



Exploring Gender Constructs: Colombian and Mexican Biology Teachers' Perspectives

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Accepted: 19 March 2024
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Abstract

The traditional relationship that has been constructed between gender and biological sex has been characterised by a mimetic perception between the two concepts, in which gender seems to reflect sex, or at least to be limited by it. This issue has given rise to reflections, questions and criticisms that try to identify how it is expressed in different social contexts, such as schools. In this sense, this research explores the views of secondary school biology teachers on the concepts of sex and gender. To this end, an exploratory qualitative study was carried out. Semi-structured interviews were conducted with Colombian and Mexican teachers and interpreted using discourse analysis. It is concluded that there is a weak differentiation between the concepts of sex and gender, a perception of neutrality of school biology with regard to identity construction, and a deterministic perspective of biology with regard to gender.

1 Introduction

The assumption of a direct correspondence between sex and gender, prevalent in both science and everyday life (Štrkalj & Pather, 2021), requires individuals to be classified into two categories (male or female) based on the belief that they correspond to the biological conditions inherent in each sex. However, this assumption has been widely challenged, as gender is a social construct influenced by cultural meanings, personal and social aspects and historical and socio-cultural diversity, and cannot be reduced to a single characteristic such as sex (Butler, 1990; Fausto-Sterling, 2012; Joel & Vikhanski, 2020). It is argued that it is difficult to find sets of exclusively masculine or feminine characteristics that transcend human history and socio-cultural diversity.

The sex-gender continuum is informed by biological research which reveals differences between men and women beyond the traditional 3Gs of sexual differentiation (Joel, 2012). While biology is essential to understanding human nature, it is important to be cautious

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of biological determinism, which overemphasises biology and diminishes the influence of culture on social phenomena (Astorino, 2019; Lewontin et al., 1984).

The relationship between biology and social and cultural studies of gender is complex (Guerrero, 2014). While biology can provide insights into issues such as sexual preference and gender identity, gender biases can influence questions, interpretations or methodologies in biological research (Lundin, 2014). In contrast, a gendered perspective could enrich life sciences research by avoiding these biases.

In the field of education, it is crucial to recognise the expression of tensions in school biology. In many countries, biology covers aspects of sex education, which can inadvertently reinforce sexist and essentialist ideas about gender. Despite this, there is a lack of research on the subject. It is important to understand how ideas, beliefs and emotions influence students', teachers', parents' and communities' perceptions of sex and gender. Morgade (2011) suggests that formal education often fails to take a critical perspective on the relationship between sex and gender, which hinders the development of inclusive educational environments and contributes to identity construction and social development (Lundin, 2014; Plaza & Meinardi, 2009).

In this scenario, questioning how biology teachers perceive and respond to LGBTIQ students, and their experiences and discourses about their role in the school in terms of reinforcing or challenging power structures, becomes pivotal (Lundin, 2014). This is because the discourses represent an evaluation of appropriate or inappropriate actions and attitudes (Frohard-Dourlent, 2016). In this sense, it is possible to look through the discourses at the practices favoured by teachers and, in the case of biology, to show how biology can be part of a discourse that justifies discrimination.

In light of the above, the central aim of this research is to explore the perspectives of biology teachers in relation to the concepts of sex and gender. The main aim is to explore and better understand teachers' perceptions and approaches to the interrelationship between sex and gender, as well as their practical experiences of dealing with these issues in the school environment. More generally, it is expected that this research will contribute to the knowledge and understanding of how biology teachers view the concepts of sex and gender, which will enable a more effective and sensitive approach to sex education in schools.

In order to achieve this aim, the research will address the following question: "What are biology teachers' views on the relationship between sex and gender and how do they address these issues in their teaching?" The study is exploratory in nature and aims to provide a detailed picture of the perceptions and experiences of the teachers involved. It is important to note that the geographical scope of the research was limited to teachers in Mexico and Colombia. In these countries, biology teachers have a relevant role in sexuality education, as they are responsible for integrating sexuality education into the curricula of this subject. In addition, Mexico and Colombia have other socio-cultural similarities, which are noted below.

2 Theoretical Background

2.1 Biology, Sex and Gender

The categories of sex and gender do not refer to the same characteristics. The latter is not directly derived from the former (Ha, 2011; Lamas, 2013; Muehlenhard & Peterson, 2011). Gender refers to a set of sociocultural relations, including norms, laws, positional

power, behaviours and roles that are expressed in the individual and social sphere and vary across cultures and time (Aivelo et al., 2022). This contrasts with an essentialist view of gender as involving natural, discrete and immutable characteristics (Donovan et al., 2019), which allows for the definition of two mutually exclusive categories. Biology has played a key role in this. A look at the history of biological research reveals an ongoing interest in identifying differences between men and women in anatomical, physiological, cognitive, psychological and other ways. For example, in the early twentieth century, the essence of male and female was sought in hormones, leading to now discredited ideas about the existence of exclusively male or female hormones to explain these essences scientifically (Oudshoorn, 2003). Statements such as the following are common among people and in the mass media: “Neuroscience has confirmed that the female brain has a more developed communication and emotional centre than the male brain, which is primed for empathy and therefore its social role is to care for others”. The male brain, on the other hand, has a more developed sexual and aggressive centre, primed to build systems, making it suited to activities such as hunting, travelling and finance (Joel & Vikhanski, 2020). However, despite their popularity, these ideas are not firmly supported by scientific evidence, as several studies have pointed out (Eliot et al., 2021; Joel, 2021). With respect, Boltě et al. (2023) state that “the organisation of the human brain does not show dimorphism, but rather a mosaic of female- and male-typical features on multiple continua” (p. 138). In addition, these authors highlight the fact that there is no consensus in neuroscience about sex differences in the brain:

The literature on sex/gender differences in the brain is inconsistent, although some findings are more established, including on average larger whole brain, limbic and temporal regional volumes in males, and larger cingulate and prefrontal regional volumes in females. Some differences have been associated with males performing better on average in perceptual and motor tasks and females performing better in analytical, intuitive processing and communication skills, a difference that is thought to be mediated by prenatal differences in sex hormones. (p. 138)

In biological thinking, there is a tendency to consider biological traits as determinants of human social roles, leaving aside the cultural nature of human behaviour (Dupré, 2017). This debate on the relationship between nature and nurture concerns the role of the interaction between genes and the environment in determining the behavioural traits that develop in an individual. In other words, the debate is about whether human nature can be explained by our genes or whether it is necessary to recognise that environment and culture enable the expression of different behavioural traits that are not fixed but contingent. In the words of Lewontin et al. (1984), “humanity cannot be divorced from its own biology, but neither is it chained to it” (p. 23).

