

Visual Culture and Cultural History of Science: Possibilities for Studying the Human Body Through Images in Science Education

Cultura Visual e História Cultural da Ciência: Possibilidades Para o Estudo do Corpo Humano Através do Uso de Imagens no Ensino de Ciências
Cultura Visual e Historia Cultural de la Ciencia: Posibilidades de Estudio del Cuerpo Humano a Través del Uso de Imágenes en la Educación Científica

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Abstract

The human body is an important subject in the science and biology curriculum; however, research indicates that students lack identification with the bodies presented in teaching materials. In addition to biological issues, the human body must be understood as a social, historical and cultural construct, subject to normative discourses. Based on the above, our research was developed with the aim of building support to discuss how the development of the study of the human body in the 16th and 17th centuries privileged bodies to be studied and representations that point to a universal body. The historical research was developed under the historiographical lens of the Cultural History of Science with the objective of analyzing the scientific practices and visual culture involved in the study of the human body in the defined period. The dissection of human bodies and the production of images in anatomy treatises were the scientific practices analyzed, highlighting the predominance of the representation of the male/European body and the limitations in the representation of diverse bodies. Finally, we highlight the role of images in the construction of scientific knowledge about the human body and its relevance for science education, pointing to the need for a more critical and diversified representation of the human body in educational materials, in order to promote an education more inclusive and reflective.

Keywords: Science Teaching, human body, cultural history of science, visual culture, images

Resumo

O corpo humano é um tema importante no currículo de ciências e biologia, no entanto, pesquisas apontam a falta de identificação dos estudantes com os corpos apresentados nos materiais didáticos. Além das questões biológicas, o corpo humano deve ser entendido como um constructo social, histórico e cultural, sujeito a discursos de normatividade. A partir do que foi exposto, nossa pesquisa foi desenvolvida com objetivo de construir subsídios para discutir como o desenvolvimento do estudo do corpo humano no século XVI e XVII privilegiou corpos a serem estudados e representações que apontam para um corpo universal. A pesquisa histórica foi desenvolvida sob a lente historiográfica da História Cultural da Ciência com objetivo de analisar as práticas científicas e a cultura visual envolvidas no estudo do corpo humano no período delimitado. A dissecação de corpos humanos e a produção de imagens nos tratados de anatomia foram as práticas científicas analisadas, evidenciando a predominância da representação do corpo masculino/europeu e as limitações na representação de corpos diversos.

Por fim, destacamos o papel das imagens na construção do conhecimento científico sobre o corpo humano e sua relevância para a educação em ciências, apontando para a necessidade de uma representação mais crítica e diversificada do corpo humano nos materiais educacionais, a fim de promover uma educação mais inclusiva e reflexiva.

Palavras-chave: Ensino de Ciências, corpo humano, história cultural da ciência, cultura visual, imagens

Resumen

El cuerpo humano es un tema importante en el currículo de ciencias y biología, sin embargo, las investigaciones indican que los estudiantes carecen de identificación con los cuerpos presentados en los materiales didácticos. Además de las cuestiones biológicas, el cuerpo humano debe entenderse como una construcción social, histórica y cultural, sujeta a discursos normativos. Con base en lo anterior, nuestra investigación se desarrolló con el objetivo de generar apoyos para discutir cómo el desarrollo del estudio del cuerpo humano en los siglos XVI y XVII privilegió el estudio de cuerpos y representaciones que apuntaban a un cuerpo universal. La investigación histórica se desarrolló bajo el lente historiográfico de la Historia Cultural de la Ciencia con el objetivo de analizar las prácticas científicas y la cultura visual involucradas en el estudio del cuerpo humano en el período definido. La disección de cuerpos humanos y la producción de imágenes en tratados de anatomía fueron las prácticas científicas analizadas, destacando el predominio de la representación del cuerpo masculino/europeo y las limitaciones en la representación de cuerpos diversos. Finalmente, destacamos el papel de las imágenes en la construcción del conocimiento científico sobre el cuerpo humano y su relevancia para la educación científica, apuntando a la necesidad de una representación más crítica y diversificada del cuerpo humano en los materiales educativos, con el fin de promover una educación más inclusivo y reflexivo.

Palabras clave: Enseñanza de las Ciencias, cuerpo humano, historia cultural de la ciencia, cultura visual, imágenes

Introduction

The theme of the human body has a consolidated place in the curricula of Science and Biology, being in these subjects' curricular proposals at different times with different perspectives and treatments (Moraes & Guzzetti, 2016; Ribeiro & Silva, 2019; Silva, 2005; Viannay & Selles, 2016). Although it arouses students' interest in Science and Biology classes, the literature indicates problems when the topic is taught; one of the reasons is that students do not relate to the human body presented to them. Research results suggest that students study the human body through texts and images with which they do not identify and, therefore, have difficulties in recognizing the body studied as equal to their own (Macedo, 2005; Trivelato, 2005; Vilela & Selles, 2015).

