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Body, sexuality, and gender in science education: (im)possible connections?

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Abstract: Historically, researchers in the Natural Sciences have had their approaches to sexuality and gender questioned with regard to their validity and the potential harm they may cause to students. This scenario has highlighted the limitations of teaching focused solely on the biological, chemical, or physical aspects of the body, pointing to the need for broader approaches. This study aims to present, from the perspective of preservice teachers of Science and Biology, the challenges involved in discussing sexuality and gender with students in basic education. To this end, we investigated the perceptions of 151 undergraduate students enrolled in licentiate and bachelor's degree programs in Biological Sciences at a federal institution, considering the influence of cultural studies on teacher education. In addition to the analysis of objective responses, 32 students participated in an open-ended question, enabling a qualitative analysis grounded in a Foucauldian perspective of discourse. The study was developed within the context of the research group Masculinity, Culture, Education, and Subjectivity (GPEMCS) and the curricular courses of the programs analyzed. The results indicate that, although the Biology teacher should not be the sole professional responsible for addressing sexuality and gender, they can and should facilitate this dialogue within the teaching of the human body, creating opportunities for broader interpretations. Thus, an approach is proposed that goes beyond the physical body, also recognizing cultural, emotional, and social dimensions, which are essential to students' integral education.

Keywords: science; gender; sexuality; education.

1 Introduction

In undergraduate teacher education programs in the biological sciences, the emphasis on solidity, technicality, and positivism of knowledge has long been institutionalized, as a legacy of the early organization of this degree. For this reason, we argue that, as students in such programs, engaging with a humanized perspective on sexuality and gender becomes essential, since it challenges a prevailing paradigm—namely, the breaking of scientific theories and laws through approaches that recognize individuals beyond what we are quantitatively.¹

¹ Testimony from one of the thirty-two undergraduate students who responded to the proposed questions. The participant is a sixth-semester student in a Biology teacher education program at a federal higher education institution located in the Triângulo Mineiro region, Minas Gerais, Brazil. He self-identifies as Black, is 23 years old, and male.



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The epigraph that opens this text seeks to raise important concerns that we consider essential to current discussions. In this sense, we aim to contribute to a debate already initiated by Souza, Santos, and Silva (2021) regarding why Science and Biology teachers have historically faced difficulties in addressing issues of sexuality and gender in the classroom. Our objective is to understand how this process developed in this way. Why has it persisted? What are the challenges involved in overcoming the difficulties of addressing gender and sexuality in educational settings? From the outset, we do not claim that this paradigm has been fully overcome. Rather, our proposal is to demonstrate that, over the past 25 years, significant advances have occurred in this field. These advances must be acknowledged and strengthened so that this movement may occupy its rightful place—earned through its trajectory—within the broader debate on Science Education.

Within this challenging process of weaving new understandings, new generations of pre-service Science and Biology teachers can and must be questioned (Souza; Meyer, 2020) regarding how debates on sexuality and gender were and continue to be addressed in their education. What impact has this had on their academic and professional trajectories? In this context, the opening epigraph, which presents the testimony of one of these undergraduate students, can be seen as a reflection of our time. A question that arises is: if the practices of Biology teachers appeared insufficient—addressing the topic in a way restricted to the biological body and grounded in scientific and positivist perspectives—why did this occur? We argue that significant changes are underway, and the initial excerpt reinforces this assertion.

In light of these questions, one statement can be made: the first two decades of the twenty-first century enabled the establishment of a new scenario. However, what paths toward overcoming this paradigm can be identified?

Researchers in Science Education have faced the challenge of overcoming the limitations of teaching approaches focused exclusively on the biological, chemical, or physical body. How has this issue been characterized, and what advances have been achieved? What factors have been considered relevant in influencing changes in this field? In this sense, we seek to organize data, testimonies, and theoretical articulations that may signal such transformations, advancing and consolidating, in Biology teaching, a debate on sexuality and gender that is consistent with contemporary

realities. Testimonies from pre-service Biology teachers, whose training includes this debate as a mandatory component of the curriculum, will serve as our references. This choice is justified by the need to consider and better understand fundamental issues, particularly the historical disarticulation between teachers and students in the field of sexuality and gender, given that teachers have long been called upon to address such demands without adequate initial or continuing education.