Deterministic ideas have created or reinforced the naturalised social construction of gender, building a very deep demarcation between two sexes and generating a biological principle of reality, in other words, biologising the social and cultural division into two sexes (Bourdieu, 1998; Fausto-Sterling, 2006). This tendency has been referred to as gender essentialism, which influences not only scientific thinking but also human behaviour. In this sense, people might reinforce their gender stereotypes by assuming that they are based on human nature, for example, the belief that women’s and men’s brains have important differences, and consequently different behaviours, as an adaptive response of the species (Fine et al., 2017). Behavioural traits, such as male aggression, are then explained as brain traits linked to sex and as an evolutionary adaptation. For these reasons, it is important to

understand the differences between sex and gender and their implications for education (Aivelo et al., 2022).

School biology is no stranger to discourses of sex and gender. It has often been reported how disciplinary content reinforces discriminatory ideologies and the status quo (Junkala et al., 2021; Morgade, 2011; Plaza & Meinardi, 2009; Prado & de Queiroz, 2019). Some studies have shown that biology textbooks overemphasise sexual dimorphism between women and men (Bazzul & Sykes, 2011; Esquivel, 2020), confirming that hormones cause radical differences in the way people feel, perceive the world and think between the sexes. With respect, Aivelo et al. (2022) state: “Sexual behaviour is often discussed in terms of evolutionary or hormonal determinants. Furthermore, stereotypical attributes of women include emotionality, softness, diligence, and social skills, while men are described as aggressive, competitive, and thrill-seeking” (p. 10). These ideas became the justification for heteronormativity as a social norm and the representation of inequality between men and women as a natural phenomenon (Caetano et al., 2016). However, biology can help people construct their identity by providing a broad perspective on human diversity and sexuality, as well as sexual and reproductive strategies in nature. It is important to recognise the impact of biological discourses at a social and individual level, and to avoid naturalising human behaviours and transferring them to other species. As Bazzul and Sykes (2011) state: “What is certain is that all of us in science education need to abandon a universally deterministic view of the human body for one that is open to change and reconceptualisation” (p. 283).

2.2 School Biology and Identity Construction

Schools and classrooms are spaces that contribute to the construction of subjects’ identities through the interaction of values, traditions, symbols and beliefs (Prado & de Queiroz, 2019). Identities are a personal and social construction in which subjects change and adapt their ways of conceiving and acting in the world in relation to the socio-cultural context in which they find themselves (Hall, 1996). In other words, identities are the ways in which we relate to others (subjects, knowledge, institutions, etc.) in any given moment or space and are highly contextual (Fine, 2010). Despite the personal nature of the construction of identities, they are closely linked to customs, culture, social life, etc. (Torras, 2007).

In school, the confluence of different fields of knowledge shapes new ideas, ways of seeing the world and rules for acting on it (Youdell, 2006). In school biology in particular, ideas about life, the relationships between living things, the nature of the human being and the body are discussed. This knowledge has a strong impact on students and the development of their identity in relation to science and society, but also in relation to themselves.

A key element in the construction of identities is the body (Butler, 2012), which is configured through the relationship of the subject to the norms and categories of society. The body is not a passive matter, but a system influenced by different discourses and conditions—textual, social, biochemical, etc. (Haraway & Goodeve, 2000). The social world therefore affects human subjectivities by establishing desirable cultural models and roles in each context (Fausto-Sterling, 2006). In this respect, school biology becomes a reference to explain how bodies are constituted and develop.

In our society, gender is the main axis around which the body is constructed. Gender identities thus ratify a sexual division of labour, establish differences in social activities and regulate personal ways of being (Bourdieu, 1998). According to Butler (1990), “the original identity on which gender is modelled is an imitation without an origin” (p. 169).

This means that gender identities, which in some cases are considered natural, are the result of performances that are subject to constant social regulation, interaction and sanction. That is, subjects' gender identities are constructed in a sociocultural context where practices such as roles, rituals, customs and laws create and reinforce the dominant social expectations of masculinity and femininity (Fine et al., 2017).

The school is one of the social devices that regulate gender identities through pedagogical devices such as the curriculum, behaviour manuals, uniforms and the monitoring of students' discourses and practices (Piedrahita, 2008). In this context of disciplining bodies through school, some knowledge, such as biological knowledge, can function as mechanisms to justify, through naturalisation, social phenomena such as gender. Biological explanations of gender diversity as non-natural could contribute to fostering a hostile school climate for LGBTIQ youth. Taking this into account, a deep reflection on sexual and gender diversity can challenge silences and misinformation in order to create a more inclusive and safe school climate for all students, but especially for LGBTIQ youths (Gowen & Wings-Yanez, 2014; Ullman, 2017).

2.3 Sexual Education, Sex and Gender

The relationship and differentiation between the concepts of sex and gender are not specifically addressed in the classroom; this approach has developed over time in the school system through sexuality education, where in many cases, the approach to these concepts is bypassed through the teaching of reproductive health and within biology classes (Plaza & Meinardi, 2009). Sexuality education differs from other school subjects because it deals with intimate topics such as desire, feelings and eroticism (Lundin, 2014). This means that teachers should plan the topics carefully and create a safe and inclusive classroom climate (Pound et al., 2016). While it is true that biological knowledge is an important element for discussing sexuality, it is not the cornerstone for understanding it.

Certainly, the inclusion of a gender perspective in sexuality education is not only desirable, but a fundamental part of its proper development, but the approach to sexuality in schools has focused on reproductive health and disease prevention, leaving aside concepts such as gender diversity. Furthermore, the discourse in the classroom addresses gender identity and sexual orientation through a pathologising narrative that associates non-heterosexual practices and lifestyles with health risks due to sexually transmitted diseases (Gowen & Wings-Yanez, 2014).

