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DOSSIER

AFRICAN AND AFRO-BRAZILIAN CULTURE AND THE CHEMISTRY EDUCATION: STUDIES ON RACE AND GENDER INEQUALITIES AND SCIENTIFIC PRODUCTION

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ABSTRACT: According to CNPq data, women participate in practically all major areas of knowledge. However, they are majority in areas related to care and minority in the technological and exact areas. Here we analyzed the design and development of a Pedagogical Intervention (PI) entitled "*Teaching Science and Black Identity: Studies on Hair Chemistry*". In this study, we intended to think about a science that isn't for the universal subject, thus contributing to the formation of chemistry teachers, capable of operationalizing Law 10,639 considering the African diaspora in the Americas, as an alternative to evidence the contribution of black researchers in the construction of scientific knowledge. Our results demonstrate that PI represented the conscious contact with a non-hegemonic and Eurocentric science; fostered the dialogue

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between differences, questioned discourses that reinforced discriminations and stereotypes, intended pre-established contents and instituted processes for the constitution of teachers capable of (re)creating practices that articulate chemical knowledge and Africanities in chemistry teaching.
Keywords: African and Afro-Brazilian Culture; Black women in the sciences; Chemistry teaching.

CULTURA AFRICANA E AFRO-BRASILEIRA E O ENSINO DE QUÍMICA: ESTUDOS SOBRE DESIGUALDADES DE RAÇA E GÊNERO E A PRODUÇÃO CIENTÍFICA

RESUMO: Segundo dados do CNPq as mulheres participam em praticamente todas as grandes áreas do conhecimento, porém são maioria em áreas ligadas ao cuidado e minoria nas áreas tecnológicas e exatas. Aqui analisamos o design e o desenvolvimento de uma Intervenção Pedagógica (IP) intitulada "*Ensino de Ciências e Identidade Negra: Estudos sobre a Química dos cabelos*" objetivando pensar uma ciência não para o sujeito universal, contribuindo assim para a formação de professoras/es de Química capazes de operacionalizar a lei 10.639 a partir da diáspora africana nas Américas, como alternativa para evidenciar a contribuição de pesquisadoras negras na construção do conhecimento científico. Nossos resultados demostram que a IP representou o contato consciente com uma Ciência não hegemônica e eurocêntrica, fomentou o diálogo entre as diferenças, questionou discursos que reforçam as discriminações e os estereótipos, tencionou conteúdos preestabelecidos e instituiu processos de constituição de professores/as capazes de (re)criar práticas que articulem os conhecimentos químicos e as africanidades no ensino de Química.
Palavras Chave: Cultura africana e afro-brasileira; Mulheres negras nas Ciências; Ensino de Química.

INTRODUCTION GUIDE

The predominant view of science among high school students is a solitary activity performed only by men without mention the importance of the role of scientific community in the construction of knowledge (KOSMINSKY and GIORDAN, 2002). In addition, this conception to being influenced by the didactic choices adopted by the teacher in the classroom, is also influence's product of the non-specialized mass media which propagate distorted images about the scientific activity and the subjects that practice it (KOSMINSKY and GIORDAN, 2002; TOMAZI *et al.*, 2009).

According to Bordieu and Passeron when they state that *"the school curriculum is based on the dominant culture: it expresses itself in the*

dominant language, it is transmitted through the dominant cultural code" (SILVA, 1999, page 35), so that we use any internet search tool with the words "scientist" and/or "sciences" the most frequent images (Figure 1) characterize the universal subject: the white man in his laboratory.

FIGURE 1. The universal subject. Search tool used: Google Images. Accessed on 25/09/2018

Westernized science promises a neutral and privileged view of knowledge outside the political field, it still ignores how the inequalities of race and gender built up in scientific institutions influenced and it influences the knowledge produced in them (SCHIEBINGER, 2008). However, the universal subject involved in scientific activity is always the same: male, white and European (KOSMINSKY and GIORDAN, 2002; TOMAZI *et al.*, 2009). It is important to emphasize that *"ignorance about how scientists think and act prevents the approach of students of scientific culture"* (KOSMINSKY and GIORDAN, 2002, p. 17).

