

Transgender and intersexuality in Genetics Teaching: Limits and possibilities for a post-critical Biology

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Abstract

This work aims to analyze the limits and possibilities for a post-critical Biology through Queer Sexual Education, aiming to problematize essentialist discourses in the Teaching of Genetics for the (re)cognition of multiple identities/differences, such as (trans)genders and (inter)sexuals. Although distinct, both are socioculturally delegitimized and/or pathologized for deviating from cisgender normativity. To this end, we developed a lesson plan related to the Teaching of Genetics in a Queer approach, making it possible to extrapolate biological limits and assume sociocultural issues about bodies, genders and sexualities. As biologist-educators, we problematize essentialist discourses, seeking to (de)construct knowledge and practices on such themes, through cultural artifacts, such as films and music. Thus, we point out problematizations to question essentialist and fundamentalist discourses based on biological determinism, seeking (re)knowledge about the diversity of bodies from the subversion of queer approaches, by encouraging the (de)construction of a post-critical, plural and transitory Biology.

Keywords

Biology; intersexuality; Genetics; transgender.

Transgeneridade e intersexualidade no Ensino de Genética: limites e possibilidades para uma Biologia pós-crítica

Resumo

Este trabalho objetiva analisar limites e possibilidades para uma Biologia pós-crítica por meio de uma Educação Sexual Queer, visando a problematizar discursos essencialistas no Ensino de Genética para o (re)conhecimento de múltiplas identidades/diferenças, como (trans)gêneros e (inter)sexuais. Embora distintas, ambas são, socioculturalmente, deslegitimadas e/ou patologizadas por destoarem da cisgender normatividade. Para tanto, desenvolveu-se um plano de aula referente ao Ensino de Genética em uma abordagem Queer, possibilitando extrapolar os limites biológicos e assumir questões socioculturais sobre corpos, gêneros e sexualidades. Enquanto biólogos/as-educadores/as, problematizaram-se discursos essencialistas, buscando (des)construir saberes e práticas sobre tais temáticas, por meio de artefatos culturais, como filmes e músicas. Assim, apontaram-se problematizações para questionar discursos essencialistas e fundamentalistas alicerçados no determinismo biológico, buscando (re)conhecimentos sobre a diversidade de corpos a partir da subversão das abordagens Queer, ao encorajar a (des)construção de um Biologia pós-crítica, plural e transitória.

Palavras-chave

Biologia; intersexualidade; Genética; transgêneros.

Transgeneridad e intersexualidad en la Enseñanza de la Genética: límites y posibilidades para una Biología poscrítica

Resumen

Este trabajo se propone analizar los límites y posibilidades de una Biología postcrítica a través de la Educación Sexual Queer, buscando problematizar los discursos esencialistas en la Enseñanza de la Genética para el (re)conocimiento de múltiples identidades/diferencias, como (trans)géneros e (inter)sexuales. Si bien distintas, ambas son socioculturalmente deslegitimadas y/o patologizadas por desviarse de la cisheteronormatividad. Para ello, se desarrolló un plan de clase relacionado con la Enseñanza de la Genética en un enfoque Queer, posibilitando extrapolar los límites biológicos y asumir cuestiones socioculturales sobre cuerpos, géneros y sexualidades. Como biólogos-educadores, se problematizaron los discursos esencialistas, buscando (de)construir conocimientos y prácticas sobre dichos temas, a través de artefactos culturales, como películas y música. Así, se señalaron problematizaciones para cuestionar los discursos esencialistas y fundamentalistas basados en el determinismo biológico, buscando (re)conocimiento de la diversidad de cuerpos desde la subversión de los enfoques Queer, fomentando la (de)construcción de una Biología postcrítica, plural y transitoria.

Palabras clave

Biología; intersexualidad; Genética; transgeneridad.

1 Between bodies and genes: Queer questions

If the chromosome pairs that classify "men" and "women" are XY and XX, where would men and women with gender identities discordant from the cisheteronormative standard fit in? This is one of the questions we take as a starting point for problematizing Genetics classes for high school students in Biology classes.