It is also important to highlight the persistent historical neglect within Biology teacher education programs—both initial and continuing—which have long remained detached from this challenge. Nevertheless, it can be noted that since the early 2000s, some researchers have dedicated themselves to the construction of knowledge, as well as to strengthening and recognizing the importance of this field of research and practice, specifically for the teaching of Biology and Science in basic education, enabling significant advances. Therefore, the objective of this study is to present, from the perspective of pre-service Science and Biology teachers, the challenges involved in discussing sexuality and gender with students in basic education

2 Theoretical Framework of the Study

When problematized solely from a traditional perspective (as a mere biological organism) the body proves to be insufficient for understanding the contemporary world. This restricted view offers limited possibilities for analyzing complex human experiences. It is therefore essential that the discussion incorporate social, political, cultural, economic, religious, and technological dimensions. Deleuze (1998) points out that, in disciplinary societies, “they proceeded to the organization of the great means of confinement” (p. 219). In this regard, Foucault (2007) shows that disciplinary societies are characterized by the exercise of power through the discipline of bodies, focusing on control, normalization, and surveillance. This occurs within closed institutions such as schools, hospitals, military barracks, among others.

Within these institutions, individuals are shaped, monitored, evaluated, and formatted to behave in specific ways, adapting to social norms and standards (Deleuze, 1998). In this gradual process of transition, we can observe that we are increasingly living in societies of control. But what evidence might characterize this control scenario? The answer is complex; however, as Deleuze (1998, p. 220) argues,

we are experiencing “a generalized crisis of all the means of confinement,” such as hospitals, prisons, or even the family itself.

These are examples of groups that can be understood as so-called institutions of control. Each of these institutions presents different ways of conceiving the individual. For instance, in hospitals, human beings are conceived as patients; in penitentiaries, as inmates; in families, as relatives (Deleuze, 1998). The school is no different. Indeed, schools are organized to exercise control over children through disciplinary mechanisms such as schedules, examinations, and rows of desks.

Considering this, the conception of the body discussed in this text presents constant and uniform structures, though not singular. In fact, the human body presents constant and uniform forms because, from the womb onward, it is assigned a place, a shape, a rule, and an expectation created for it. In this sense, the body is mass, casing, and surface that persists throughout history, as emphasized by Mendes (2006).

According to this author, the body is composed of flesh, bones, organs, and limbs; it is matter, physical, and concrete. When we consider this body from a sociological perspective, Foucault (2007) urges us to view it as moldable by discourse: physical matter in motion is a malleable, transformable, and remoldable surface through disciplinary and biopolitical apparatuses, via the action of discourse.

For Foucault (2007), biopolitics is a mechanism through which power manifests itself, whereby biological life is incorporated into the political management of the State and, consequently, is governed, administered, and controlled. Thus, the body is subjected to power relations that constitute specific and historical policies.

Foucault’s words show us that “the body becomes a useful force only if it is both a productive body and a subjected body at the same time” (Foucault, 2013, p. 28). Political economies and technologies conceive the production of “docile bodies—disciplined and productive” (Foucault, 1997, p. 28). In this sense, the focus is not necessarily on the body to be tortured, exposed, or degraded, but on the body that ceases to be an object and becomes the means of reaching the soul, which implies the “effect and instrument of a political anatomy; the soul, prison of the body” (Foucault, 1997, p. 32).

Individuals are no longer punished solely for their infractions, “but for what they are, will be, or may become” (Foucault, 1997, p. 22)—for their possible present and future disorders, their abnormalities or pathologies. Foucault (2001) analyzes how the

figure of the “abnormal” was constituted between the sixteenth and nineteenth centuries. During this period, there was a growing concern with those who needed to be classified and located to better structure and manage the society that was taking shape.