According to 2007 UNESCO world report "Gender and Education for All: The Leap to Equality" of 2007, female teenagers do not pursue science careers and technical studies at the same rate as male teenagers, although there is variation by subject matter and country. We believe that this fact originates in the actions that take place in the family and in the school itself, because:

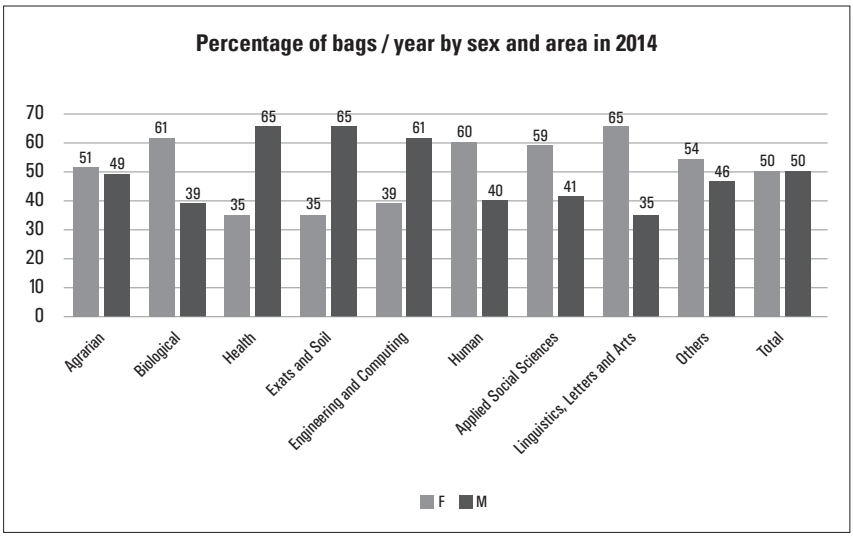
> "Women are not discussed in the classroom, visibility is not given to issues pertaining to the feminine, nor is the influence and participation of women in the sciences, in society, in the arts, in religions and in life. Chemistry, physics and mathematics are reaffirmed, mainly by the practice of educators, as essentially masculine "(SANTOS, 2012a, p. 1; translation made by us).

Women usually choose professions closest of how they were educated and so closer to care. About 34% of the female labor force is concentrated in the social services department: they are teachers, nurses, social workers and psychologists (IPEA, 2011). Therefore, the professions deal with the maintenance and preservation of life are not by chance the least valued and hence poorly paid reflecting the portrait of female invisibility in the labor market.

But what is the labour market? It's the way the population has access to income, is the place where it controls access to wealth, for this reason is also a white privilege guarantee mechanism, because the better paid individual is the white man and it does not happen because of the qualification of these subjects (WERNECK, 2016). The insertion of women into the labour market is marked by differences in gender and race (IPEA, 2011). According to IBGE (2010), about 53% of the Brazilian population is made up of women of working age, but less than 45% of the jobs are occupied by them. Still according to the IBGE (2010), the proportion of women who have completed graduation is 25% higher than that of men and only 37% of those women with full graduation are black or brown.

This situation is also reflected in the career choices in Science, as shown in Figure 2, which shows the percentage distribution by gender, in 2014, of scholarships from the National Council for Scientific and Technological Development - CNPq (the main research promotion agency in the country), by area of knowledge.

FIGURE 2. Percentage of bags / year by sex and area in 2014, based on data from CNPq in 2015, and light gray the percentage of women and dark gray to men



According to the database from CNPq, women participate in practically all major areas of knowledge, but this participation varies according to the area of knowledge: women are the majority in areas related to care and minority in the technological and exact areas. As can be seen in Figure 2, women are above 60% in the areas of Health, Humanities and Linguistics, Arts and Letters and in the 30% range in Exact and Earth Sciences, Engineering and Computing (LIMA *et al.,* 2015).

For Tabak (2002), a probable explanation for the lower female participation in these areas is also the persistence of sexual stereotypes in education, which implies that the roles defined for the feminine mother and responsible for household chores and care for the family do not are reconciled with a scientific career. Therefore, the scientific activity is considered inappropriate for girls the difficulty of reconciling professional work with family life.