In several schools in Cariri, Ceará, there are transgender teenagers, and (re)thinking about their challenges throughout the journey of (re)constructing their identities/differences makes us question: How do these transgender students feel about attending Genetics classes with an essentialist approach that disregards their gender identities/differences? At the same time, we also need to ask: how are intersex people being represented in these classes and teaching methodologies? If this identity is being mentioned or studied, what terminology is being used? What teachings are being (re)produced for students? If derogatory terms are being used, how can we abandon this discourse and adopt inclusive and respectful language? What is the role of a Sexual

Education "beyond the biological" (Souza, 2018; Souza; Santos, 2021) within a Queer approach (Furlani, 2011) in these discussions? Why is Genetics Education still so focused on binaries, and how can we overcome them? From this perspective, it is possible to recognize the (in)numerable questions that emerge from this topic if we stop to think about it from a perspective that tries to problematize. Therefore, Post-Structuralism and the perspective of Cultural Studies are the main guiding theories of this study.

Although we know that Queer theory is post-identity, here we use the concepts of identities and differences as relational and produced historically and socioculturally by a heterogeneity of discourses marked by power-knowledge relations (Silva, 2015). This includes discourses from the field of Biology. According to Butler (2003), identities (including gender identities) are the result of performative acts that become naturalized through repetition. However, these acts constitute discursive processes. In this framework, identity and difference are not viewed as innate characteristics, but rather as relational processes of signification. These processes are shaped by power dynamics that determine what is normalized as identity and what is perceived as difference. So, according to Firmino and Porchat (2017, p. 57):

[...] if people need to be recognized as men or women to 'have' a gender identity and consequently an intelligible identity, and these categories – man and woman – concern a discursive production, it follows that identity itself is a discursive production, an effect of discourse.

Moreover, "Queer theory proposes questioning epistemes (assumptions of knowledge), what we understand as truth, the notions of a masculine essence, a feminine essence, an essence of desire" (Vieira, 2015).

The anatomical, physiological, and genetic compositions of human beings, as well as their embryological, endocrine, and reproductive processes, are some of the main themes of study in Biology. This field is considered "indisputable" when used to undermine gender identities that challenge essentialist views of "masculine" and "feminine" bodies. When taking on the challenge of acting as a sex educator, Furlani (2021, p. 91-92) understood that Biology also has the position of:

[...] field of knowledge that was used to reinforce prejudiced understandings, particularly the idea that human sexuality should only be justified by reproduction and that heterosexuality is the only acceptable sexual orientation [...].

This author also understands that this area of knowledge "[...] goes beyond the transmission of systematized knowledge about our scientific field" (Furlani, 2021, p. 92), as it also has the role "[...] of reflecting and questioning the argumentative and explanatory uses that have been made by those who appropriate Biology to reinforce prejudices and discrimination" (Furlani, 2021, p. 92).

For a long time, transgender identities were psychopathologized (Tenório; Prado, 2016); however, this psychopathologizing process has shown "[...] much more the effort to maintain hierarchies of knowledge and scientific power as forms of regulating social norms and coercing and submitting to gender norms [...]" (Tenório; Prado, 2016, p. 42).

In addition to transgenderism, intersexuality is another identity that subverts cisheteronormative notions. Some medical literature defines intersexuality as an "anomaly." According to Silva and Silva (2021, p. 580), "the biomedical field consolidated the idea in the 20th century that intersex bodies present chromosomal and gonadal/genital variations that disagree with binary logic and sex-gender alignment.". From this perspective, it is worth problematizing how Genetics is taught, a field within the Biology realm. We can question the limits and possibilities of recognizing transgender and intersex identities within biology itself. "[...] by problematizing essentialist discourses and understanding biology as a sociocultural production of multiple expressions of life, we can talk about 'biologies,' considering the plurality of knowledge, practices, identities, and differences that this discursive field encompasses." (Souza, 2018, p. 131).

In Chapter 1 of her book "Sexing the body: Gender politics and the construction of sexuality: Dualisms in duel", Fausto-Sterling (2000) reports an Olympic case from 1988: Spanish athlete Maria Patiño failed the "sex test" for having the Y chromosome in her genetic makeup, in addition to the absence of ovaries and uterus. The International Olympic Committee (IOC) deemed Patiño "not a woman" and barred her from the Spanish Olympic team. Other "consequences" included Patiño losing titles she had won, being barred from returning to competition, and having a scholarship revoked. After countless medical expenses, it was concluded that Patiño had an intersex body, which was technically termed Androgen Insensitivity Syndrome, meaning her body possessed biological variations present in both "female" and "male" bodies.