In terms of respect for sexual and gender diversity, there is a hidden and heterocentric curriculum (Plaza et al., 2013; Péchin, 2011). According to Czernikier et al. (2015), teachers do not have the space to reflect on the sexist references and models that circulate in the school and how their personal beliefs influence the educational process (Morgade et al., 2016). There is a need for more training for the educational community, parents, teachers and students, on how to deal with sexual and gender diversity in different situations and spaces (Paechter et al., 2021). In particular, when biology teachers are delegated to teach sexuality education, they use textbooks as their main reference, which in many cases legitimise traditional models of sexuality education (Bazzul & Sykes, 2011; Esquivel, 2022; Orozco, 2017). It is worth clarifying that gender bias and heterocentric sex education are not only present in teachers' practices and discourses, but also in the whole educational system, including ethical objectives, community expectations and textbooks. In this sense, changing this situation is not only the responsibility of teachers, but also of all social actors involved in education.

For the development of gender-sensitive sexuality education, it is important that teachers are appropriately qualified to develop their teaching practices and materials (Collet, 2018) and to reflect on their practices to identify problematic issues related to gender, even if they recognise that silence about some aspects of sexuality education is a way of denying certain rights (Bazzul & Sykes, 2011). However, little is known about how prepared teachers are (Blair & Deckman, 2019) and what perspectives they have on sexual diversity, and consequently the desirable characteristics of teacher professional development programmes on these issues. For example, in the case of biology teachers, it has been shown that when describing puberty and the characteristics supposedly associated with and exclusive to one sex or the other, natural characteristics such as growing a beard are mixed with others such as wearing make-up or doing one's hair, which are cultural elaborations (Collet, 2018). This conveys a false idea of homogeneity between the sexes, of clear dimorphism and discrete characteristics. In this sense, it is important to reflect on what it means for sex education to be part of the biology curriculum (Morgade, 2011).

3 Methods

3.1 Research Approach

The analysis is carried out using a qualitative approach, which starts from the premise that concepts of sex and gender are intrinsically influenced by notions of power and hegemony. In this way, ideology is seen not only as confined to the realm of ideas, but also as materialised in the actions and mechanisms that shape the process of signification (Orlandi, 2012).

Accordingly, we applied critical discourse analysis (CDA) to interpret teachers' ideas, using two main references: Orlandi (2012), who states that discourse is immersed in a linguistic, historical materialism and subject position, and Van Dijk (2015), who argues that discourse, in addition to its linguistic nature, is embedded in political and cultural power relations. In this study, CDA is assumed to be a type of research that focuses on discursive analysis and aims to identify and reveal the ways in which it is represented, reproduced, legitimised and resists the abuse of power and social inequality (Van Dijk, 2015). It does this by examining specific social contexts and making connections between micro and macro levels of social order. CDA is not a specific method, but an analytical practice and a critical perspective that encompasses different aspects that can be studied in the discourse and ways to develop it (Van Dijk, 2015).

Given the nature of the issues addressed in this work, CDA is appropriate because it focuses more on social and political issues than on discourse outside of context (Van Dijk, 2015). In this sense, this research seeks to explain certain discursive patterns in terms of social structure and interaction, showing how they represent, confirm, legitimise or challenge power relations, in this case in relation to gender and in the context of school. With respect to teachers' discourses, we consider that although they operate at the so-called micro level of the social order, they are related to macro structures such as the orientations of educational policy, the curriculum and the dominant culture. A key aspect of CDA developed in this work is power/control, understood as the capacity of the school to exercise domination through persuasion, the use of knowledge and authority. It is therefore considered that through teacher interviews, it is possible to identify and characterise tensions in relation to the hegemony of certain ideas and social groups, specifically to

highlight how certain ideas from school biology can be used as a means to justify sexism and gender discrimination.

3.2 The Context of the Study

In both the Colombian and Mexican contexts, sexuality education has primarily been integrated into the biology curriculum because of its focus on the human body and the perception that it can address sexuality in a “neutral” way (Morgade et al., 2016). In Colombia, biology is taught in all grades of secondary and high school, while in Mexico it is taught in the first grades of secondary and high school. In the last decades of the twentieth century, sex education in Colombia was addressed through psychology and medicine, but its limited reach led to its inclusion in the school curriculum (Roa García & Osorio González, 2016). This inclusion was accompanied by a focus on issues such as teenage pregnancy, sexually transmitted diseases, sexual violence and prostitution, with the addition of socio-emotional aspects to provide a more comprehensive sexuality education.

Sexuality education has been part of the Mexican school curriculum since 1974, as documented by Heredia Espinosa and Rodríguez Barraza (2021). Over time, this educational component has been adapted in line with evolving policies. Currently, sexuality education is characterised as comprehensive, including personal, emotional and social dimensions. Nevertheless, its predominant focus is on reproductive health and pregnancy prevention, as highlighted by the findings of Rosales-Mendoza and Salinas-Quiroz (2017).

Colombia and Mexico share a predominantly Catholic population, but there has been a notable increase in evangelical communities in recent years (Thorsen, 2023). Both countries have engaged in significant social debates around sexual and reproductive rights, with religious perspectives playing a central role and often challenging traditional family structures and social norms (Camarena, 2017; Vaggione, 2018). In particular, in both countries, there is resistance to including content on sexual and gender diversity in textbooks or educational materials (Morán Faúndes, 2023; Rosales-Mendoza & Salinas-Quiroz, 2017). Furthermore, educators express concerns about the perceived lack of complete freedom to openly address sexuality education and cover all curriculum topics (Heredia Espinosa & Rodríguez Barraza, 2021).

3.3 Participants

A total of six participants were involved in the study, three teachers each from Colombia and Mexico. A quota sampling technique was used by assuming that certain attributes are prevalent in the secondary biology teachers population. The selection process involved asking ten teachers in each country to respond to a series of pre-screening questions. The following criteria were then applied to select participants: (i) having a solid academic background in biology; (ii) having at least three years of teaching experience; (iii) being located in an urban educational setting; (iv) working at the secondary level; and (v) demonstrating an enthusiastic willingness to actively participate in the study and be interviewed. Table 1 provides an overview of the relevant characteristics of the participants, giving an insight into their educational background, experience and work context. These carefully crafted selection criteria were instrumental in ensuring the participation of educators with a suitable profile, thereby providing the research with a nuanced and representative perspective that would help to address the research objectives in both depth and detail.