We rely on Benite, Silva and Alvino (2016) to affirm that:

> "Scientific knowledge is socially constructed: it develops models to understand natural phenomena and understands that these phenomena slowly became complex from numerous transformations / mutations that gave rise to organisms that were fixed by natural selection, which constitutes a body of knowledge accumulated "(BENITE, SILVA and ALVINO, 2016, p. 737; translation made by us).

We defend like Heerdt and Batista (2016) that *"Science is a human enterprise developed by women and men scientists. These women and men participate in a society that has an androcentric culture"* (page 32). In this way, distorted visions in relation to the construction of scientific knowledge reflect in the teaching and maintenance of an androcentric, positivist, quantifying (white) and angular vision (ANGÓS, 2010; GONZÁLEZ, 2010 and 2013).

Furthermore, when you want is to locate the Brazilian women's production of scientific knowledge, the racial perspective presents determining a fair claim, since:

> "I know of no black Brazilian woman, living or dead, whose name is associated with unique cultural intervention, memorable talent in the arts, universally celebrated in academia or any other social sphere. Known and unanimously encouraged and admired, I believe that we have not a black woman, but a naturalized representation yet submitted to the agency of history, an "improved" biossocial version, the pivot of a complex racial problem, the germ of an unusual gender issue genuinely national. [...]. If male and female, it is an individualized power enclosed in one black man. If feminine, it is a collective representation, politically sterile, uncompromising with gender as well as race. But is there another possible Brazil for the blacks besides samba and soccer? "(LIMA, 2012, p. 282; translation made by us).

Tavares and collaborators (2015) tell us that, which deals with the presence of black women and black men in the training and research grants of CNPq, these are more than 30% of the total number of fellows in Scientific Initiation in 2015. Meanwhile, as registered in Table 1, the Productivity in Research (PQ) grants *"are the ones that present, more clearly, the exclusion of blacks and indigenous people in the S & T system, as well as the greater gender inequality"* (page 4). At the beginning of 2015, out of a total of 14.040 PQ fellows, only 4.993 were women, corresponding to 35.6%. *"In the Research Productivity grant, the participation of blacks is smaller, especially among black women, which does not reach 1%. Among men, only 1.2%"* (page 6).

TABLE 1. Percentage of blacks and whites in training and research grants

Gender	Color-race	Scientific research	Masters Degree	Doctorate degree	Productivity in research
Female	White	59,0	59,1	61,0	75,5
	Parda	25,8	20,1	16,9	6,2
	Black	5,8	5,2	3,8	0,8
	Negras	31,6	25,3	20,8	7,0
Male	White	57,2	54,0	53,9	67,1
	Parda	26,5	20,3	17,9	8,3
	Black	5,9	7,0	4,9	1,2
	Negros	32,4	27,3	22,8	9

We support Olinto (2011) to affirm that there are two types of mechanisms that are generally identified to describe the barriers faced by women, horizontal segregation and vertical segregation, and in *"horizontal segregation women are led to make choices and follow paths that are markedly different from those chosen or followed by men"* (OLINTO, 2011, p. 69), that is, careers are marked by gender and the so-called female professions are more devalued in the labor market. On the other hand, vertical segregation *"is a subtler, more invisible social mechanism that tends to make women more subordinate or, in other words, not progressing in their professional choices"* (OLINTO, 2011, p. 69).

The History of Science was basically structured in male deeds (AQUINO, 2006, page 12), mainly because women were forbidden to study and, according to men, they could only take care of the home (RAGO, 1997). At times when the sciences were produced within the family, women often assisted their parents, husbands or

brothers in their research and scientific discoveries (CASAGRANDE *et al.,* 2005). And when they began developing important research, the merits were given to the father, brother or husband, and women remained invisible (CASAGRANDE *et al.*, 2005). Science was then built in the midst of gender inequalities so that its history was not systematically preserved as regards the participation of other subjects beyond the universal subject.