However, Patiño's case is not the only one of its kind. At the 2024 Paris Olympics, the world was confronted with controversy and fake news. J.K. Rowling, renowned for writing the Harry Potter series, incited a series of transphobic attacks online against Algerian boxer Imane Khelif. Rowling accused Khelif of being transgender after her opponent, Italian boxer Angela Carini, abandoned the fight 46 seconds into the match:

'The smirk of a man who knows he is protected by a misogynistic sporting establishment, preying on the anguish of a woman he has just punched in the head and whose life's ambition he has just destroyed,' wrote J.K. Rowling via X (formerly Twitter).

The incident was fake news. Khelif is not a transgender woman but rather a cisgender woman with high testosterone levels that deviate from what is considered "normal" for a "feminine" body. Cases like those of Patiño and Khelif could signify an absence of topics related to intersexuality in genetics education. This absence demonstrates the urgency of addressing these topics so that students can build knowledge and reframe misconceptions about these identities/differences.

From this perspective, according to medical definitions, "an intersex person may not have a chromosomal sex, external genitalia, or internal reproductive system that corresponds to the standards considered normal for male or female" (Tilio; Haines, 2021, p. 3). Thus, the concept of gender is essential to recognizing the multiple identities and differences of transgender men and women by decoupling biological sex and gender. But how can intersex people perform gender when biology places them at a crossroads or on the border?

Butler (2003, p. 24) argues that:

If gender is the cultural meanings assumed by the sexed body, it cannot be said that it derives from a particular sex. Taken to its logical limit, the sex/gender distinction suggests a radical discontinuity between sexed bodies and culturally constructed genders. Assuming for a moment the stability of the sex binary, it does not follow that the construction of 'men' applies exclusively to male bodies, or that the term 'women' refers only to female bodies.

According to Butler (2003), gender is not inherent to biological sex. Rather, it is a social and cultural construction that promotes independence from biological sex. Thus, gender identity goes beyond the concept of alignment between gender and biological sex.

Beyond identities/differences, a strategic movement of critical anti-systemic politics of (re)affirmation and resistance is also fundamental: the transfeminist movement. In 1851, black feminist Sojourner Truth asked, "Ain't I a Woman?" with the aim of enabling the recognition of black femininities and also how these women are agents of the feminist movement. In her book *Transfeminism*, part of the book collection *Plural Feminisms*, Professor Letícia Nascimento (2021), from the Federal University of Piauí (UFPI), reworks Truth's question: "And can't I be a woman?", because Nascimento is a transgender woman and aims, with this problematization, at the inclusion and (r)existence(s)istence of transgender women in the feminist movement, as well as their validation as women in a cisgender normative society that uses biological binaries to make their gender identities unviable and disregard them.

It is worth noting that:

However, by directing the focus to the "fundamentally social" character, there is no intention to deny that gender is constituted with or on sexualized bodies. In other words, biology is not denied; rather, the social and historical construction produced on biological characteristics is emphasized (Louro, 2003, p. 21-22).

In this sense, it is important to mention the potential obstacles that genetics teaching based on a queer approach could face. "In recent years, we have witnessed the emergence of reactionary religious activism in dozens of countries on all continents that has found 'gender' to be the main theme of its mobilizations." (Junqueira, 2017, p. 25).

The main movements with this aim were "baptized" as "Gender Ideology" and "School without Party", having as main representatives and disseminators: politicians – including senators, deputies, and councilors – conservative, making it necessary to confront the so-called "Gender Ideology" (Junqueira, 2017; Souza; Meyer; Santos, 2019). According to Rosa, Zanette, and Felipe (2021), these reactionary movements have achieved little more than the establishment of a moral panic, distorting and criminalizing important theoretical concepts related to sexuality and gender. These movements are not new organizations. In fact, they have been active since 2004, focusing:

[...] [...] an initiative against the use of schools and universities for ideological, political, and partisan propaganda purposes, also a bill, initiated in 2014 and archived in December 2018 by the National Congress, but with the implementation of similar laws in several cities in Brazil (Rosa; Zanette; Felipe, 2021, p. 239).

In any case, these conservative movements partially achieved a “victory”, as they managed to prevent the term “gender” from being included in the final version of the Plano Nacional de Educação (PNE), approved in 2014. “Partially,” as this doesn't completely inhibit the exploration of sociocultural themes such as body and gender, providing an opportunity for intercultural and (trans)disciplinary teaching. “It is precisely within this framework that the affirmation of queer politics and theory must be understood.” (Louro, 2001, p. 546).