Table 1 Characteristics of participants in the study: biology teachers in Mexico and Colombia

Teachers & characteristics	Juliana	Sonia	Eduardo	Elizabeth	Angélica	Alberto
Nationality and region (city) of employment	Colombian - Medellín	Colombian - Bogotá	Colombian - Bogotá	Mexican - Monterrey	Mexican - City of México	Mexican - Monterrey
Age	29	30	30	29	28	33
Sex	Female	Female	Male	Female	Female	Male
Undergraduate studies	Bachelor's degree in biology ^[1]	Bachelor's degree in biology	Bachelor's degree in biology	Bachelor's degree in biology	Biologist	Biologist
Years of experience	6	8	9	4	6	7
The course(s) or degree(s) in which he/she has the most experience	Seventh grade secondary school ^[2] (12–13 year age group students)	Sixth grade secondary school (10–11 year age group students)	Eighth and ninth grade secondary school (13–15-year age group students)	First and second year of secondary school ^[3] (11–14 year age group students)	First and second year of secondary school (11–14-year age group students)	Sixth grade secondary school (11–13-year age group students)
Type of school where they are employed	Private	Private	Private	State	Private	Private

^[1]It should be clarified that the term “licenciado” in the Colombian context refers to professionals with pedagogical and didactic training in a specific field, in this case biology. Professors that do not have this prefix are now considered to deal with this science

^[2]It should be noted that, in the Colombian context, school design is divided into initial education, pre-school education, basic education (five grades of primary education (1–5) and four grades of secondary education (6–9)) and secondary education (two grades of secondary education (10–11) and the baccalaureate), although for students these last two stages are not perceived as separate but as continuous, whereas in most cases the institutions provide all these stages in a continuous manner

^[3]Similarly, in the Mexican context, basic education is divided into three stages: preschool, primary (first six grades (1–6)) and secondary (three grades (1–3)). After these stages, it is possible to continue with upper secondary education, which can last 2 to 3 years and is commonly known as preparatory education, as it is the prelude to access to higher education

3.4 Data Collection

Two focused semi-structured interviews were designed for data collection (see Appendix 1). Due to the complexity of the issues addressed, people may refer to several aspects of these issues - personal, political, moral, etc. -at the same time (Costa et al., 2016), resulting in a high dispersion of information. Therefore, it was necessary to develop an interview that focused the participants' ideas on specific facts. To do this, the interviewees were presented with a stimulus (a video, a document, a narrative, etc.) from which their views were explored (Flick, 2015). To design the interviews, a validation process was carried out to assess the relevance of the stimuli and interview questions in relation to the research objectives and educational contexts. Two experts (one from Colombia and one from Mexico) participated in the validation. Based on their suggestions and recommendations, a final protocol was designed for each interview. The first interview provided a comprehensive examination of biology education, analysing the experiences of participants from both the Colombian and Mexican contexts. In order to gain deeper insights, we delved into a variety of sources, including professional experiences, textbooks, educational policies and curriculum documents from each country.

In the second interview, our focus shifted to the participants' perspectives on transsexuality, which served as a compelling platform for discussing ideas about sex and gender. To achieve this, three carefully selected videos were used. The first two featured statements from transgender people, while the third highlighted gender roles. The visual representation of the stimuli used in each interview is shown in Fig. 1. By incorporating a wider range of sources and using thought-provoking stimuli, our study achieved a more conclusive and compelling approach to exploring both biology education and the nuanced aspects of sex and gender.

3.5 Data Analysis

The data analysis process is geared towards constructing interpretations and explanations of the teachers' expressions, rather than limiting itself to mere description.

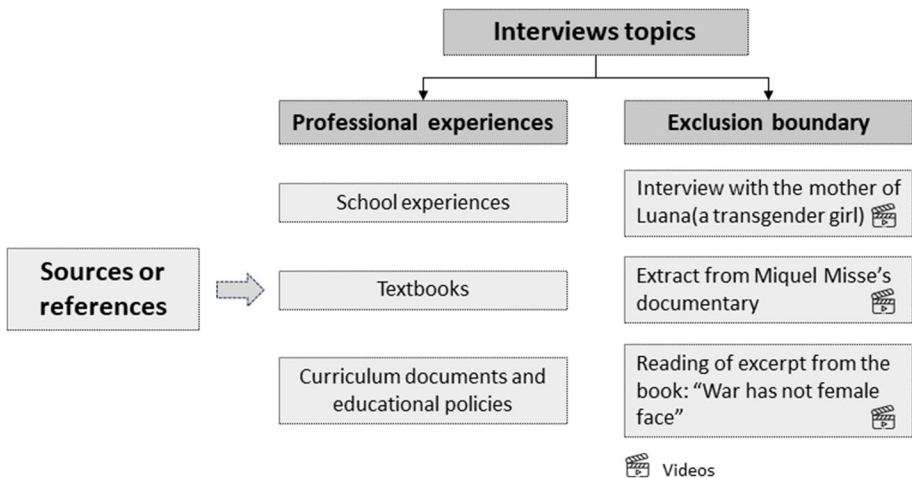


Fig. 1 Stimuli used in the interviews

Consequently, the analytical approach goes beyond a superficial understanding of the teachers' expressions and seeks to provide interpretations of possible relationships between these expressions and the modalities through which social power is exercised (Van Dijk, 2015). In order to achieve this, individualised data analysis was conducted for each teacher with the aim of identifying independent dimensions or themes associated with each educator. As the interviews provided a platform for the articulation of personal and individual ideas, a conscious decision was made to conduct a preliminary separate analysis. The ultimate intention is to integrate these different aspects in a later phase of the study. To facilitate this process, qualitative analysis software (Atlas.ti ®) was used to the analysis into three distinct phases, as outlined in Fig. 2.

During the initial interpretation phase, each interview text was carefully examined, with the responses to each question serving as the primary unit of analysis, as shown in Fig. 2, which outlines the stages of data analysis. From these extracts, deductive interpretations were formulated for each unit, meaning that the researchers initially interpreted each response. These interpretations were complemented by two key elements: firstly, an initial coding that captured observed trends and secondly, a brief comment or analysis of the information embedded in the text. In the subsequent phase of data reinterpretation, the researchers engaged in discussions to clarify the criteria used in the initial text readings to delineate different codes. These criteria were used to identify potential divergence or synthesis of particular codes. The interviews were then recoded on the basis of these refinements.