The body is the first place of our identity, establishing the boundaries that define who we are (Goellner, 2013). Biology as a subject and, by extension, science are school spaces that, through the teaching of the human body, describe and produce what bodies are or should be like. In these disciplines, the human body is generally presented only in its anatomical and physiological aspects, defined by its organs and functions, as a kind

of universal body (Trivelato, 2005; Vilela & Selles, 2015). The legitimacy of the body presented is given through the scientific discourse and, thus, through the processes of transmission of the notions of the biological body of the sciences of origin, marked by the production of the universal “truth” of science, which does not mobilize the sociocultural aspects, emotions, and affections to which the body is exposed in its construction and development (Santos & Silva, 2019).

However, following Goellner (2013), we understand that the body is a social, historical, and cultural construct and cannot be defined only by its anatomical and physiological structures. In this sense, the body is also constructed by language, which has the power to name it, classify it, define normalities/abnormalities, and is subject to normative regimes (Goellner, 2013).

This statement dialogues with Elizabeth Macedo (2005), when the author highlights that bodies are presented in textbooks and Science/Biology classes as objects manipulated by scientists and something external to the subjects who manipulate them, thus being removed from the cultural spaces they occupy. For Vilela and Selles (2015), the fragmentation of the human body in teaching accompanies mechanistic and simplified approaches to physiological processes, operating with reductionist analogies. With this, a scientific discourse is produced about an idealized body, which does not coincide with the “real” bodies of the students, making them not recognize that body studied as their body. This fragmented teaching represents separate parts of the body in boards and schemes, deepening the understanding of the body in parts and thus compromising the construction of an integrated notion about its functioning (Trivelato, 2005; Vilela & Selles, 2015).

In addition, other aspects of the approach to the human body generate this non-recognition. For example, in the images of human bodies present in textbooks, we find a model body, usually white and male, which ignores and makes the different existing bodies invisible, such as black bodies, bodies that do not fit into the binary of sex, gender or sexuality, fat bodies, or people with disabilities.

These considerations dialogue with Viannay and Selles (2016), whose research points out that reducing the study of the human body to anatomical and physiological perspectives implies ignoring the tremendous social and cultural importance of the human body in the students’ lives, especially teenagers. Teenagers who are going through significant transformations in their bodies do not recognize themselves in front of the perfect bodies represented in these books. The issue related to body recognition is also discussed by Lucy Avraamidou (2019) when the author, analyzing processes of marginalization and non-recognition, proposes that such processes turn the difference into a bodily experience, in which students perceive their bodies as unacceptable to others in specific places.

We claim, supported by Avraamidou (2019) and Carlone and Johnson (2007), that recognition and self-recognition are central dimensions of identity that impact the development of scientific identity. Thus, the underrepresentation of bodies in Biology

and Science classes and teaching materials can lead students to find it difficult to recognize the human body presented to them as equal to their body. In the case they do not recognize that scientific knowledge is produced for and about them, they may not see themselves as capable of dialoguing and questioning the scientific knowledge presented to them. It is because they do not recognize that knowledge as belonging to their culture (Carlone & Johnson, 2007).

We also understand that the school is one of the spaces in which the identity of students is constructed (Louro, 2014), but it also constitutes a space in which differences and socially constructed conceptions can be problematized. Thus, it is crucial to bring to Science classes discussions about the human body that raise problematizations of the idealized bodies commonly presented to students. One way to do so is the historical discussion of how the representations of anatomical and physiological aspects were established as representations of a universal body. In this way, students can understand that the representation of the human body found in textbooks is the result of a construction permeated by power relations, choices, and erasures. In this sense, we agree with Yuri Jorge Almeida da Silva (2018) when the author states that it is necessary to discuss how Biology and culture produce the human body as the teaching process also produces and leads individuals.

From what has been exposed, we conducted the research intending to build subsidies to discuss how the development of the study of the human body in the sixteenth and seventeenth centuries privileged bodies and representations that point to a universal body. To contemplate the highlighted intention, we developed historical research under the historiographical lens of the Cultural History of Science (CHS) to analyze the scientific practices and visual culture involved in the study of the human body in the delimited period. Supported by primary and secondary sources, we give attention to the study of the scientific practice of dissection and manipulation of bodies and the analysis of the visual representations produced about the human body and presented in anatomy treatises used by medical and arts students in European universities in the sixteenth and seventeenth centuries. This is a significant period because we witness the expansion of the mechanism of image reproduction of the human body, which is considered decisive for the implementation and expansion of modern science.

After the introduction, we present the theoretical-methodological foundation that supports the work developed: the Cultural History of Science and Visual Culture. Based on these references, we carry out, in the following section, an analysis of the images of the human body produced in the delimited historical context based on answers to the questions: Whose bodies were studied? What were the practices established for the study? How were the images constructed? Who were the social actors involved in the scientific practice of studying the human body?