Queer theory problematizes and confronts conservative movements such as “Gender Ideology” and “School without Parties,” which attempt to prevent the approach to sexuality and gender issues, causing fear and insecurity in educators; even if they are not being directly observed in their teaching work, a feeling of threat and surveillance hangs over them. “Gender Ideology,” however, not only works as a prohibitive and punitive device, but also generates resistance, since we, educators, continue to fight, resisting and confronting discourses and legislation that attempt to prohibit approaches “[...] fundamental to building a more egalitarian society, with less sexism, feminicide, LGBTphobia, and transphobia. Resistance is not a one-off action; it is building a way of being and thinking based on a reference point and a social place.” (Arruda; Soares Junior, 2021, p. 14).

From this perspective, as Biology teachers, it is up to us to problematize and deconstruct devices, discourses, and narratives that reinforce binarisms and essentialisms about sexuality, body, and gender.

Therefore, the conditions that enabled the emergence of the queer movement go beyond specific gay and lesbian political and theoretical issues and must be understood within the broader framework of poststructuralism. Indeed, queer theory is linked to strands of contemporary Western thought that problematized classical notions of the subject, identity, agency, and identification throughout the 20th century (Louro, 2001, p. 547).

To this end, a Sexual Education that goes beyond the boundaries of the biological (Souza, 2018), in a Queer approach (Furlani, 2011), would encourage a subversion of essentialist classifications and discourses that delimit binaries and pejorative representations regarding sexual and gender identities that differ from the cisheteronormative standard, favoring the process of deconstruction of such standardizations. In this direction, “[...] queer theory goes beyond the analysis and

critique of sexual identities and differences. We can speak of queer epistemology, that is, 'a way of thinking, a way of producing, articulating and problematizing knowledge' (Furlani, 2011, p. 35), in this case, Genetics and other subareas of Biology, enabling a pluralistic teaching, which puts any essentialisms under analysis.

As biologists and educators, we emphasize the importance of questioning from the outset of teacher training and throughout one's career. Biology is a science based on essentialist and universalist discourses. Recognizing the multiplicity of lives prompts us to question the singularity and universality of biology as a field of knowledge. We speak, therefore, of multiple biologies, assuming an infinity of knowledge, practices, discourses, subjectivities, identities, and differences, and voices. Intersex and transgender individuals, for example, have been silenced and deserve a prominent place in the teaching of lives beyond the biological (Souza; Maknamara, 2024). Furthermore, Trujillo (2023, p. 145) proposes Queer feminism for all within the educational field, since:

Queer feminist epistemologies, with their critique of normality and binarism, their teaching of respect for differences, and their intersectional perspective, are more necessary - and urgent - than ever. Inside and outside the classroom, on the streets, in schools, for everyone, everywhere.

As a Science undergraduate in partnership with two biologists and educators, we consider it essential to promote a Genetics Teaching "beyond the biological", using this moment as an opportunity to enable the recognition of transgender and intersex identities and (de)construct (mis)information from (and for) a post-critical Biology. To this end, Sexual Education, in a Queer approach, would be a powerful path, aiming to destabilize essentialisms and go beyond the biological, mainly because:

[...] the school subject Biology and teacher training courses in Biological Sciences are, in general, demarcated by the idea of organization, classification, anatomical-physiological, and genetic representations of what can be understood as masculine and feminine [...] (Santos; Silva, 2019, p. 148).

In this sense, the main objective is to analyze limits and possibilities for a post-critical Biology, through Queer Sexual Education, aiming to problematize essentialist discourses in the Teaching of Genetics, to favor the recognition of identities/differences, such as transgender and intersexual. Furthermore, we highlight the guiding questions of this work: in what ways could biologists/educators (de)construct essentialist discourses

on transgenderism and intersexuality in Genetics classes? Thus, we problematize: what limits and possibilities would a post-critical Biology, based on Queer Sexual Education, provoke in Genetics Teaching?

2 Methodological path towards Queer epistemology

This work was the result of an activity developed in the subject of Instrumentation in Biology Teaching, taught by the second author, present in the curriculum of the undergraduate degree in Biology at Instituto de Formação de Educadores (IFE), *campus* of the Brejo Santo, Ceará (CE), in the Universidade Federal do Cariri (UFCA). The activity involved a problematization exercise based on an acrostic, in which students had to relate the word “Biology” to eight questions and use it to (re)create a lesson plan.