According to Aquino (2006), addressing the issue of gender and science involves at least three dimensions:

> "The first one concerns the entry and participation of women in various disciplinary fields. Mapping the chart and monitoring historical trends require access to different statistical databases dispersed in numerous institutions and development agencies, often not disaggregated by sex. The second dimension refers to the cultural transformations in the scientific environment, in the gender relations, in the spaces of production and dissemination of knowledge, which demands the realization of socio-anthropological studies, still scarce in the country. The third dimension involves the very content of the knowledge produced, requiring complex analyzes of epistemological, historical and sociological character "(AQUINO, 2006, p. 11; translation made by us).

More specifically, it is worth emphasizing how the introduction of women in chemistry took place:

> "From the sixteenth century onwards, Chemistry asserts itself as an independent science of Alchemy. In particular, Chemistry applied to Medicine developed by Paracelso (1493-1541) was based on the extraction and purification of substances active from minerals, animals or plants. In the following century the courses of Chemistry were generalized and a great number of theoretical-practical treatises on the preparation and the use of medicines began to be published during this period. Among them, the first book of Chemistry written by a woman deserves special mention "(TOSI, 1998, p. 381; translation made by us).

The result of historic struggles of the black movement, on January 9, 2003 was sanctioned by President Luiz Inácio Lula da Silva the law 10.639/03[1] which changes the Law on Guidelines and Bases of National Education (LDB) and it makes teaching on Afro-Brazilian history and culture compulsory in curricula. According to Silva (2012), the implementation of this law alters the curriculum of schools in a direction in which way of living and the "representations" of ethnic-racial groups are required to emerge to end racist speeches and attitudes. Law 10.639/03 repeals an anti-racist education, since it aims at valuing identity, memory and black culture. Thus,

> "It is recognized that in addition to guaranteeing vacancies for blacks in school benches, the history and culture of their people must be properly valued, seeking

> to repair damages that have been repeated for five centuries, to their identity and their rights. The relevance of the study of themes deriving from Afro-Brazilian and African history and culture is not restricted to the black population, on the contrary, it concerns all Brazilians, since they must be educated as citizens acting within a multicultural society and pluriethnic, capable of building a democratic nation "(BRASIL, 2004, p. 17; translation made by us).

Law 10.639/03 has been in force for fifteen years *"and yet, there are still strong initiatives at the national level so that they start a real campaign in pursuit of appreciation of African-Brazilian theme"* (SOUZA *et al.*, 2012, page 2). We agree with Silva that the Brazilian school receives the Brazilian population that is mostly self-declared black and brown, about 50.7% (IBGE, 2010). Hence, the need for a school curriculum in which ethnic-racial diversity is recognized to operate in the fight against dominant hegemonic discourses (SILVA, 2012) is urgent.

We agree with Alvino and Benite (2017) that:

> "Since Federal Law 10.639/03 was promulgated, much has been debated on the ways and possibilities of implementing its guidelines in teaching. Governments (Federal, State and Municipal) have also been encouraged in the last 12 years to produce bibliographical, didactic and paradidate materials to assist teachers in their pedagogical practices. However, initiatives for the insertion of the content of Law 10.639 / 03, its opinion CNE / CP 03/20042 and Resolution CNE / CP 01/20043 on science teaching are still timid. This resistance can be understood by the fact that this area historically practiced a conservative pedagogical action in the face of our social and socioral problems "(ALVINO and BENITE, 2017, p. 86; translation made by us).

As chemistry teachers we support the operationalization of law 10.639/03 from the African diaspora in Brazil, as an alternative to evidence the contribution of black researchers in the construction of scientific knowledge and in the production of technological resources, in addition to encouraging students of High School to opt for a scientific career. However, chemistry teachers often point out that an obstacle to the implementation of said law is the small availability of didactic materials that deal with themes related to African and Afro-Brazilian History and Culture. In general, the textbooks used in Elementary and Middle School represent the figure of the black man and black woman in a negative way, marked by inferior stereotypes and caricatures, punctuating the violent aspects of slavery and omitting resistance to trafficking (SILVA, 2005).

Aiming to operationalize Law 10.639/03, the present work had as its objective the planning, design and development of a pedagogical intervention (PI) called **"Science Teaching and Black**

Identity: Studies on Hair Chemistry", through which we think a Science not for the universal subject, that is, not only white, not only European and not only male, thus contributing to the formation of teachers of chemistry able to operationalize the law.