Thus, in light of the CHS, an analysis of the practice of artistic and scientific image production in the studied context will be presented to build subsidies to discuss the construction of the universal body presented in textbooks and explore the problematization of this idea.

Theoretical and Methodological Foundations

This section aims to present the theoretical-methodological foundation that guided the development of this research. In the first section, we present some discussions regarding the historiographical aspect of the CHS and in the following section, one of the categories of analysis of CHS, the Visual Culture.

Cultural History of Science: Thinking About Scientific Practices

As previously stated, the historiographical current used in this research was the CHS. This approach is based on the New Cultural History, which emphasizes everyday practices and habits (Burke, 2008; Pimentel, 2010). According to Juan Pimentel (2010) and Moura & Guerra (2016), CHS studies the scientific practices and the elucidation of how scientists and non-scientists in a given time and space, given the material conditions of their time, interact to produce knowledge.

The history of science, according to Pimentel (2010), can contribute to understanding science as culture. In this way, the structures of society, its economic, political, religious, social, and cultural aspects are considered an integral part of the historical study of science.

As the main focus of CHS, scientific practices are not restricted only to experimental activities carried out in laboratories and include activities not exclusive to science, such as writing and debates at congresses, among others. They are recognized as historical, local, and temporal enterprises, encompassing cultural performances and activities that are marked by a particular space and time outside of which it makes no sense to analyze them (Pimentel, 2010).

In this way, CHS distances itself from those studies that focus exclusively on the results produced by scientists and the ideas they construct. Considering that science is co-produced with the society in which it is inserted, looking at scientific practices means seeing them as human actions carried out by different social actors and permeated by the power relations that define which knowledge is valid and which is not. The treatment of historical cases through the lens of CHS allows us to understand that scientific development is not produced with the work of one person alone in a laboratory. Finally, the exchange between all those who directly or indirectly participated in the construction of the scientific knowledge studied is valued (Moura & Guerra, 2016).

The historiographical approach adopted here analyzes in a more in-depth way how certain activities have been recognized throughout history as scientific activity and who were the social actors who participated in the construction of science, and why some of these social actors remained in the condition of invisibility in official documents of scientific dissemination (Nyhart, 2016). In addition, it is interested in the forms of production and communication of scientific knowledge, its modes of representation, and the visual and material dimensions of science (Pimentel, 2010).

Associated with scientific practices and representations, we must pay attention to visual and material culture, that is, to the procedures and material means immersed in the construction of scientific knowledge. Visual studies have penetrated historiography, and historical narratives can be written to make things visible, whether they are new or familiar (Wise, 2006). Visual culture, one of the possible categories of analysis brought by CHS, will be the theme of our next item.

Visual Culture: Every Image Tells a Story

Every image tells a story and constitutes a language beyond what is written and/or spoken. We learn to interpret the world through images, even before we learn the written codes (Burke, 2016). In different societies, throughout history, many techniques have been employed to tell stories through images, such as paintings, sculptures, mosaics, tapestries, frescoes, and photographs, among others (Burke, 2016).

The telling of these stories is not neutral since all images contain layers of meaning including their formal aspects and cultural and socio-historical references. An image does not speak for itself; but expresses and dialogues with ways of life typical of the society that produces it (Burke, 2016; Hall, 2016). A single image can serve many purposes, appear in various contexts, and have distinct meanings for different people and contexts (Sturken & Cartwright, 2018). Authors such as Burke (2016) and Hall (2016) point out that images interfere in the construction of social representations, identities, and stereotypes.

From the understanding of the importance of images, an interdisciplinary field of research emerged, the Visual Culture, which studies the cultural construction of the visual in the arts, media, and everyday life (Dikovitskaya, 2005; Hernandez, 2018). According to Sturken and Cartwright (2018), visual culture is not simply about images but also about practices related to vision and how the world is visually organized in relation to power. Thus, the gaze can be defined as a cultural construction, which can be learned and involves power relations (Dikovitskaya, 2005).

In addition, the image can be understood as a cultural artifact and allows the reconstitution of the cultural history of social groups, also contributing to a better understanding of processes of social change, the impact of the economy, and the dynamics of intercultural relations (Monteiro, 2008).

When we think about the construction of scientific knowledge, according to Coutinho et al. (2010), images are a widely accepted medium in scientific dialogue, with the potential to communicate aspects of nature and to indicate the content of scientific ideas. Scientists use images such as schemes, maps, figures, diagrams, and tables, among others to communicate the results of their research in their classes, assignments, and articles. Sometimes, conceptualization itself depends on visualization, and it can be said that science is inherently visual (Silva et al., 2006).

