2015) seek to promote institutional changes in the workplace by fostering equal opportunities and organizational recognition of inclusive practices.

Within the Brazilian context, educational policies also play an important role in this process. The Brazilian National Textbook and Teaching Materials Program (PNLD), responsible for evaluating and distributing textbooks for basic education, establishes pedagogical and social criteria that guide textbook production, including principles related to diversity and non-discrimination. At the same time, broader science policy initiatives, such as the National Strategy for Science, Technology, and Innovation (ENCTI), emphasize the need to expand the education of qualified human resources and reduce gender inequalities within the scientific system. Consequently, the way scientists are represented in school textbooks may influence students' career expectations, processes of scientific socialization, and ultimately the development of the human capital necessary for scientific and technological advancement.

The findings indicate that the observed gender inequality is reflected not only in the number of references to scientists but also in the way these individuals are portrayed in the textbooks. Whereas male scientists are frequently presented as the authors of theories, laws, or models that structure the conceptual content of Physics, many of the women identified in the analysis appear only in brief biographical notes or supplementary sections of the textbooks.

In many cases, these women scientists are associated with specific historical episodes or illustrative narratives, without their contributions being fully integrated into the explanation of the physical concepts discussed throughout the chapters. This pattern suggests that, beyond their limited numerical representation, women tend to be portrayed as exceptional or peripheral figures rather than as integral contributors to the historical development of science. Such a portrayal may reinforce the perception of scientific activity as predominantly male instead of highlighting women's participation as an essential component of scientific progress.

Within this context, recent examples of scientific recognition are particularly significant. One such example is the 2023 Nobel Prize in Physics, awarded to the French physicist Anne L'Huillier, together with Ferenc Krausz and Pierre Agostini, for their pioneering research on electronic phenomena occurring on the attosecond timescale. The textbook notes that L'Huillier is only the fifth woman to have received the Nobel Prize in Physics since the award was established, underscoring the persistent gender imbalance in the scientific community. This fact not only illustrates the underrepresentation of women in one of the highest forms of international scientific recognition but also highlights the long path that remains before women scientists are perceived as a regular, rather than exceptional, part of the history of physics. Nevertheless, the textbook does not provide a more detailed discussion of the scientific significance of L'Huillier's contribution to the advancement of the field.

CONCLUSION

The findings of this study reveal a pronounced gender imbalance in the representation of scientists in the Physics textbooks approved under the 2026–2029 Brazilian National Textbook and Teaching Materials Program (PNLD). The quantitative analysis demonstrated a substantially greater presence of men scientists than women scientists, while the qualitative analysis showed that, even when women are included, they are frequently presented only in brief biographical notes or isolated references, without their contributions being integrated into the core conceptual development of the Physics topics addressed in the textbooks. These findings suggest that the scientific narrative conveyed by these educational materials continues to reproduce a predominantly male image of scientific activity.

The analysis also revealed that, among the relatively small number of women scientists represented, Latin American researchers are even less visible. This finding indicates that the observed inequality extends beyond gender, encompassing a limited regional representation within the history of science portrayed in the textbooks. Such a pattern may restrict the range of scientific role models available to students, particularly within the Latin American context, where recognizing regional scientific achievements is an important element in strengthening scientific and academic identities.

Taken together, these findings are consistent with the phenomenon known as the Matilda Effect, described by Margaret W. Rossiter, which refers to the systematic under recognition of women's contributions to science. Within the educational context, the limited visibility of women scientists identified in the textbooks may contribute to the persistence of stereotypes regarding who produces scientific knowledge. Given the central role of science education in basic education in developing future human resources in science and technology, increasing the diversity of scientific references presented in textbooks, including women scientists and researchers from different regions, may represent an important step toward strengthening scientific education and, more broadly, promoting scientific and technological development across diverse regional contexts.

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