It is important to note that the “abnormals” were those who resembled monstrous figures (physical “abnormalities,” such as conjoined twins, Indigenous peoples with facial adornments; homosexuality; women with attitudes considered insufficiently “feminine”), as well as individuals with excessive sexual appetites. Those who transgressed socially imposed rules were classified as undisciplined. The body was treated as the central factor in the “cure” of these three figures.

Thus, the body is an invention constructed through discourse and power relations (Foucault, 2007). In this discussion, Fischer (2001) refers to discourse and invites us to consider it as productive, acting upon bodies by sexualizing them, assigning them fixed gender positions, and rendering them docile and adjusted to expectations regarding the place each body should occupy. The author urges us to consider the authenticity, reach, strength, and power of this discourse that permeates us. In this sense, control is “self-deforming,” and at the same time, “control is short-term and of rapid rotation, but also continuous and unlimited [...]” (Deleuze, 1998, p. 224). The modulation of control circulates in order to “determine” the actions of individuals by subjectivizing them. These are waves that “shape actions” in different scenarios (Deleuze, 1998). There is no place where control begins or ends.

The “modulating principles” act as constitutive elements of societies of control for everyone. As Deleuze (1998) argues, this type of “total control” is already underway, making it unnecessary to rely on imaginative exercises to identify it. Proposals for electro-electronic control are either being tested or already in operation. A clear example can be observed in the tracking of an element in open space—such as an animal in a nature reserve or an employee in a company—through electronic mechanisms (Deleuze, 1998, p. 224). Everyone can be electronically tracked.

In the academic field, parallel to social and technological transformations, there has been a growing understanding among researchers and those involved in initial and continuing teacher education that discussing sexuality and gender, including cultural interpretations and their implications, could promote greater awareness and

create conditions for the development of creative sensitivity. This understanding gained strength in graduate programs in Brazil at the beginning of the twenty-first century.

However, to undertake this task with social and political commitment, it became evident that teachers required adequate training. In undergraduate Biology programs aimed at elementary and secondary education—often characterized by a bachelor-oriented profile (in which students generally do not take mandatory pedagogical courses during initial training)—pedagogical preparation was typically fragile and lacked grounded analysis of teaching processes and their political, cultural, social, and educational determinants. As Souza (2015) states, initial teacher education for secondary education prioritized subject-specific knowledge at the expense of knowledge that would ground teaching practice.

Based on these considerations, we observe that pedagogical knowledge essential to teaching practice received little emphasis, space, or recognition. In the training of Biology teachers who would address themes such as sexuality and gender, there was a strong emphasis on specific biological content. It was within this context and period that the development of collective works on sexuality and gender emerged, grounded in the National Curriculum Parameters (PCNs), encouraging teachers to develop theoretically informed practices that contributed to citizenship education and the resolution of identity conflicts from a social and cultural perspective.

The physical, neurological, and behavioral changes studied within Biology content opened space for broader articulations that initiated a distinct discussion on sexuality and gender. By the late 1990s, Biology assumed the role of discussing life in its multiple manifestations, collaborating with other fields such as Philosophy and Sociology. According to Kuenzer (2005, p. 177), Biology plays the role of “[...] contributing to the understanding of the world and its transformations, situating human beings as participatory individuals and integral parts of the universe.”

Several authors highlighted, during the same period, that articulating Biology as a discipline with debates on sexuality and gender was essential. Nevertheless, the challenge was significant. According to Louro (1997), Weeks (1999), Furlani (2008), and Castro, Abramovay, and Silva (2004), a strictly preventive or prescriptive approach in Biology classes was often considered limiting.

Studies by Cruz (2008) and Altman (2005) confirm that Biology as a discipline has the potential to host such discussions. Cruz (2008) reinforces this possibility by

stating that, although the debate still exhibited cultural “biases,” it held strong potential to advance toward more conscious and humanized perspectives. For the author, the disciplines of Science and Biology—despite being strongly linked to an informative character focused on concepts such as reproduction, health, body care, and disease prevention—already showed signs of change.