The images produced throughout the development of science are not, therefore, mere illustrations. The production of images, as a scientific practice, and the visual representations created by scientists help to build ideas about the nature, truth, objectivity, and institutional relations of a given context of scientific development (Burke, 2016; Park, 2010).

The historical study of images allows us to perceive the interaction between artistic and the scientific production of the historical moment studied, both through the images portrayed and through the way they were produced (Jones & Galison, 2013; Pimentel, 2010).

The concept of visual culture taken by the CHS is in line with the perspective adopted in this research, that is, the looks, devices, and ways of seeing of each era are related to the context in which they are produced. Based on the above, we will discuss, in the next session, the practices and social actors involved in the production and use of scientific images related to the development of the study of the human body in the sixteenth and seventeenth centuries, which were important in the construction of the visual culture of modern science.

According to Burke (2016), images have a valuable testimony of artifacts and their organization, as well as clothing, ways of life and production, objects and their uses. From observing the images, we can discuss these aspects and reflect on the representations of people and situations and how these can allow us to see the social organization and hierarchy. These highlights are in line with the CHS approach, since studies on visual culture within this perspective value questions such as: how these images are produced, what was highlighted, what was hidden and who were their authors (Pimentel, 2010).

Results

In the construction of the historical research developed from primary and secondary sources and in the light of CHS, we studied the scientific practices related to the study of the human body in the sixteenth and seventeenth centuries developed in Europe. In this way, we found two essential activities: the practices of dissection and image production, with a focus on anatomy treatises. Thus, we have divided this section into two subsections to present the results of the historical research from these two activities.

The Practice of Dissection: Opening the Bodies

When we talk about the study of the human body in the sixteenth and seventeenth centuries, a valued and frequently performed practice was the dissection of human bodies (Pimentel, 2007). In the Late Middle Ages (from the twelfth to the fourteenth century), dissection was practiced by some doctors, becoming more frequent in Renaissance Italy (Mandressi, 2012).

The practice of opening human bodies was regulated and systematized in Italy in the sixteenth century (Porter, 2008). In this context, Andreas Vesalius, a student and professor of anatomy at the University of Padua, performed many human dissections. This practice promoted the creation of a culture of dissection since Vesalius's work at the university revealed and promoted the idea of visual evidence (Klestinec, 2011; Pimentel, 2007).

This proposal of visual emphasis was connected to the architecture of the anatomy amphitheater, where public dissections took place. A suitable anatomy amphitheater became essential for any university that wanted to be competitive in the study of medicine. Padua, Bologna, and Leiden had the most important anatomy amphitheaters of that period (Klestinec, 2011; Pimentel, 2007).

The structure of the amphitheater was made of wood in the shape of a semicircle, with two or three levels. The spectators took their places in a hierarchical order, organized according to the distance from the corpse. Those seated on the lower steps attended the dissection sessions with greater visibility of the bodies than those on the upper steps. There were also structures to lift the corpse from time to time and some parts of the body were extracted and taken to the audience so that they could take a closer look (Klestinec, 2011; Mandressi, 2012).

Anatomical classes and dissection demonstrations took place following a previously established script. They were public events, almost spectacles, and their main objective was not the construction of knowledge about the human body but the demonstration of knowledge so that these events allowed the professor to show off his competence (Klestinec, 2011).

Anatomical demonstrations could be public or private. Public demonstrations were events that took place once a year, mainly after Christmas and before Carnival, not only because they were the coldest months (allowing for a more significant conservation of the body, delaying decomposition due to low temperatures), but also because they marked the change of academic semesters (Klestinec, 2011; Willians, 2016). In the early sixteenth century, public anatomical demonstrations were held as an introduction to inexperienced students and seemed to emphasize the importance of eye training in learning anatomy (Klestinec, 2011).

The pictorial representation highlighted in Figure 1 is an example of images produced in the period regarding anatomy lessons. These images, in general, portray the distribution of the roles in the anatomical demonstration, which followed the following order: at the top and in the center, seated in a chair and wearing a long gown and hat, is the professor/*lector*, presented as the supreme authority from whose word the truth emanates. His job was to read aloud important passages from Galen's work while performing the dissection. On the lower plane, we find the demonstrator/*ostentor*, usually an assistant professor, who was responsible for pointing out the parts of the dissected body with a small stick, represented, in the image, with a different outfit from that of the professor/*lector*, indicating his position in the hierarchy at the event.

Finally, opening the body, we have the surgeon/barber, considered the most subordinate figure in that practice, as he was the one who came into direct contact with the matter of the corpse. The surgeon/barber was represented with simpler and even shorter clothes than the others to highlight his category (Klestinec, 2011; Porter, 2008; Rifkin et al., 2006).

Figure 1

Dissection scene



Source: Fascicle of Anatomy, 1494.

Death row inmates were the primary source of corpses for human dissection, being hanged in the morning (a practice that did not compromise the rest of the corpse) and dissected at the end of the day (Park, 2010; Willians, 2016).