In the third stage, the construction of discourse dimensions, the codes were systematically clustered. Thus, codes and their groupings were derived for each individual interview and teacher. On this basis, overarching dimensions were identified from the totality of the teachers' discourses. It is crucial to emphasise that these dimensions emerged organically through the process of interpretation and were not predetermined by any theoretical framework. This finding is in line with the methodological approach adopted, which assumes that discourses are contextually situated and embody distinctive properties that emerge from teachers' perspectives and contexts. The adoption of theoretical categories in this context was deliberately avoided to avoid potential limitations in recognising these unique nuances (Orlandi, 2012).

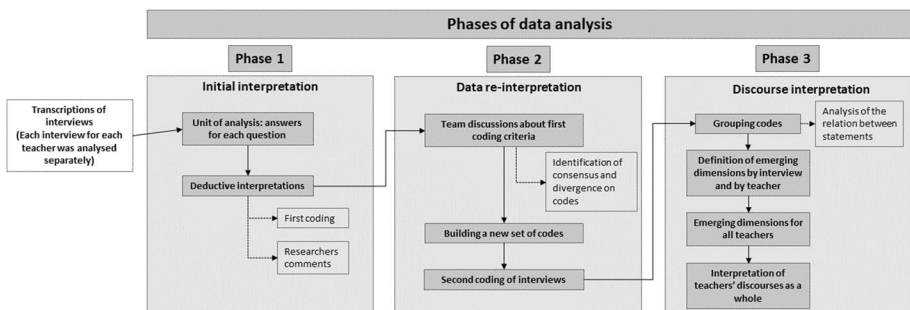


Fig. 2 Data analysis phases

3.6 Ethical Considerations

According to the legislation in both Mexico and Colombia, this type of study falls under the category of “research without risk”, which exempts it from the need for ethics committee approval, provided that there is no intentional intervention or modification of the biological, physiological, psychological or social variables of the individuals involved. However, the principles and ethical guidelines outlined by the American Educational Research Association (2011) were followed. This included maintaining confidentiality of information, ensuring protection of sources, and responsible use of data. To formalise their participation, each participant voluntarily signed an informed consent form that outlined the research objectives and guaranteed the confidentiality of their information. To protect participants’ identities, pseudonyms were used in the interview transcripts and any potentially identifying information was carefully removed.

4 Results

A comprehensive analysis of the interviews, delving into the discourses articulated by the participants, led to the following themes.

4.1 Other than the Biological Pathway

Biology serves not only as a lens through which life and vitality are perceived, but also as a fundamental framework for understanding the complex interplay between sex and gender, which is a central theme in the teachers’ statements. From their perspective, this scientific discipline facilitates an understanding of the inherent natural processes within the human body, thereby encouraging contemplation of the body’s potentialities. For example, Alberto notes that biology enables individuals to identify their “appropriate” social role and find their place within the social fabric.

I think that biology can encourage people a little bit to be pigeonholed or to feel that they are in a certain place. I don’t think it has a negative influence, on the contrary, I think it can have a positive influence, where people can find a way or an opportunity to be what they have always wanted to be, and that biology suddenly couldn’t offer them. (Alberto, interview 2)

In the context of the idea that science provides insights and tools to explain processes such as sex change, some educators perceive biology as impartial and neutral. This perspective stems from the belief that biology refrains from imposing value judgments on individual choices and instead focuses on providing certainties based on evidence. In this view, biology serves as an informational resource that empowers individuals to make decisions based on factual knowledge.

Biology helps to provide evidence. Approaches that are supported by evidence that help to classify and identify each person. Even though we, as human beings, have our culture, which is constantly changing, there is also a part of science

where I have proof, evidence of what exists and is maintained, which will always clarify the phenomena. (Juliana, interview 2)

But Angelica and Elisabeth challenge this view of science, arguing that science is not entirely neutral or unbiased because it is a human activity, heavily influenced by social and political factors.

Science is a human act, and it is an act that is fixed and crossed by a series of interests, where you also have to remove the veil that science is pure and only for the benefit of humanity. (Elisabeth, interview 2)

Rigid norms and models that allow no middle ground are challenged. They appear to be based on biology and help to shape what is considered normal, natural and therefore acceptable to society.

I wonder who sets these standards, like the gender dysphoria tests or the ranges of hormone production that women and men should have ‘properly’, because if a heteronormative person has done it, it makes no sense, it’s not worth it, because the result will always say you’re crazy. (Angelica, interview 2)

Beyond these questions about the role of biology in defining what is natural and normal, for some teachers, the decisions to change and transform bodies go against a natural or biological path. It is therefore difficult to understand these choices.

Transsexuals themselves have talked about how nothing is the same after the operation, that they go crazy, that they actually lose their mind. That they don’t feel good about the decision they’ve made, it’s that a lot of things come together that instead of making them feel a little bit more normal, make them feel a little bit more alienated from society. (Alberto, interview 2)

In this sense, some professors believe that psychology, psychiatry and medicine should help people to place themselves in one of the two possibilities of the norm: as a woman or as a man.

Even though I don’t know many trans women or trans men, I think I’ve always felt the need for the person to move from one place to the other and feel satisfied to suddenly be in one of the two corners. (Elisabeth, interview 2)

However, during the interviews and the presentation of a video narrating the life of a young transgender person, some teachers questioned their position on the transformation of bodies and, even more, on the conditions or aspects that we believe are relevant to the construction of gender identities.

I think that in reality there’s a tendency to categorise individuals or create these conceptual frameworks to give them existence. It seems that without these predefined categories or lenses through which to perceive them, I would not attribute existence to them. (Angélica, interview 2)

For other teachers, such as Alberto or Eduardo, a person’s gender identity must coincide with the sex assigned at birth, otherwise there is an anomaly. In this way, each body has two basic forms, each predestined to develop only one type of identity.

I believe that there are different forms, namely biological men and women, each of whom has different experiences. The majority of these experiences tend to affirm their inherent status, while a minority, albeit a small one, undergo transformation

and follow paths that differ from their biological predispositions. (Alberto, interview 2)

One of the mechanisms that mediate the relationship between sex and gender is hormones. It is thought that each sex (male and female) is born with a unique set of identity-forming hormones that control elements such as behaviour, taste, social roles and even cognitive development.

To understand a gender change, I think you must look at the hormones your daughter has had, I wish you could do a hormonal study of the changes she has had over time so that the mother can support her daughter if she wants to make a complete gender change. (Angélica, interview 2)

For this reason, some teachers view facts such as the transsexuality of children with uncertainty, in relation to the fact that hormones have not played the radical role that they seem to have done at this stage of life.