Table 1 – Acrostic in Biology Teaching

Subarea that most identifies with:	Post-critical biology
Invertebrate animal:	<i>Ophiocoma wendtii</i>
Angiosperm plant:	<i>Orchidaceae</i>
Notable biologist:	Anne Fausto-Sterling
What can't be missing in a Biology class:	Gamification
A complex subject:	Genetics
A teaching methodology:	Interculturality
A film to teach Biology:	The Danish girl (2015)

Source: Authors' own (2024).

The author conceived the idea of developing a genetics class that included issues related to transgender and intersexuality. The class would serve as a problematization object, aiming to (de)construct knowledge and learning about transgender and intersexual identities, inspired by Foucault's discourse analysis.

Foucaultian discourse analysis enables the examination of a set of statements by analyzing the power dynamics involved in their dissemination and simultaneous or successive appearances. In other words, it involves describing and analyzing systems of dissemination to identify patterns (correlations, transformations, etc.). Statements are based on discursive formations that encompass different fields of knowledge (for example, Biology) involved in the production of discourses, as well as such formations

presuppose (non) discursive practices, which determine rules and relationships within a discourse (Foucault, 2015).

3 Deconstructing essentialisms and (re)constructing Queer approaches

Although transgenderism and intersexuality are distinct identities, one a gender identity and the other related to sexual ambiguity, both are delegitimized and/or pathologized by countless discourses anchored in cisheteronormative views. In other words, they are identity markers made invisible in "traditional" genetics education. Teaching genetics through an essentialist approach reinforces binaries such as male/female, penis/vulva, and XY/XX chromosomes. This leads to the disregard of transgender identities. Furthermore, this approach can lead to the pathologizing of intersexuality. Even though intersexuality is not a topic covered in biology classes, its mention may be superficial and fail to address this identity meaningfully.

In this context, we return to the guiding questions of this study: in what ways could biologists/educators (de)construct discourses on transgenderism and intersexuality in Genetics classes? Thus, we problematize: what limits and possibilities would a post-critical Biology, based on Queer Sexual Education, provoke in teaching Genetics?

The author developed a lesson plan with a queer approach to allow articulation with transgender and intersex identities. It should be noted that the acrostic was only used as a means of developing the lesson.

In this regard, we highlight the lesson plan: the topic of the class would be "Teaching Genetics from a Post-Critical Biopedagogy," whose main objective is to promote the recognition of transgender and intersex individuals. The syllabus would be "Genetics and Biotechnology Today," a chapter on Genetics Education found in the textbook¹ of a high school in Cariri, Ceará. The cultural theme would be "Transgenderism and intersexuality and their articulation with the Teaching of Genetics and Queer Sexual Education".

¹ The textbook mentioned was: *Moderna Plus: Ciências da Natureza e suas tecnologias* (Amabis et al., 2020). Although the objective of this study is not to analyze a textbook, the author needed to find out which year of high school deals with the Teaching of Genetics and whether the themes of transgenderism and intersexuality are present in the book.



This way, we can highlight the objectives to be achieved:

- (1) Explore the interrelationship between anatomical, physiological, and genetic compositions and gender identities.
- (2) Questioning biological determinism to enable the recognition of transgender and intersex individuals in socio-educational spaces.
- (3) Promote interculturality and transdisciplinarity in Genetics Teaching, integrating sociocultural discussions through Queer Sexual Education.

By articulating Genetics teaching with transgenderism and intersexuality, it is possible to understand the potential to deconstruct essentialist discourses that directly impact the social environment, such as, for example, biological determinism:

Using biological differences to hierarchically position or qualify women and men in society (determining their lifestyle or what should be appropriate for them) is what we call Biological Determinism. That is, when Biology is used as a parameter to determine what is socially acceptable for women and men, or when Biology defines what is considered normal - even if this determination is arbitrary - we are witnessing Biological Determinism in action (Furlani, 2021, p. 93, our emphasis).