Private dissections, with only the presence of doctors, students, and surgeons, took place throughout the school year in local hospitals, smaller classrooms, apothecaries, pharmacies, and the homes of local doctors and professors. These dissections were closely linked to clinical medicine, and often, from them, it was possible to discover the cause of an individual's death through autopsies performed in these spaces (Klestinec, 2011; Park, 2010).

When we deal with the study of the human body in the sixteenth and seventeenth centuries, we observe the absence of female bodies being studied in this period. The corpses used in the public demonstrations of dissection were male, not only because few women were executed for capital crimes but also because anatomy, according to Park (2010), sought to understand the generic human body, which was understood as male, European, and white.

Female bodies were dissected only in private sessions, focusing on clinical medicine and autopsies performed to unravel the cause of the woman's death, which usually occurred during or after childbirth (Klestinec, 2011).

This difference in the treatment of female and male bodies reflects, in a way, the social places occupied by female and male bodies. When we think about the relationship between the public and private spheres, the female body is understood as a body that should not be exposed in public, whether in dissections or while alive in health issues.

Until the beginning of the fifteenth century, the work of monitoring pregnancy and childbirth was carried out mainly by midwives, and in the case of health issues other than pregnancy, women were seen by doctors, but always in the presence of another person (Park, 2010). However, throughout the fifteenth century, in the case of Italy's prosperous urban dwellers, midwives lost their position to doctors at the same time that interest in the study of reproduction through the female body increased. Pregnancy and, especially, childbirth were moments of risk for women's lives, and a considerable number of them died from complications related to childbirth. In the case of the upper classes, this mortality rate affected issues related to succession and inheritance, which were important in the public sphere of that context (Park, 2010).

In this context, the uterus was recognized as an essential structure in the pregnancy process. Thus, understanding its structure and functioning became one of the main objectives of medicine in the fifteenth and sixteenth centuries. The uterus acquired special attention in private dissection practices as an organ that could reveal the answers to questions related to the reproduction and mortality of women during pregnancy and childbirth.

It is in this context that Park (2010) draws attention to the growing tendency on the part of Italy's prosperous urban dwellers to entrust their reproductive lives to male doctors. In the second half of the fifteenth century, certain women afraid of abortion consulted their doctors instead of their midwives, while husbands recorded, in their account books, payments made to these professionals for the care of their pregnant, parturient, and postpartum wives. Consequently, midwives started losing their position to white men in the care of the female body of a certain portion of that population. Thus, the study of the woman's body recognized as scientific is practically limited to the study of reproduction and the uterus, the organ to be represented in the *Treatises of Anatomy*. This movement concerning the study of the female body can also be discussed based on scientific and artistic images of the period, as we will see in the next subsection.

Image Production: *Treatises on Anatomy*

As mentioned, our time frame is between the sixteenth and seventeenth centuries. At a time when European powers were undertaking exploratory voyages to distant lands, image-making represented a central practice for investigating nature in different places and incorporating knowledge about flora and fauna into European science (Bleichmar, 2012).

The traditions of expeditions, painting, and collecting contributed to shaping the new science, and images became an important way of recording, collecting, cataloging, and witnessing, making possible a new mode of visual communication (Burke, 2016; Marcaida & Pimentel, 2014). Visual representation was not just a technical achievement but rather a highly specialized form of imitation of reality (Bleichmar, 2011).

The practice of elaborating scientific images followed conventions and, often, rigid control (Chansigaud, 2016; Wise, 2006). Artists stood out in producing these images, and although they were crucial actors in the chain of scientific communication, they were subordinated to the authority of naturalists. The images generally did not describe individual species but archetypal specimens (whether of animals or plants). The illustrator elaborated the scientific image, guided by the naturalist, by observing several individuals, whose characteristics were combined to form a kind of chimera, a perfect specimen (Bleichmar, 2011; Chansigaud, 2016).

One of the scientific practices that gained recognition in this period was the elaboration of illustrated books, such as the treatises on botany and anatomy, which, according to authors such as Kusukawa (2012) and Pimentel (2007), achieved high status in sixteenth-century European universities with descriptive studies.

According to Chansigaud (2016), the production of an illustrated book generally followed the following order: the author/natural philosopher supervised the creation of the illustration, the artist produced, under the author's guidance, an original image, and an engraver translated this image into a wooden, metal, or stone support, for a black and white print. The elaboration of the images was usually carried out by artists and printed in woodcut¹, the predominant means of reproducing images in the sixteenth century (Chansigaud, 2016; Kusukawa, 2012).

Anatomy treatises were designed to help medical students (and art students to learn how to pictorially represent human bodies) during their theoretical studies or to accompany public dissection events (Rifkin et al., 2006; Saunders & O'Malley, 2002). In them, we find countless images.