Therefore, according to the author, Biology educators, when working with themes such as anatomy, physiology, reproduction, and genetics, can guide teaching based on students’ needs. According to Varela (1997), educators who are aware of their role can expand their classes to approaches that discuss the diversity of life, addressing who we are, our differences and preferences, and establishing this dialogue also within the field of human sexuality. Altman (2005) adds that multiple readings of the body and the meaning of what “kills and wounds” go beyond purely physical aspects.

The challenge of teacher education remained. Silva and Carvalho (2005) demonstrate that, during that period, many institutions developed Biology curricula focused solely on subject-specific training, disregarding the pedagogical, humanistic, and social dimensions of the formative process. This gap contributed to a prescriptive and restricted form of teaching that urgently required revision in light of contemporary challenges.

3 Methodological Path

Based on the brief overview presented here, although the study involves a quantitative number of participants — 151 students enrolled in two undergraduate Biology programs at a federal higher education institution, one teacher education program (licensure) and one bachelor’s degree—the inquiry conducted regarding whether “the approach to sexuality and gender in undergraduate education, centered on cultural studies, can be considered a distinguishing feature” yielded objective responses. From this group, 32 students were randomly selected to respond to the question in a descriptive manner, offering their subjective perspectives on the topic.

This research was conducted using a qualitative approach, justified by the need to explore the personal, subjective, and contextual dimensions of the participants, for which quantification would not be appropriate. The study is the result of academic discussions and actions developed by the research group Masculinity, Culture,

Education, and Subjectivity (GPEMCS, abbreviation in Portuguese). It also draws upon the theoretical framework of mandatory courses that are part of the curriculum of the undergraduate Biology teacher education program at the Federal University of Uberlândia (UFU). Some of these mandatory courses have been attended by students from programs other than Biology, supporting extension activities and research in diverse fields.

Regarding the methodological tools employed, Santos (2016) emphasizes that when dealing with research objects related to personal histories and lived experiences, it is a challenge for the researcher to articulate methods that provide participants with greater comfort and security, as well as an appropriate environment aimed at enhancing the research process. In this context, in contemporary times, digital media have become efficient tools due to the subjectivity they enable and the reach they provide (Miskolci, 2013). Mann and Stewart (2000) define interviews conducted through digital media and argue that non-standardized and less structured questions are ideal for online interviews, as they allow for real-time questioning via website chats. In this study, the WhatsApp application was used for this purpose.

Considering interviews conducted through digital media is supported by studies such as those developed by Santos (2016). According to the author, the digital generation feels safer and more comfortable discussing complex and personal topics, as the screen creates a sense of distance between interviewer and interviewee, facilitating greater freedom of expression on the part of the participant. The use of digital media by new generations is a hallmark of the twenty-first century, reflected in interpersonal relationships and society at large. Likewise, it has become a resource of invaluable importance for research in the human sciences. It's because,

Beginning with how—unlike in the past—new media elevate anyone to the condition of protagonist, personal characteristics and differences become possible articulating motives for contact and socialization (Miskolsi, 2011, p. 13-14).

Through the use of the WhatsApp application, after consulting the participants regarding their willingness to take part in the research, and once they had agreed and were fully informed about the nature of the study, the quantitative interview phase began. All items contained in the Informed Consent Form (ICF) were ensured to the participants. Subsequently, a space was provided for them to freely express their opinions in response to the question: "Can the approach to sexuality and gender in

undergraduate education, centered on cultural studies, be considered a distinguishing feature?” As previously mentioned, 32 students expressed their opinions.

Once the testimonies were collected and accessed, principles of French discourse analysis were used as a reference for the production of the empirical material, seeking correlations between discourse and history. In this endeavor,

analyzing discourse with Foucault means accepting the rarity of things said (or of statements); it is certainly a kind of attitude toward life—an ethical and political attitude, as well as an intellectual one—through which we assume that there is no identity between ourselves and what we investigate, and that thinking always involves navigating differences (Fischer, 2015, p. 126).

Thus, discursive sequences—excerpts and fragments from the collected testimonies—were adopted as units of analysis. Along this path, Santos (2000) clarifies the challenge inherent in undertaking such analytical movement. According to the author, the research setting must be carefully observed, as evidence is conveyed through subjective data that are often unforeseen during the study’s planning phase.