ABOUT THE METHODOLOGICAL CHOICES

This is a participant research that search for the participation of the community in the analysis of its own history with the objective of promoting collective actions for the benefit of the school community, and this aims to improve the critical view and the formation of teachers (BRANDÃO and BORGES, 2007). It is, therefore, an educational activity of formation of citizens and of social action.

The research was conducted at a state college located in the western region of Goiânia, Goiás, Brazil. The PI was developed in a class with 19 black high school students (14 female and 5 male, of which 4 students were in 1st grade, 4 in 2nd grade and 11 in 3rd grade of high school) during 3 classes, totalizing 150 minutes, with volitional participation.

To explained that the participant research is based on knowing how to think and intervene together and that participation, in this case, occurs from the moment we represent two places legitimized in the social structure of Brazilian society, along with teachers of this multiracial society we are also the black members of it.

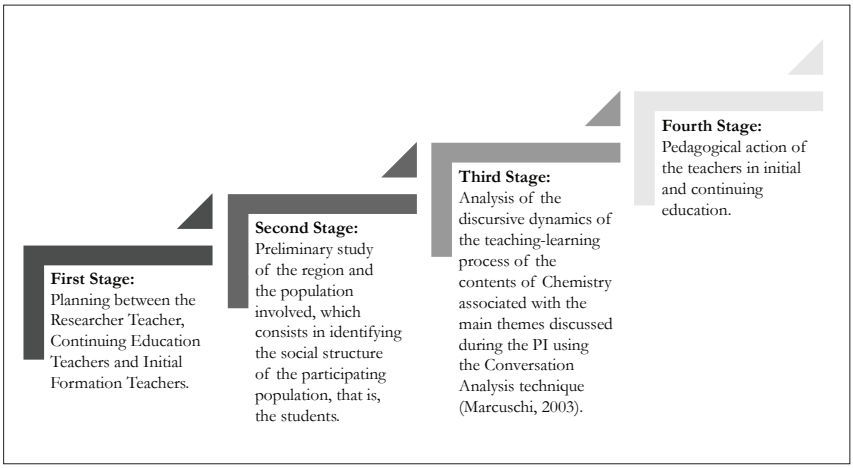
The corpus of analysis is formed by the PI planning and the audio and video recording of the pedagogical intervention. In this article, the data collected by film record will be presented. All material collected was acquired through free consent, through our ethical commitment to preserve the identity of the research subjects and was transcribed for analysis.

> In 2009, the CIATA[2] Black Collective of the Laboratory of Research in Chemical Education and Inclusion - LPEQI - (https://lpeqi.quimica.ufg.br/) of the Institute of Chemistry of the Federal University of Goiás (CIATA-LPEQI/UFG) is organized promoting research on ethnic-racial relations in the training of chemistry teachers and on the implementation of Law 10.639/03. We argue that this is not an easy task, and for this, it will be *"necessary to understand and consider the importance of the articulation between culture, black identity and education. An articulation that takes place in the educational and non-school processes"* (GOMES, 2003, page 169).

The Collective is a collaborative partnership between the school of basic education (continuing education teachers and students), the University (production of scientific knowledge - teachers in initial formation and teacher educators) and society (black feminist movement - Black Women's Group Dandara in the Cerrado) as a strategy of initial and continued training under the law number 10.639/03. In its turn, 'Dandara in the Cerrado' is a non-profit, feminist civil society organization founded in Goiânia, Goiás, Brazil in 2002. The Group's relationship with the local, state, national and international community is political articulation, training, and partnership in the fight against all forms of discrimination of gender, race, class and ethnicity, as well as the generation of work and income, preserving the traditional culture and knowledge.

This investigation obeyed the following steps (Figure 3).

FIGURE 3. Stages of the investigation (LE BOTERF, 1984)



Conversational Analysis (CA) is the study of speech, in other words, the systematic analysis of the conversation produced in daily situations of human interaction in the so-called speech-in-interaction process (HUTCHBY and WOOFFITT, 1998).