The use of images, both to know the body and to improve medical treatment, dates back to Antiquity (Sturken & Cartwright, 2018); however, in the Renaissance, a new relationship between art and the representation of nature emerged. Art was considered the direct and faithful representation of natural phenomena, and the artist had to become familiar with the structure and physical properties of natural phenomena to portray them appropriately (Saunders & O'Malley, 2002). Painters and anatomists shared the same values about sensory experience, and the participation of artists in the establishment of anatomical iconography was based on the conviction that illustration played an essential role in organized knowledge about visual perception (Mandressi, 2012).

1 Woodcut is the technique in which wooden boards are used as a matrix to reproduce the image engraved on paper or other suitable support. The wood is carved with the help of sharp instruments, leaving in relief the figure or shape (matrix) that is intended to be printed. Then, an inked roller is used, touching only the raised parts. The end of the process is the printing (in high relief) on paper or special cloth, which is impregnated with the ink, revealing the figure (<https://www.ufrgs.br/napead/projetos/glossario-tecnicas-artisticas/xilogravura.php>).

The first records of “illustrated anatomies” are found in the work *Comentário sobre a obra de Mudinuus de Lucci* (title in Portuguese) published in 1523 by Jacopo Berengario da Carpi (1460–1530) (Saunders & O’Malley, 2002). The treatise presented bodies in dramatic poses, characteristic of Renaissance art (Rifkin et al., 2006). His works highlighted a scenario of landscapes, animated skeletons, and anatomical mannequins that open their chests with their own hands to provide an internal view of their organs (Mandressi, 2012). The other anatomy treatises produced in the period followed this trend, and the representation of bodies sought not only to present body structures but also to express ideas of death, life after death, and medicine in modern culture (Rifkin et al., 2006).

A milestone in the production of anatomy treatises and in the study of this area was the publication of the book *De Humani Corporis Factory* by Andrea Vesalius (1514–1564) in 1543 (Rifkin et al., 2006; Willians, 2016). The treatise has some of the finest images of the human body produced at the time, mainly due to Vesalius’s collaboration with illustrators and the quality of the images’ printing.

The images of the treatise, made by artists such as Titian, his disciples, and Kalkar and by Vesalius himself, were elaborated, according to Vesalius, to help students memorize the structures and, in the dissection sessions, to guide students and those who attended the events to follow the demonstrations (Rifkin et al., 2006). Vesalius understood that images were fundamental to help the understanding of an idea, thus making the concepts more straightforward because the propositions were “seen” and not just described through texts (Saunders & O’Malley, 2002).

To explore this point better, we bring the example of the frontispieces of anatomy treatises from the sixteenth and seventeenth centuries. The frontispiece aims to present the work to readers and, as Boustani (2018) points out, allows us to understand a little of the author’s conception of the subject dealt with in the work. In Figure 1, highlighted above, we see the frontispiece of the book *Fascicle of Anatomy* (1494), in which an anatomy lesson is portrayed.

The frontispiece of Vesalius’s book (1543) (Figure 2), in which the image of a public demonstration of dissection made at the University of Padua is represented, presents elements that differ from the representations and descriptions of an anatomy class of the time (Park, 2010). In the image, Vesalius occupies the role of the demonstrator (the one who points to the parts of the body) and not of the reader, as it was expected to see him represented because he was a doctor and professor of anatomy. as previously highlighted, roles such as demonstrator and body opener were delegated to positions considered inferior in the academic hierarchy. On the frontispiece of his treatise, Vesalius, the natural philosopher, positions himself in a non-traditional place, that of the demonstrator, pointing to the body. Another representation that distances itself from the traditional one is that of the reader, represented by a skeleton (Pimentel, 2007).

Figure 2

Frontispiece of the book De homini corporis fabrica



Source: Andrea Vesalius, 1543.

Vesalius's seven-volume treatise has 663 pages and 300 engravings accompanied by captions with descriptions resulting printing and painting techniques used at the time. In *De fabrica*, Vesalius named various body parts and described their structures, functions, and pathologies (Rifkin et al., 2006).

The images contained in *De fabrica* usually present bodies in poses and landscapes characteristic of the representations of the Renaissance period, showing drama and emotion. The bodies are presented with exposed muscles, skinned and suspended skin. In one of the images, a skeleton is presented in Hamlet's pose, with his right hand on a skull (Figure 3). The dramatic intensity of these disembodied bodies is the work of the best painters of Titian's school, who applied the perspective technique (Boustani, 2018).

Figure 3

Skeleton



Source: *De humani corporis fabrica* — Andrea Vesalius, 1543.

An interesting fact to note is that despite containing many images of the human body, anatomy treatises, including Vesalius's, mostly portrayed male bodies, the female presence was peripheral. Vesalius's treatise, for example, contained 300 images; among these, only six were of female bodies, emphasizing the representation of the uterus (Figure 4). In other treatises, such images did not appear (Rifkin et al., 2006).