In light of these parameters, we sought to identify the meanings of regularities in order to understand the extent to which society and teacher education institutions have sought to accommodate, understand, respond to, and adjust to emerging demands. In this context, we present a fragment of discourse that allows us to value the challenge of a field of knowledge committed to engaging in a complex debate:

I am a pedagogue, and during my undergraduate studies I took this course with a professor whose initial training was in Biology. My conclusion is that it seems essential to engage in discussion and to have deeper knowledge of the articulated biological body. I keep thinking that, in order to understand the concepts involving sexuality, gender, and the body, everything begins with a body that is biological. From there, training, understanding principles—what are the best foundations for perceiving this body as a whole? The aspect that involves the biological dynamics of this body seemed broader to me. I had already participated in debates led by other professionals, but Sociology, Physiology, Anatomy, and even Neurology together made the discussion completer and more moved me far beyond the physical body (Participant 5).

By proposing the interpretation of meanings in expressions such as “*I am a pedagogue*,” “*during my undergraduate studies*,” and “*a course with a professor whose initial training was in Biology*”, the aim is to understand the socio-historical conditions related to a set of statements and/or silences that have enabled—and continue to enable—the production of subjectivities. It is understood that, in research such as this, supported by Fernandes (2012), the primary concern should be the search for

meanings in recognizing subjects and their discourses, as exemplified in the statement “*I had already participated in debates led by other professionals.*”

In light of the above and drawing on Fischer (2015), we argue that it is necessary to reject univocal and simplistic explanations, as their acceptance may constitute a common yet flawed practice. Fischer (2001, p. 198) further notes that, from a Foucauldian perspective, “it is necessary to remain (or attempt to remain) simply at the level of the existence of words, of things said.” An example of this is the excerpt “Sociology, Physiology, Anatomy, and even Neurology together made the discussion completer and more moved me far beyond the physical body.” This fragment serves as a meaningful perception.

When considering the scope of this study, Fischer (2015) invites us to value, in contemporary times, educational research that allows for greater expression of human sensitivity—both in the researcher’s writing and in participants’ self-narratives. This represents both the distinguishing feature and the challenge of our time: breaking away from the technicality and coldness that often characterize academic production. Guided by the author’s orientations, we adopt this design of small excerpts that dialogue with the theoretical framework underpinning the writing, as we did at the outset and have continued to do throughout this work.

4 Results and Discussion

In Biology teacher education programs, structured in a nearly fully bachelor-oriented design, it is difficult to imagine that a biologist with initial training would address gender and sexuality from a social and cultural perspective (Participant 27).

If it is indeed “difficult to imagine that a biologist with initial training would discuss gender and sexuality from a social and cultural perspective” (Participant 27), how has this path and objective become possible? Historically, it is important to consider that, according to Santos (2015), debate on this topic was introduced into the secondary school curriculum of some Brazilian state education systems during the 1990s through content developed within Health Programs. Discussing the urgency of this debate and its establishment in that context is fundamental to understanding the topic, as it refers to a period spanning nearly three decades. Supported by the development of programs aimed at secondary school students, Biology teachers were called upon to assume this position of responsibility, as implemented by state

education departments, including those in Minas Gerais. It is likely that this moment, in the 1990s, marked the emergence of the first concerns and the initial efforts to construct knowledge in this field. Such demands and urgency are discussed by Molina (2018).

However, according to Santos (2015), the focus of schooling — from the late nineteenth century through the late 1980s — was limited to addressing the most urgent needs, encompassing only basic notions of nutrition, organic defenses, parasitic diseases, body care, social, sanitary, and mental hygiene, first aid, and other subtopics. During this period, there was a strong influence of hygienist medicine seeking to penetrate the school system, as analyzed by Foucault (2007). Drawing on this author's considerations, and without diminishing the importance of hygienist medicine for society, it is observed that this approach represented an investment in the control of bodies and reproduction, including among minors. Parallel to this context, the spread of Acquired Immunodeficiency Syndrome (AIDS) occurred during the 1980s and 1990s. AIDS was quickly recognized as a global public health issue, claiming lives regardless of nationality, class, or social status (Forattini, 1992).