The conversational analysis is a tool for analysis of dialogue (verbal and nonverbal), because according to MARCUSCHI:

> Speech is a much more central activity than the everyday writing of most people. However, school institutions give speech almost inverse attention to its centrality in relation to writing. Crucial in this case is that it is not a contradiction, but a posture. We would be too naïve if we attributed this position to the argument that speech is so practiced on a day-to-day basis that

> it is already well mastered and does not need to be transformed into an object of study in the classroom. One of the central reasons for the neglect of spoken language remains the widespread belief that school is the place of learning to write. A belief so deeply ingrained that it has already become a kind of consensus: school is there to teach writing and not speech. It is possible to agree with this, but it is also possible to add that the school is not allowed to ignore speech. The human being is typically a being who speaks and not a being who writes (MARCUSCHI, 1997, p. 39; translation made by us).

The pedagogical intervention followed the class plan presented below.

Class Plan: Teaching Science and Black Identity: Studies on Hair Chemistry

Target Audience: High School Students

Performing time: Three classes (150 minutes)

Goals: Through this PI we sought to implement Law 10.639/03 in the teaching of Chemistry, through the rupture of stereotypes related to curly hair, chemistry and the various reactions that occur in discoloration or coloration of hair. To discuss the chemical concepts involved in the discoloration and dyeing of hair and to identify in the present society the Afro-Brazilian civilizing values transferred with African diaspora.

To contribute to the deconstruction of the idea of science that is only white and masculine and European, and to combat the epistemicide to which black and Diaspora production is submitted. Discuss the concepts of chemical bonding, bond breakages, damage to hair from the discussion of the beauty pattern imposed on our society.

Methodology: This study was carried out in three stages: 1) Problematization: it was made a discussion about hair functions, about how the hair discoloration occurs and the damages caused on it as well as their characteristics; 2) Execution of the experiment - Discoloration and Hair Dyeing, with data analysis, discussion and conclusion about the results. 3) Study and critical discussion about the stereotypes associated with curly hair.

Experimental Procedure: Utilizamos uma mecha de cabelo, descolorimos e tingimos os fios, ressaltando as reações químicas envolvidas em cada um dos processos, os tipos de reagentes utilizados e os danos causados aos cabelos nesses processos, bem como os devidos cuidados que se devem ter ao realizar cada um desses procedimentos. We used a lock of hair, discolored and dyed it, emphasizing the chemical reactions involved in each of the steps, the types of reagents used and the damages caused to the hair in these processes, as well as the due care that must be taken in performing each of these procedures.

NVEILING THE PLOTS

The PI was developed on May 6, 2016 and produced 1312 speech Turn. Table 1 is an activity map that systematizes the development of IP divided into 5 moments.

TABLE 1. Map of IP activities

Time used	3 class hours
Development	In the ***first moment*** a survey was made on the vision of Science and scientist that the students had so far and how this vision is dissipated in the media, in the media, etc. In the ***second moment*** we characterize what is social identity and how it is formed in school environments. In the ***third moment*** we emphasize that the hair is a form of construction of identity. In the ***fourth moment*** we characterize hair, its structure, chemical bonds, hair function for our body, damages that can be caused by the various chemical processes commonly used as social practices. In the ***fifth moment*** we analyze the discourses produced in the teaching-learning process.

We support Heerdt and Batista (2016) when they affirm that situated knowledge is constituted in social and historical relations, in the unequal power relations in whom women are involved. Specifically, in relation to black women, the construction of identity is a social, historical, cultural and plural activity since:

> "To build a positive black identity in a society that, historically, teaches the black man, from a very early age, that to be accepted it is necessary to deny oneself, it is a challenge faced by black Brazilians. Are we at school aware of this issue? Do we incorporate this reality in a serious and responsible way when we discuss, in teacher training processes, the importance of cultural diversity? "(GOMES, 2003, p.171; translation made by us).

We now turn to the analysis of the speeches produced in the learning teaching process, analyzing extract 1 where the construction of the dialogue refers to the discussion about identity and black corporeity in Chemistry class.

EXTRACT 1. Building Identity in Chemistry Classroom

Turn 313 PF3: [...] The hair is what? It represents our identity, it represents our emotions, what we are feeling. It is not? So, when someone decides to "wear your Black hair" it's not because she's sticking to fashion, she's finally identifying herself by assuming her corporeality. Right?

Turn 314 PF2: A11, do you think your hair is fashionable?