From this perspective, we analyze the limits and possibilities of creating a biology education free from prejudice and discrimination against transgender and intersex people, especially in the subarea of genetics. To achieve this, we must challenge essentialist discourses and binarisms imposed by cisgender normativity, which is based on biological determinism. Part of this is to question the way high school students learn Genetics, since they usually learn that "male bodies" are composed of XY chromosomes and "female bodies" are composed of XX chromosomes:

Biology textbooks still argue that bodies with XX chromosomes are female and XY chromosomes are male, committing a serious analytical leap that disregards social markers of gender. An XX body will manifest a uterus, vagina, and breasts, but to then assert that this body is female, I must consider an entire sociocultural and psychological process of constructing subjectivities. This reality, manifested in textbooks, which also defines male and female reproductive systems as if these organs served only for reproduction and, further, as if they erroneously had genders, is constructed based on the projections of a cisgender heterosexual majority, which pays little attention to problematizing intersexuality, as well as the identity processes of transgender, agender, and other gender-dissident people (Pagan, 2021, p. 115).

In this sense, it is worth asking them: what makes a body "masculine" and/or "feminine"? Theoretically, biologists/educators who (re)convey this concept would not be

wrong, but it is a view that limits the understanding that genetic makeup is not always aligned with gender identity, making it impossible to recognize transgender men and women, as well as excluding intersex people: "In other words: Biological Determinism is when Biology is used as the criterion of normality; when Biology is used as the only aspect that justifies behavior defined as natural." (Furlani, 2021, p. 93). These behaviors include gender identities that are out of alignment with their bodies and sexual systems, as well as intersex people, especially those who reject hormonal surgical processes for "body correction" and/or have genetic makeups such as XX/XY mosaics, for example.

Simone de Beauvoir, one of the main precursors to questioning sexual hierarchy due to "sexual differences," reflected on this idea in her classic book *The Second Sex II: Lived Experience*, enabling gender scholars to further explore the concept. She wrote, "No one is born a woman; one becomes a woman." (Beauvoir, 1967, p. 9). Although this quote from Beauvoir (1967) is limited to the oppressions experienced by women in a cisheteropatriarchal society due to their biological characteristics, it is also possible to extrapolate this reflection and adapt this understanding to the recognition of transgender and intersexual identities.

It is worth noting that:

It's not because biology isn't important, but because education is what allows us to change, as a process of formation and modification of the individual, based on the acquisition of knowledge and the development of deconstructive, logical, philosophical, and critical reflection. Let us never lose sight of this: even if biology 'explains' certain behavior to a certain extent, what interests us is what, in the individual, in the person, in the individual or collective context, can be rethought and modified by the educational process (Furlani, 2021, p. 96).

Therefore, biologists and educators are responsible for promoting biology education that achieves these objectives in conjunction with other areas of knowledge.

To this end, one can begin to think about gender from a Foucauldian theoretical perspective, which sees sexuality as a 'sexual technology'; in this way, it would be proposed that gender, as representation and as self-representation, is also a product of different social technologies, such as cinema, for example, and of discourses, epistemologies and institutionalized critical practices, as well as of the practices of everyday life (Lauretis, 1994, p. 208).

Rios, Cardoso, and Dias (2018) emphasize that teacher training demands the incorporation of the themes of sexuality, body, gender, and sexual diversity into school



curricula, as educators are often called upon to recognize and embrace the multiplicity of identities/differences. Thus, the authors argue for the power of a Queer curriculum as a strategy for subverting sexual and gender norms, aiming to develop a vibrant teaching approach that transcends specific content, prioritizes social relations, and deconstructs sexist pedagogical practices (which reinforce gender inequalities from early childhood education onward). To this end, teacher training for diversity is necessary.

In this path, in school curricula and teacher training, Sex Education classes with a Queer approach, which contemplate the experiences of transgender and intersex people, become indispensable to understand the dilemmas of bodily and psychological (self)dissatisfaction of transgender men and women, as well as the journey of intersex subjects. The Danish Girl is a powerful cultural artifact that encourages students to reconsider issues of sexual and gender identities and differences. This 2015 biopic depicts the life of Lili Elbe, a Danish transgender artist who was one of the first people to undergo sex reassignment surgery. The film depicts Elbe's journey to embrace her transgender identity. By watching the film, high school students can become more aware of the emotional, physical, and psychological challenges of self-acceptance and how a cisheteronormative society reacts to them. However, this cultural artifact has its limitations. "The Danish Girl" requires further analysis because Einar Wegener's (Eddie Redmayne) "discovery" of his transgender identity through contact with women's clothing could be confusing. Furthermore, the film focuses heavily on the conflicts that emerged in the relationship between Einar and his wife, Gerda (played by Alicia Vikander). Another issue is that the role is being played by a cisgender actor. In addition to this classic film, there are countless others related to gender identity, such as the 2022 Netflix drama *Valentina*², such as the 2022 Netflix drama *Valentina*, starring a trans* actress.