I don't know if they will feel apathetic towards things like sexual desire, on the contrary, they will feel that it is not close to them because they don't experience it. (Eduardo, interview 2)

In summary, the prevailing perspective among most teachers is that gender is simply understood as a social construct of biological sex. As a result, alternatives that deviate from heteronormative norms are often perceived as deviant and considered wrong or abnormal.

4.2 A Veiled Question, not Allowing Traditions

According to the teachers, the social interpretation of sex and gender depends on two critical factors: the standpoint from which it is articulated and the historical context in which it occurs. In this regard, they note that the relationship between sex and gender in their respective contexts is a delicate matter. They point out that not all individuals are able to openly discuss this issue, as it is perceived as challenging deeply held beliefs or traditions, making it a sensitive topic for many.

When you talk about things like sex and transsexuals, it can lead to demands for respect for tradition and the destruction of all the things that make us who we are. But I think that these kinds of traditions are the ones that make it a bit difficult to develop these issues. (Sonia, interview 2)

These assertions are based on teachers' professional, family and educational backgrounds. Consequently, educators acknowledge the pervasive influence of the cultural milieu, which is perceived as exercising various mechanisms to shape and regulate ways of being. Consequently, individuals are expected to conform to these established norms in order to gain social acceptance. These ideals of selfhood are instilled from an early age and persist into adulthood.

I think society is responsible for guiding them in assuming what men and women should wear in a certain way. Where there are objects like the kitchen, they produce a place for the woman as a housewife, and for the man cars or houses, because he is the one who can acquire property. (Juliana, interview 2)

Teachers say these ideas are strongly influenced by Catholicism, which has constructed the notion of two possible gender models, arguing that these are correct and natural.

Well, I think that the Catholic faith in our country, and in Latin America in general, has created a very strong barrier to the development of ideas about what is correct and within the norm, and therefore they are the ones who have constructed most of the taboos about what cannot be talked about outside the norm. (Sonia, interview 2)

The main challenge identified by some teachers in this scenario is the emergence of a dichotomy in which anything that deviates from the norm is branded as socially inappropriate and negatively stigmatised.

In society there is a very strong definition or limitation of what is in a drawer, because there are drawers, mental drawers about what is a woman and what is a man. I think that, at least in Mexican society today, we cannot break them or see beyond them. (Angélica, interview 2)

According to the teachers, their contexts have propagated the notion that the norm goes beyond a mere set of communal living rules, but rather includes religious constructs or inherent, innate attributes of the individual body.

I think that we, or at least I, have had the idea that there are certain colours for men and women, and certain toys, and that everything that is for girls is not for boys and vice versa. That is exactly what we were taught, I mean it is not something innate, it is something learned. (Elizabeth, interview 2)

Finally, teachers claim that acts of monitoring and reinforcing gender roles are not alien to the school environment; conversely, they claim that these ideas are sometimes reinforced in the classroom.

First, we associate that boys are the experimental ones, they are the ones who have the possibility to take risks, they are the ones who have the right to make mistakes and to start again, they are the ones who dare. Whereas the girl is the one who writes it down in her notebook, the one who does the formatting, the one we make do the grid, the one who takes the report of the experiment, the one who does the less risky task. (Angélica, interview 2)

These elements allow us to see that teachers have reservations about the normalisation of the gender dichotomy. However, they express a sense of being overwhelmed by the prevailing situation and often adopt a passive stance as recipients of these entrenched ideas.

4.3 The Conflict of Dealing with Issues of Sex and Gender in the Classroom

The majority of participating educators acknowledged their constraints in addressing issues related to gender diversity in the classroom. As a result, they actively seek alternatives to circumvent potential questions from school authorities or parents. As an illustrative example, Alberto adopts a strategy of allowing students to initiate discussions and propose topics related to gender, but within the limits of what he considers relevant.

It depends on the interest of the students, if I have time to go back to the subject I try to deal with it, but if the questions are complicated it is better not to go too much in depth because then the student will always want to ask more questions and the subject is overflowing and the class is lost and all of a sudden it is dealing with things that I cannot talk about anymore. (Alberto, interview 2)

They also strive to navigate these issues in a way that avoids the intersection of issues that they may find challenging or prefer not to address. This approach involves a strict adherence to the curriculum, avoiding contentious discussions or interventions. Regarding the treatment of sexuality in the school context, Alberto aptly remarks: “There are two perspectives - those who advocate its inclusion in the school setting and those who favour discussing it only within the confines of the home” (Interview 1).

The anxiety or discomfort felt by teachers appears to be linked to a prevailing culture of silence within the educational community. According to educators, this silence is often subtly induced and communicated through nuanced expressions or sometimes explicitly underlined by the threat of sanctions.

I have asked my superiors about some [issues] and they tend to be very cautious. They told me: yes, but we don't talk about it here. They said ignore it, other teachers haven't said it, it's better not to get involved in these issues. (Angélica, interview 1)

Penalties for teachers can range from reprimands to dismissal. Moreover, such consequences can have the powerful effect of sullyng the professional reputation of the teacher.

Unfortunately, I think that as teachers we have to limit ourselves to a lot of things, because on many occasions you can have a kind of public contempt and that is not well seen and the image that you have as a teacher can be affected because it is a very social profession. (Eduardo, interview 2)

Some teachers argue that promoting effective communication between teachers, parents and school administrators has the potential to alleviate these challenges. By placing greater emphasis on the importance of these issues within the classroom and recognising the wider societal importance of addressing issues such as gender diversity, there is an opportunity to foster greater understanding and cooperation.

You are a very important influence as a teacher and that can raise doubts, so I always want to make it clear to the parents and the directors that being gay or lesbian or having any other queer or different identity is not something that is taught, it is a fact and an experience and a life experience that each of the subjects has. (Angélica, interview 1)

5 Discussion

5.1 Biology as a Cast of Characters

Teachers recognise that society influences gender identity through various mechanisms, regulating behaviour, preferences, attitudes and more. This influence begins in early childhood and continues through family, religious, educational, media, medical and legislative channels (Preciado, 2009). The foundation of this social regulation rests on two main sources of authority. On the one hand, religion, guided by moral principles, plays a role in shaping perceptions of what constitutes acceptable sexual behaviour. As Reiss (2014) notes, religious believers often assert their own understanding of appropriate sexual behaviour and seek to extend their ethical views to the wider society. On the other hand, medicine and psychiatry, in defining norms and pathologies, have historically delineated acceptable and unacceptable behaviour, often unconsciously influenced

by biases related to gender, ethnicity and other factors. These criteria have sometimes aimed to correct or punish individuals who openly express non-conformity with heteronormative binarism (Bustamante, 2008).