Based on Forattini's (1992) considerations, the urgency observed in the late 1980s and early 1990s — driven by AIDS — reflects a historical pattern of state intervention. This pattern can be traced back to what Gondra (2005) describes as a period in which Brazilian cities faced high rates of contamination by syphilis, dengue fever, malaria, Chagas disease, and other endemic illnesses.

These diseases intensified between the late nineteenth and early twentieth centuries, systematically becoming public health concerns. Historically, this scenario resulted in the mobilization of schools as apparatuses for disseminating hygienist practices and social control.

Along this trajectory, it is worth revisiting the 1980s to reinforce the issues and discourses produced by the same hygienist medicine described by Foucault (2007). Faced with new challenges such as AIDS and early pregnancy, school Biology was once again called upon to reinforce its role in providing information, prevention, and control (Santos, 2015). The school curriculum was redesigned to include themes such as human reproduction and development, studies of the male and female reproductive systems, pregnancy, contraceptive methods, sexually transmitted diseases, and Acquired Immunodeficiency Syndrome (STD/AIDS), among others.

As such, Biology education has traversed decades leaving significant marks on society, often assuming a prescriptive and descriptive role (Santos, 2015). The challenge lies in deconstructing a teaching practice focused solely on the biological body, disconnected from emotions and social issues. This approach reflects a form of teaching shaped by educators who failed to perceive the relationship between curricular content and the needs and conflicts of a generation already subjected to considerable pressure due to the lack of recognition and legitimation of their subjectivities within Science (Santos *et al.*, 2018). What was lacking was the articulation between conceptual and technical aspects of the biological body and personal and social issues vital to the constitution of emotional, social, and subjective individuals.

It is observed that the 2000s marked a significant and far-reaching movement in this field. Research efforts that would later trigger meaningful changes emerged from scholars such as Helena Altmann (2001, 2005, 2007). Altmann became a key reference during this period, and her contributions were notable: she developed a perspective on sexuality and gender debates that influenced many researchers of her generation, transcending the fields of Pedagogy, Sociology, and Anthropology.

According to Santos (2015), difficulties related to addressing sexuality and gender in the classroom—beyond mere biological description—stem from the fact that such discussions require an understanding of the teaching process itself and of the subject's subjectivity, elements rarely perceived in undergraduate programs up to that point. Historically, in Science and Biology teacher education programs, pedagogical training has been considered fragile, even in preparing teachers for elementary and secondary education. This fragility often manifests in the absence of grounded analysis of teaching processes and their political, cultural, social, and educational determinants. Currently, the insufficiency of such training is widely acknowledged among pre-service teachers themselves (Santos, 2015).

The excerpt “Statements about sexuality and gender have always had an impact, and learning about the topic during undergraduate studies—subjects rarely explored in textbooks—is important and plays a fundamental role in students' lives, especially in addressing those who do not feel the same as others” (Participant 21) highlights those discussions of sexuality and gender have always had an impact. However, it was only from the late 1990s and early 2000s that a significant movement

emerged, reshaping pedagogical training profiles and approaches to these themes (Santos, 2015).

Until then, a considerable number of Biology teachers working in secondary education limited themselves to the uncritical reproduction of content, disconnected from students' needs. Paradoxically, despite insufficient initial training and teaching materials in this field, Biology teachers were frequently called upon to mediate important discussions on STD/AIDS prevention and gender-related issues. In this context, Biology itself sometimes contributed to discriminatory discourse, often portraying AIDS as a "gay plague" and describing in vivid detail the sentence of a contaminated biological body destined for death (Santos, 2015). For Santos *et al.* (2018), because these themes were part of young people's daily discussions in society—regardless of social class or culture—they inevitably entered the classroom, and educators were required to address them.