The use of the song "Born This Way" by American artist Lady Gaga would be a crucial tool for instilling respect and acceptance for people who deviate from cisheteronormativity. At one point in the song, Gaga sings: "It doesn't matter if you're gay, straight, bi, lesbian, or transgender," which refers to the process of acceptance, as many LGBTQIAPN+ individuals face internalized homophobia due to social oppression.

² Synopsis available at: <https://www.adorocinema.com/filmes/filme-297314/>. Accessed on: January 10, 2025.



In this context, a post-critical Biology would argue about the contemporary process of creating a post-human, to glimpse beyond biological determinism and think together with Haraway (2016) about didactic-methodological strategies, knowledge and practices to study and teach not "[...] so much biology as a research science, but the way in which it is part of politics, religion and culture in general" (Kunzru, 2016, p. 29). In Biology teaching, especially in Genetics classes, we, educators, could (re)create approaches and cultural artifacts to problematize essentialisms, recognizing that "[...] women (and men) are not natural, but constructed, just like a cyborg, so, given the right tools, we can all be reconstructed" (Kunzru, 2016, p. 25).

Tensing the knowledge and practices of the so-called "science of life" demands deconstructing the idea of "absolute truth" to rethink biology (and its teaching) as multiple, localized, contingent, and cultural. After all, whose lives are we talking about? "[...] There are moments in life when the question of knowing - that one can think differently than one thinks, and perceive differently than one sees - is indispensable to continue looking or reflecting." (Foucault, 2014, p. 13). How could one "think differently than what is thought" about Genetics classes and teaching Biology based on cultural artifacts?

Thus, Pagan (2018, p. 77) asks: "Is being a woman having a vagina? And why do they continue to say that a transgender woman, who has undergone genital reassignment, is not a woman? Is being a woman being XX? But what about the case of X0, XXY people? [...]", aiming to destabilize the pseudo-arguments anchored in "scientific" discourses that operate as delegitimizers of identities/differences of transgender and intersexual subjects.

Biology as the "science of life" goes beyond chromosomes, genes, laboratories, and (de)limited places, because: "[...] Life is always a 'between', a multiple body that multiplies and differentiates itself, life is becoming" (Chaves, 2020, p. 100). By using cultural artifacts to give visibility to different life stories and allowing multiple experiences to invade the school, we envision new curricular horizons, deconstructing essentialisms that impose limits on teaching knowledge and practices and (re)constructing possibilities in Biology Teaching such as: "[...] a space for thought, for language, for sensitivity and for action (and above all for passion)" (Larrosa, 2014, p. 75).

5 Transitory considerations

In this context, we question biological discourses that permeate the dimensions of sexualities, bodies and genders, with an emphasis on the human body and reproduction, through specific content from genetics, anatomy, physiology, and other related areas, which reinforce naturalizations and essentialisms based on biomedical discourses, highlighting that Biology Teaching requires problematizations, questionings and (de)constructions of knowledge and practices. How might cultural artifacts enable us to explore different paths and discover new knowledge and practices in science and biology?

The initial problematizations led us to other questions that highlight how much Biology Teaching and other (trans)disciplinary fields urge for knowledge and practices that highlight creativity, subjectivities and transformation movements, aiming to subvert essentialist discourses on body, gender and sexuality, assuming that we are multiple and that both intersex and transgender people have the right to enjoy human freedom, to (re)cognize themselves beyond identities/differences as subjects of a changing culture, especially in socio-educational spaces.

From this perspective, students and teachers in schools and universities advocate for social, cultural, and political changes in school and academic curricula, as well as in approaches to sexual education. These changes are seen as powerful possibilities for reconstructing biology teaching based on empathy, affection, and plurality of subjects, knowledge, and practices. To this end, we emphasize that Biology Teaching and Curriculum, schools, and other socio-educational spaces could open new didactic and methodological horizons, especially through the problematization of cultural artifacts. Thus, we emphasize that the strangeness, subversion, and boldness of Queer approaches could encourage the (de)construction of a post-critical, plural, and transitory Biology.

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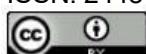
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DATA AVAILABILITY

The entire dataset supporting the results of this study has been published in the article itself.

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