Turn 315 A11: (Shaking his head). In the old days my hair was smooth, but I started to use it natural because I think it's better that way than straight.

Turn 316 PF2: And the A7? Is your hair curly?

Turn 317 A7: I think it's curly.

Turn 318 PF2: Is it curly? And why do not you use it curly?

Turn 319 A7: Because I prefer it that way.

Turn 320 PF2: And the A6?

Turn 321 A6: Me! I always wanted to have my hair wrapped around because I had a cousin and her hair ... her mother would make some curls and look so beautiful. I was in love with her curly hair. But I never curled no, I think it's curly.

Turn 322 PF2: And you?

Turn 323 A10: I like smooth. I prefer smoothing, I think ...

Turn 328 PF4: Have you heard this phrase "Wow, that hair there, pixaim"? Have you heard that?

Turn 329 A11, A10 and A7: nod.

Turn 330 PF4: Have you ever been through something like this?

Turn 331 A11, A10 and A7: nod.

Turn 332 PF4: [...] does it affect them?

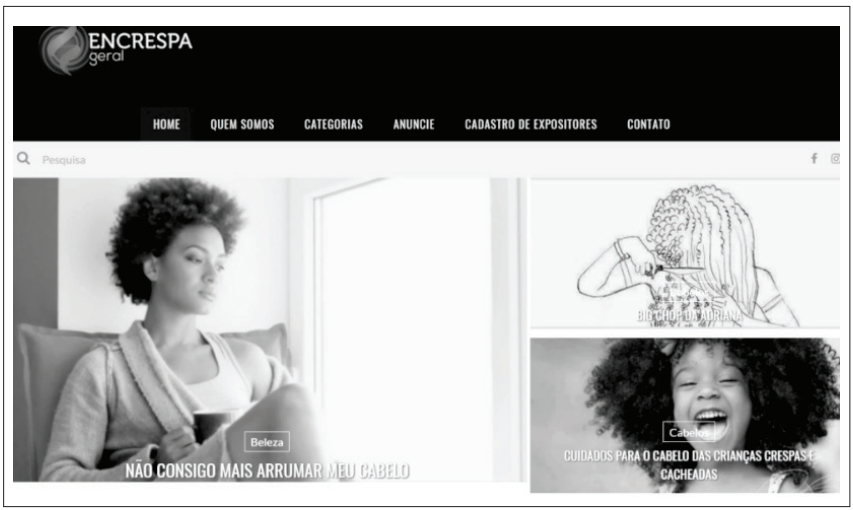
Turn 333 A11: I wore it flat where I lived and everyone thought it was flatter. Only when I started to use it natural began to criticize, saying it was ugly and that it was better smooth because it was BAD! The people say, do not they?

Turn 334 A5: It was bushing.

Turn 335 A11: But then I started to form my own opinion and I decided to use it curly because I thought it best curly and it is already curly!

Turn 336 PF4: [...] to use natural hair is to have the courage to be who we are. In this endeavor arise several groups of women who act to encourage other women to assume their curls, to assume their curly. Has the Strong Root [Available in: < *http://www.projetoraizforte.com.br/blog/*>] who are women who speak of the difficulty that the black woman with curly hair faces with the hegemonic patterns of white beauty, and they do so, they are videos of back and forth from childhood to adolescence and from adolescence to adulthood. I recommend you to use these spaces of support and discussion of identity. The woman chooses a style to try to fit, only it is not for her, it is for society, for how others will see her. This one from here (Figure 3) is "Encrespa", a movement that promotes meetings in various parts of the country on the subject. [...]

FIGURE 4. Imagery representation: territorialities of the body and black hair. Available at: <http://encrespageral.com.br>. Accessed on 29/09/2018



The results expressed in Extract 1 show that the students have difficulty in recognizing themselves (difficulty to classify the texture of their hair, in turns 313 to 331), as for example:

> "**Turn 321 - A6:** Me! I always wanted to have my hair wrapped around because I had a cousin and her hair ... her mother would make some curls and look so beautiful. I was in love with her curly hair. But I never curled no, I think it's very curly" (Translation made by us).