In this context, teachers exhibited skepticism regarding the possibility that children and adolescents might have a gender identity different from the one assigned to them at birth. As identified by Guerrero and Muñoz (2018), this skepticism emanates from two underlying assumptions regarding how children construct their gender identity. Firstly, there is a belief that they do not undergo a comprehensive social process enabling them to adapt to their identity. Secondly, there exists a naturalistic perspective positing that a genuine or natural “self” is inherently present and expressed through the subject’s development, aligning with the sex assigned at birth. Consequently, any alternative representation of gender appears incomprehensible (De Lauretis, 1996). Notably, a review of the perspectives and experiences of young individuals reveals their perception that sex education predominantly centers on heterosexual intercourse, neglects to recognize them as sexual beings and presupposes their incapacity to make informed decisions about their own sexual activities (Pound et al., 2016).

This conceptualisation of childhood identity amounts to nothing more than an ageist bias (Guerrero & Muñoz, 2018), which assumes that children and adolescents lack the capacity to articulate their desires and emotions, and therefore require adult supervision for all their decisions (Castañeda, 2015). Consequently, within this framework, teachers often advocate for the involvement of medical or psychological services to assess, approve or disapprove of students’ conditions.

Teachers believe that the transition to adulthood involves not only a process of socialisation but also specific biological developments, particularly hormonal maturation. Hormones are often seen as influential in determining gender conformity, cognitive development and sexual orientation. However, this assertive stance contrasts with the current scientific landscape, where the effects of hormones on complex behaviours such as the formation of gender identity are less clearly understood. Indeed, there is no consensus within the scientific community about the mechanisms by which this occurs. On the one hand, various studies have strongly challenged the ascribed role of hormones as causal factors for social behaviour (Fine, 2010; Joel & Vikhanski, 2020; Rippon, 2019). Furthermore, studies investigating the role of hormones in gender identity and sexual orientation have challenged the assumption that hormones serve as direct determinants in these processes (Alcántara, 2016; Castañeda, 2015; Jeffreys, 2012).

However, in stark contrast to these studies, the teachers’ statements assert the role of hormones as substances that not only influence the anatomy and physiology of the body, but also dictate how individuals behave and make decisions. This perspective can be characterised as biologicistic, attributing unidirectional causality between hormones and complex behaviours, and assuming uniform effects across individuals. It overlooks the nuanced reality that “hormones are not only internal instincts that direct us towards certain environments and behaviours, but that their influence also works in the other direction, where elements such as environmental stimuli can provoke a very different change in each person” (Fine, 2010, p. 221). This perspective shapes discourses around the concept of the “wrong body”, interpreting non-binary subjectivity through a medical and psychopathological lens that systematically constructs the idea that such subjectivity requires psychological or physical therapeutic intervention (Preciado, 2009). As a result, gender reassignment is perceived as having profound implications for the well-being and mental health of individuals, a sentiment articulated by Professors Alberto and Eduardo.

As highlighted by Morgade (2011), crucial elements such as gender identity have not received significant attention in school contexts or teacher training programmes. Instead, these spaces have predominantly focused on sexual and reproductive health, neglecting aspects related to gender diversity. This lack of coverage has resulted in teachers potentially lacking the necessary knowledge and confidence to address these nuanced issues (Pound et al., 2016). The limited scope of sex education is not solely due to teachers' perspectives, knowledge or beliefs, but is deeply rooted in the broader patriarchal fabric of society. As noted above, school principals, families and communities closely monitor the content of sex education, which continues to focus on a traditional, narrow approach. Textbooks further contribute to this limitation by predominantly framing sexuality in the context of reproduction, neglecting a broader and more inclusive approach to sexuality education (Heredia Espinosa & Rodríguez Barraza, 2021). Furthermore, Stewart et al. (2021) argue that introducing discussions of gender identity in schools poses significant challenges for teachers, given the pre-defined positions or roles that have been established, which often confine both teachers and students within a binary and heterosexual framework.

5.2 Tensions Between the Biological and Cultural

A tension between the innate or natural and the learned or cultural aspects of education is evident in the distinction between the concepts of sex and gender. This tension is reflected in teachers' descriptions of the body, where it is sometimes perceived as immutable and determined by its biological conditions, while at other times it is seen as a malleable entity shaped by social and cultural meanings. According to Butler (1990), the difficulty in distinguishing between these two concepts lies in their materialisation in bodies, which in turn is mediated by discourse and culture. As a result, claims are made about radical differences between bodies, often articulated in seemingly binary terms, without acknowledging the inherent complexity and variability within bodies that lie on a spectrum (Fausto-Sterling, 2006). For teachers, certain characteristics, such as reproductive cells, hormones and genitalia, are seen as non-negotiable, allowing bodies to be discretely differentiated and classified. However, it is important to note two aspects: first, that reductionism tends to assume that these differences are universally self-evident and follow a discrete distribution; and second, that determinism can oversimplify the incorporation of these differences into the social order.

Eduardo claims that differences in standardised academic test scores between women and men are due to hormonal changes in women at a certain age, which put them at a perceived disadvantage. This is an example of how sexual characteristics are extrapolated into different areas, rationalising social inequalities with biological arguments. This view perpetuates the illusion of two fundamentally different sexes based on biological characteristics, neglecting the social context in which these distinctions are constructed and reinforced (Joel & Vikhanski, 2020).

Similarly, Alberto perceives bodies as inherently marked by pronounced differences that are accentuated by experience. From this perspective, changing this inherent "fate" is seen as counterproductive. According to Dupré (2017), the notion of an immutable biological predisposition of bodies promotes an essentialist perspective on human construction. This implies the existence of a fixed feminine or masculine essence that resides in the body (in gonads, hormones, etc.) and is then expressed in the social sphere. Within this framework, non-heteronormative identities are categorised as deviations or disorders from this essence. As a result, surgical and psychological interventions are seen as necessary to align the

individual with “normality” (Fausto-Sterling, 2006). This is broadly in line with Alberto’s suggestion of therapies aimed at helping individuals to feel normal.