Figure 4

Dissected body of a woman, showing the uterus



Source: *De humani corporis fabrica* — Andrea Vesalius, 1543.

It is important to note that in Vesalius's treatise *De humani corporis fabrica*, the frontispiece's dissected body is that of a woman (Figure 2), whose uterus is being touched by the demonstrator, Vesalius (Boustani, 2018).

According to Park (2010), the choice of a human corpse in the presentation of the work would have been a resource used by Vesalius to demonstrate the superiority of his work in relation to that of Galen. Galen worked with animal dissection, and Vesalius had access to human corpses and included in the treatise some criticisms of Galen's work (Saunders & O'Malley, 2002).

Despite proposing to criticize Galen, Vesalius based some understanding of the human body and its anatomy on the Galenic theory. According to this theory, women's bodies were anatomically the same as men's, although they had inverted genitals. However, reproductive capacity, menstruation, and other aspects related to the particularities of the female body and the characteristics attributed to women's personalities, such as sensitivity and delicacy, made women be seen as beings utterly different from men.

Thus, we can suggest that the uterus would represent this difference. In this regard, Park (2010) states that Vesalius's choice to represent a female body on the frontispiece was intended to present him as the founder of a reformed anatomy, and the gender difference between the anatomist and his object was a way of showing a distance (about identity and reciprocity) between the two actors on stage.

According to Kusakawa (2012), Vesalius represented, as it was hegemonic in that context, a canonical body in the book *De humanis corporis fabrica* (1453), which would be the body of a perfect man, without variations or deformities, contrasting with the bodies that were usually used in dissections.

When discussing the representation of the human body, it is also important to discuss the artistic works produced in this period. In this way, we rely on Jones and Galison (2013) when they highlight that science and art are activities of image and knowledge creation. Thus, artistic images refract and reflect the context in which they were produced and can be used to promote discussions and reflections on not only these contexts but also on the current one.

Public dissection events were valued practices in that context, which generated representations of these events in several paintings of the time, generally called "Anatomy Lesson" (Figures 5 and 6). Although they did not have an academic objective, like the images in anatomy treatises, those images portrayed standard practices of that context, expressing and dialoguing with the typical ways of life of the society that produced it and disseminating the anatomy studies carried out in these spaces. In these paintings, we find scenes from anatomy lessons and public events in which female bodies were not present either as a studied body or as those who had the legitimacy to study bodies.

Figure 5

Anatomy Lesson by Dr. Nicolaes Tulip — Rembrandt — 1632



Source: <https://www.mauritshuis.nl/ontdek-collectie/kunstwerken/146-de-anatomische-les-van-dr-nicolaes-tulp>.

Figure 6

Anatomy Lesson by Dr. van der Meer — van Mierevelt — 1617



Source: <https://www.wga.hu/frames-e.html?/html/m/mierevel/anatomy.html>.

The absence of women in the Anatomy Lessons and how they are represented in other paintings reinforce discussions already pointed out concerning the bodies studied and those who studied them. In the painting “The Birth of Mary” (Figure 7), in contrast to the paintings in Anatomy Lessons, only women are depicted. They are participating in a birth in a domestic environment, the different spaces occupied in the scene portrayed, and their faces point to the various roles they performed in that activity, but without their clothing indicating any hierarchical relationship between them. Throughout the fifteenth century, scenes such as the one in the painting “The Birth of Mary” are less and less portrayed, reflecting a change in the importance of the female presence in the care of pregnancy and the delivery of urban women from families with high social and purchasing power. Considering the differences in the social roles of women and men in that context, reflected by the distinction between their activities, we can infer that in the study of the human body developed there, the knowledge that women had about the female body was not valued, suggesting a waste of knowledge in that process.

In this session, we brought up issues related to using images, based on the study of Visual Culture, to discuss aspects related to the construction of scientific knowledge about the human body in the sixteenth and seventeenth centuries. In addition to examining, based on the CHS, the practices and social actors involved in the process of producing these images, we also presented possibilities of themes to be discussed from the images produced in the mentioned period. Understanding that images are historical sources like any other type of document, placing visual culture as a means of studying images allowed us to rethink them, and to question and reflect on their role in the communication and constitution of scientific knowledge and the social relations that permeate it.

Figure 7

The Birth of Mary — Anonymous — 1520



Source: <https://www.mauritshuis.nl/en/our-collection/artworks/897-the-birth-of-mary>.

Discussion

The results of our research indicate that, in the process of constructing scientific knowledge about the human body in the sixteenth and seventeenth centuries, the type of body valued and that served as a model for the images of the official documents of science in that period was the body of the white European man. In the representations of the treatises of anatomy, we find a body without color and of a certain gender, making bodies different from them invisible, such as female bodies, for example. Our research points out that these treatises used to teach about the human body to medical and art students enabled a look at the human body, which was reflected in different printed materials and constitutes a cultural heritage that shaped the construction of didactic materials. The body portrayed in those treatises disseminated the knowledge produced there and the conceptualization of a single body to represent all human bodies, indicating a model of the body to be studied, which was intended to be universal.