However, the lack of theoretical grounding in pedagogical training contributed to the emergence of a generation of teachers who felt embarrassed and threatened by desires that fell outside socially established norms (Santos, 2015). This gap in training is evident in the testimony of Participant 13: *"I was afraid of getting sick; I was afraid of having sexual relations. I had my first sexual experience at the age of 20 because I was afraid of contracting AIDS. Now, through my studies, I have acquired knowledge and information about this, and it challenges me toward teaching centered on subjectivities"* (Participant 13, 50 years old).

According to the discussion presented, the final two decades of the twentieth century posed significant challenges. In Brazil, a milestone in studies conducted between the late 1990s and early 2000s was highlighted by Lajes (2009), who pointed to the need for more effective teaching on sexuality and gender. Authors such as Silva (2004), Altmann (2005), and Cruz (2008) recognized the discipline of Biology as having strong potential for this endeavor, considering it capable of contributing to debates on sexuality and gender beyond the biological body.

Below are some excerpts that signal the value of this debate in the initial training of Biology teacher education programs in contemporary times:

This discussion during undergraduate studies brought to me the importance of a biology teacher in the classroom in a way I had never imagined. I entered Biology to work with life and Earth as traditionally recognized, and I was displaced toward a biology intersected by cultural studies (Participant 8).

My training gave me more knowledge to deal with conflicts in the field of sexuality and gender—not only with others, but also with our own negative baggage, things we went through and were able to better understand during the classes (Participant 26).

Based on the above, the present moment differs significantly from the period up to the early 2000s, when little information was available on how Biology teachers addressed sexuality and gender in their classes—and when such approaches were often inadequate and harmful (Santos, 2016). The discussions led by researcher Guacira Lopes Louro (1999), who has long worked in the field of gender and sexuality studies, were fundamental in confronting these limitations. According to the author, the exclusive use of biologizing and supposedly neutral terms was a common flaw.

In light of these apparently neutral terms, several reflections arise: How did Biology teachers in secondary education develop activities that enabled discussions on sexuality and gender? Did they understand the importance and necessity of work that went beyond anatomical and physiological information? What difficulties did they encounter in attempting to establish open and honest dialogue that fostered contextualized discussions on sexuality and gender? How and where did they seek support to face these difficulties and limitations originating from initial training?

Faced with such doubts and shortcomings, while it is impossible to return to the past, it is entirely possible to train a generation of future teachers capable of rethinking this teaching practice. It was at the turn of the twentieth to the twenty-first century that, through research and studies conducted in graduate programs across the country, reflections gained strength. This was not an isolated movement, but rather a collective call to recognize the urgency of this debate. And what was the result?

Taking a course on sexuality and gender taught by a biologist contributed to my theoretical understanding of the topic. The experience allowed me to better understand the diversity, complexity, and nuances of gender identities, gender expressions, and different sexual orientations. It made me more understanding toward others (Participant 29).

When we were taking classes on sexuality and gender during undergraduate studies, after each class I better understood what and why certain things happened to me, and I also began to understand myself better and my challenge as a future teacher (Participant 24).

The excerpts above demonstrate the impact of specific training on both the personal and professional dimensions of pre-service teachers. The testimonies of Participants 29 and 24 show that, by taking the course on sexuality and gender, they

developed a theoretical understanding of the diversity, complexity, and nuances of gender identities and expressions, as well as enhanced capacities for self-analysis and recognition of others.

Therefore, it becomes evident that overcoming challenges related to addressing these themes in Brazilian schools fundamentally depends on understanding how future teachers perceive and engage with this content during their training. The path toward implementing a contextualized, socially, and culturally grounded approach—aimed at learning to coexist with differences—requires teachers to understand their own difficulties and the obstacles present in this debate. In this way, it becomes possible to intervene effectively and strategically in undergraduate curricula.

Historically, school-based sexuality education up to the 1980s and 1990s was grounded in strictly physiological and preventive principles. According to Foucault's (2007) analysis, this approach dates back to the late nineteenth century, when Biology began to share thematic territory with hygienist medicine. Such anatomical and physiological emphasis generated severe criticism (Louro, 1997), as it was taught in a harmful manner that ignored social and subjective dimensions and negatively impacted identity formation (Hall, 2008). Nunes (2000) argues that, within this context, Biology assumed the primary role in this discussion.