5.3 A Limited Point of View on Sexuality

As Morgade (2011) points out, cultivating a broad and inclusive understanding of human sexuality is essential for educators to effectively navigate the complex relationship between sex and gender. Without such an understanding, classroom discussions may be limited to sexual and reproductive health issues that focus predominantly on heterosexual orientations. Although some of the participating teachers expressed a willingness to address issues encompassing eroticism, sexual orientation and gender identity, they highlighted several tensions that act as barriers to addressing these issues. In particular, they expressed a reluctance to actively engage with these issues in the classroom, preferring not to initiate discussions of their own accord. This avoidance can be attributed to a fear of the perceived negative impact it might have on school leadership and parental reactions—an observed constraint that is entrenched in educational spaces (Morgade et al., 2016; Nelson et al., 2019).

In general, teachers express a preference for addressing issues primarily from a biological perspective, focusing on the reproductive system, sexually transmitted diseases and sexual intercourse. While focusing exclusively on these aspects renders other important dimensions of human sexuality invisible, it promotes a sense of security among teachers, on the assumption that they are avoiding the complication of very personal and sensitive ideas (Orozco, 2017). Dos Anjos and Heerdt (2018) counter that this perspective is too simplistic and overlooks the inherent implications of discussing bodies in biology classes. According to these authors, what is often perceived as neutral in such instances entails stereotypical and reductionist notions of bodies, inadvertently promoting polarisation and reinforcing a singular idea of how bodies should be and be represented.

The above is consistent with findings from studies suggesting that teachers often seek to avoid topics they perceive as controversial or in which they lack confidence (Scull et al., 2021). The reluctance to address sexuality in the classroom is evident in reports suggesting that teachers feel more comfortable answering students’ questions outside of the formal educational environment (Gowen & Wings-Yanez, 2014). Students, however, perceive this silence and hesitation on the part of teachers on certain sexuality-related issues as detrimental. They note that issues such as gender are only addressed symbolically and are not explored in depth. As a result, students find it difficult to resolve their questions, leading to the adoption of narrow definitions of sexual relationships and eroticism, often associating healthy sexuality with either heterosexual relationships or abstinence (Gowen & Wings-Yanez, 2014). Similarly, Nelson et al. (2019) argue that male adolescents who seek relationships with other men do not derive the same benefits from school education programmes as their counterparts.

For students, it holds significant importance that their teachers engage in candid and open discussions about sexuality; such openness appears to be a prerequisite for building credibility and trust (Pound et al., 2016). This emphasis on teacher-student communication contributes to the fact that students often resort to personal internet searches for information about sexuality, where the ease of access often leads to encounters with unreliable information. This reliance on the internet as a primary source of sexual information was identified years ago and has persisted over time (Nelson et al., 2019).

An interdisciplinary approach to sexual education emerges as a viable alternative to providing more inclusive content and establishing secure, trustworthy spaces for young individuals to address and share their uncertainties. This approach entails acknowledging sexuality as a nuanced topic extending beyond its biological facets, encompassing emotional and ethical dimensions that are integral to the construction of individual identities (Pound et al., 2016). In both Mexico and Colombia, sexuality and gender diversity form integral parts of the biology curriculum. Consequently, educators are confronted with the imperative to navigate these issues within their classrooms. Initiatives for both initial and in-service training must align with the challenges posed by these curriculum components, as articulated by Chaves de Almeida and Bonzanini (2021).

6 Conclusions

Teachers' perspectives on the interplay between sex and gender converge, with a strong emphasis on the body as a central factor in shaping the dynamics of these concepts. This emphasis is particularly reflected in their expressions of scepticism and resistance to the feasibility of gender change at an early age, which they see as counterproductive to the social development of individuals. They argue that such changes run counter to societal expectations of behaviour and social roles for boys, girls and future adults. Teachers' statements underline the crucial role of the body in categorising individuals, influencing different traits and abilities that develop over a lifetime, thereby shaping different ways of being and engaging with the world. While teachers generally acknowledge the existence of two biological sexes (male and female) associated with two genders (masculine and feminine), a significant number reject the possibility that some individuals may not conform to either gender. This perspective suggests a conceptualisation of biology as the primary source shaping cultural behaviours associated with gender.

The consistent portrayal of gender as a continuous, unchanging construct throughout all stages of life represents an essentialist perspective within teachers' discourses. According to this perspective, bodies are perceived as inherently conditioned and predetermined for particular social roles and spaces, with the belief that these roles are achieved over time through factors such as hormones or genitals. This essentialist framework implies that biological knowledge, when incorporated into discourse, can inadvertently contribute to the naturalisation of certain gender stereotypes. The result is a prevailing notion that these stereotypes merely represent or follow from biological conditions, effectively conflating gender expression with biological determinants.

A prevalent view among the participating teachers is the perception of biology as an impartial determinant in the construction of gender. From their perspective, biological knowledge focuses on organisms and their physiological processes, largely overlooking the social constructions that are integral to the formation of individual identities. At the same time, teachers recognise that the concepts and guidelines derived from biological knowledge influence how society interprets and recognises elements associated with gender. In essence, biological knowledge is seen as neutral, serving as both a reference point and a boundary in the delineation of gender roles.

In conclusion, the need to address classroom in the classroom is underscored by a pervasive tension, a common predicament in both Mexico and Colombia. Teachers face formidable barriers fueled by societal prejudices that create discomfort in addressing nuanced aspects of sexuality, such as eroticism and pleasure. This discomfort, which stems from

fear of rejection by educational institutions and the wider community, creates a daunting atmosphere of frustration and anxiety among teachers. As a result, these challenging issues often go unaddressed, perpetuating a culture of silence. This underlines the urgent need to approach sex education as a distinct and complex issue that requires an interdisciplinary framework. Supporting teachers through targeted professional development programmes, building their confidence to address these issues, fostering innovative educational environments for open dialogue about sexuality and challenging prevailing social beliefs and misconceptions about gender and sexual relations are essential steps. It is also important to recognise that sexuality education and gender issues are an area where different world-views collide. Teachers and schools are embedded in socio-cultural contexts where gender and sexuality are contentious issues on the political agenda of social groups, often characterised by strongly conflicting views on ethics and freedom.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s11191-024-00516-0>.

Data Availability The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Declarations

Conflict of Interest The authors declare that they have no conflict of interest.

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