The anatomical models found in the treatises of anatomy in that context and also those present in current textbooks help to build the discourse on the human species and the human body. Authors such as Silva (2005) indicate that, in textbooks, humanity is represented by the white man and that the books place the white man as a “universal and essential subject” who is the legitimate representative of the human species, which is in line with the body presented in the treatises of anatomy discussed here.

In the case of the human body, the literature points out that the images presented to students in textbooks highlight a model/standard human body without identification, a non-localized body, a generic body. In other words, students study from images that do not represent them (Trivelato, 2005).

These results dialogue with Silvério and Motonkane (2019), whose work investigates how the human body is represented, from the racial point of view, in some current collections of Biology textbooks in Brazil. The authors indicate that the vast majority of anatomical models represent white people. In addition, they draw attention to the fact that this representation seems to normalize the white as a legitimate representative of the species, disregarding that the population that makes up more than 54% of the Brazilian population, the black population, is not represented in that image.

It is this type of representation, which omits black people, that helps to build the racist imaginary of the absence of humanity in the black population and thus justifies the exploitation and violence exercised on them (Silvério & Motonkane, 2019). Based on the results of our research, we suggest that the low representation of the black body as a human body in contemporary textbooks reflects and refracts part of the construction of knowledge about the human body, which made some bodies invisible and presents a specific one as the legitimate body to be studied.

Regarding the binary sex and gender, Santos and Silva (2019) bring essential reflections on the experience of transsexual people in biology teaching and how biological discourse often presents this and other bodies as “wrong” bodies from a biological perspective, marginalizing them. Santos and Silva (2019) report that one of

the people interviewed states that the body present in textbooks is a body that does not exist, and, therefore, black, fat, disabled bodies and, of course, the bodies of transsexual people are ignored.

In the educational context, the use of images is a fundamental part of teaching-learning practices (Grilli et al., 2015). When we turn our gaze to science education, authors (Rego & Gouvea, 2013; Silva et al., 2006) point out that images play a fundamental role in the dissemination and constitution of scientific ideas and their conceptualization. In these cases, images play a crucial role in the visualization of what is being explained and in the construction of that knowledge by the students (Neves et al., 2016).

These considerations align with Hall (2016) when the author states that representation is one of the central practices that produces culture. Thus, in the practice of image production, the domain of the *visible* and of the *invisible* is located in the sphere of power and social control, of seeing and being seen, of giving oneself to be seen or not to be seen, of visibility and invisibility. They involve power relations, including the power to define who is included and who is excluded (Meneses, 2003).

Representation is thus linked to identity and recognition. When we think about the construction of identities, they are not isolated constructions but inextricable both in individuals and their surroundings and relationships.

In this sense, the historical study developed here allows us to understand how the construction of the study of the human body, in the sixteenth and seventeenth centuries, made it possible to represent a “timeless and universal organism unrelated to the events that configure it daily and position it as endowed with a particular gender, ethnicity, sexuality, behaviors” (Souza, 2005, p. 173, our translation). It allows us to discuss the representation of the human body in that context, promoting reflections on the absences found there, which also reflect the absences in current textbooks. Discussing how the human body is produced by biology and culture seems necessary.

Thus, we highlight that images can be used in environments and cultures different from those in which they were produced (Burke, 2016), which leads us to defend their use in Science classes. The images have the potential to raise historical discussions about scientific production in Science classes and play an important role in the constitution of understandings about the process of science construction.

Final Thoughts

The study of the images in the light of the CHS approach allowed us to raise questions about the representation of the human body and the absences in these representations, which also reflect the absences in textbooks. The use of scientific or artistic images linked to the discussion of scientific practices established in the study of the human body enabled reflections on which bodies were studied in the historical cut, who were the people who opened the bodies, how the dissemination of this knowledge was done, and to discuss that the human body studied in science classes does not seem to represent the bodies of the students.

In addition, the representations of bodies in textbooks seem to reflect a heritage in scientific production, which valued representations without color and gender. Therefore, based on a historical discussion of the production of images in the treatises of anatomy, we can discuss who built them, who commissioned them, what they wanted to portray, and the absences and invisibilities in the construction of scientific knowledge in that period. It promotes reflections that enhance understandings about the power relations that determined who/what was portrayed and who/what was not portrayed in visual records and consequently problematize absences and presences of bodies in science and Biology textbooks.

The previous discussions about visual culture and the potential of images in science teaching make us defend that the historical study of scientific and artistic images can be a way to discuss in Science classes the scientific practices and social actors participating in the construction of science.

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