In times of crisis, the spread of AIDS and the increase in teenage pregnancy compelled significant changes. These factors legitimized institutionalized programs for discussing these themes (Furlani, 2008), calling upon schools and the discipline of Biology to fulfill this new role. The National Curriculum Parameters (PCNs) (Brazil, 1997) reinforced the importance of combating prejudice and discrimination, proposing that Biology address these issues in a contextualized and meaningful manner. However, merely assigning these topics within the curriculum does not guarantee the overcoming of a purely biological approach. This limitation is reflected in critiques found in official documents, which state that Biology teaching is “so distant from reality that it does not allow the population to perceive the close link between what is studied in Biology and everyday life” (Brazil, 2006).

Our research findings demonstrate that this formative gap persists and reveal how the absence of a social foundation has affected the lives of pre-service teachers themselves, as evidenced in the following testimony:

I was afraid of getting sick; I was afraid of having relationships. I had my first experience at the age of 20 because I was afraid of contracting AIDS. Now, through my studies, I understand this, and it challenges me toward teaching centered on subjectivities (Participant 13).

Paragraph I of Article 35 of the Lei de Diretrizes e Bases da Educação Nacional (LDBEN) (Brazil, 1996), by establishing the deepening of knowledge related to sexuality and gender in secondary education, aligns with references drawn from youth development studies. Sprinthall and Collins (2003) argue that during adolescence, sexual issues emerge alongside advances in self-regulation, emotional maturity, tolerance, respect, and self-acceptance. Therefore, teacher education must be capable of mediating this ethical and identity-related development.

Even today, representations of sexuality and gender within teaching practices persist within a naturalized and heteronormative discourse, widely disseminated in Science and Biology education. Drawing on Foucault (2007), Ariès (1981), and Peralva (1997), it becomes evident that the emergence of this debate within the curriculum was historically possible only within a specific configuration of knowledge. Such transformations, which occurred at the epistemic level, created conditions for the emergence of new fields of knowledge, particularly those that question the biological foundations of identity.

Advancing toward a contextualized perspective, we understand that the student in school cannot be viewed as singular, but rather as plural. Students are inserted into a much broader gender framework than that which is offered by simple biological definitions, since gender is a complex, non-natural construction that encompasses the spheres of the economy, the State, the family, and sexuality itself (Santos, 2015). These theoretical shifts enabled important advances, such as the understanding that terms like masculinity and femininity are grounded in history and gender politics. Thus, the expectation, as Britzman (1996) argues, is that issues of desire, love, affection, and identity will continue to surprise each subject.

5 Final Considerations

Ultimately, this study presented—through the perspectives of pre-service Science and Biology teachers—the challenges involved in discussing sexuality and gender with students in basic education. Our argument was supported by evidence that pedagogical training based exclusively on the anatomical–physiological model

generated fear and shame among future teachers—as illustrated by the case of Participant 13—and contributed to the perpetuation of discriminatory discourse within schools. The transition observed indicates that when the debate on sexuality and gender is incorporated into undergraduate education from a critical and subjective perspective, pre-service teachers are able to disengage the self from dominant biological discourses.

When addressing elements such as desire, love, and affectivity, identity is shown to be fluid and capable of surprising itself (Britzman, 1996). It is at this point that the critical perspective becomes urgent: it is inappropriate to seek a homosexual identity defined by fixed and immutable practices, as prescribed by determinist biological categories.

The main implication of this study is that future teachers must prioritize the pursuit of becoming (*devir*, a term used in Portuguese to express an ongoing and open-ended process of formation), mediating a continuous learning process about being in light of discoveries made throughout life, rather than fixing identities through labels. Insisting on rigid definitions of identity entails the risk of falling into the traps of normative thinking. Therefore, the central challenge of teacher education lies in preparing pre-service teachers to foster this process of becoming in the classroom, recognizing the plurality of subjects and constructing a biology education committed to social justice and the freedom to be.

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