This result leads us to the fact that when it comes to black identity many stereotypes are present, *"depending on where develops this pedagogy of color and body images are distorted or new meanings, stereotypes can be kept or destroyed, racial hierarchies can be reinforced or broken, and social relations can be established in an unequal or democratic way"* (GOMES, 2012, p. 5).

The students recognize the fact that they have suffered racism due to their hair when used natural (**Turn 332 to 336**). This scenario reflects the portrait of the society that normalizes and stereotypes the black woman/man and his hair as bad. Precisely because of this, the students resort to mechanical devices in the attempt to re-signify their aesthetics, such as the use of the so-called "plaits", or through smoothing based on (which) is, in fact, *" way of trying to get out of the place of inferiority to which it was imposed on account of its biological traits"* (SANTOS *et al.*, 2012, without pagination).

The results of **Extract 1** indicate that the teachers of Chemistry can also act in the mediation of the recognition of this identity and in the knowledge of the actions that try to make it invisible (**Turn 313 and 336**), are political, social and historical constructions that mask and erase the aesthetics of curly hair. An example occurs in the mediatic disclosure of beauty standards, which in turn are hegemonically white, a reflection of how the ideology of bleaching is present in our country. In 2015, an advertisement for hair cosmetics invaded our country causing much controversy and reaction from different segments of black women (Figure 4).

FIGURE 5. Imaging representations on smoothing advertisements. Images left - product promise; image to the right - black movement reaction. Search tool used: Google Images. Accessed on 29/09/2018

Hair is one of the traditional bases for the classification of human races, although its general structure is similar. We will analyze the **Extract 2** that deals with this theme.

EXTRACT 2. The chemistry behind the hair

Turn 347 PF2 (Using Figure 6): This is the hair cuticle measuring about 5 to 10 nanometers, which is called the epicuticle, which is composed of fatty acids ... which are a composite adhesive material by a fibrous layer and having an underlying protein, connected by cysteine thioester bonds. This feature explains the apparent hydrophobic character of hair fiber that is very important in the coloring mechanisms, and what we will see in the experiments here.

Turn 348 A13: Wait, are they connected by what connections?

Turn 349 PF2: They are connected by cysteine thioester bonds. And beneath this outer membrane, there is a highly cross-linked layer having a cysteine content, and having exocutyl and endocutyl, formed by amino acids, especially lysine, arginine, aspartic acid. Now in the inside of the cuticle and the bulky part of the thread, and as one, let me see ... the cuticle, inside the most voluminous part of the wire, and which is called the cortex, there is the straight image, which is rich in proteins organized in the form of a spiral, and which is approximately 1 nanometer in diameter, called keratin. And what does it have?

Turn 350 A13: Strength, color?

Turn 351 PF2: Hair strength. This chain is bound by disulfides, and which contribute significantly to malleability

Turn 352 PF1: Malleability

Turn 353 PF2: Wire malleability

Turn 354 PF1: That is so, you do so with your hair (it gives a shake to the hair) and it does not slip readily from your hand because of its malleability.

Turn 355 PF2: So, what should we remember, as the A5 said, is that hair good or bad? [...] One of the characteristics of the threads is the malleability. In the cortex we still find varying amounts of pigments and it is he who determines the coloration of the hair. In the cortex there are also the physical properties and they are related to the structure and the resistance of the hair. In the medulla we have a hollow axis, go there PF1 shows there the image (FIGURE 6)

Turn 360 PF1: What you're talking about, it's the bone marrow is not, the marrow (FIGURE 6) that's it from here, it's just the central part of your hair, and everything around it and the cortex, and that structure is coated here whereby? What is the function of this cuticle?

Turn 361 A10: Protect

Turn 362: All studentes: Protect.

Turn 363 PF1: [...] The cuticle of the hair has this same function, protect the integrity of the whole yarn, so it is the whole length of the yarn, okay? PF2 continues.

Turn 364 PF2: The marrow is then formed of keratin fibers, which are arranged in the form of cavities, and thus human hair is composed of 95% keratin, protein, the main one being keratin. And the natural hair color is genetically controlled, and varies according to different ethnic groups. So, come on, A11 what is the chemical difference you have from the coloring of your hair like, for example, that of PF3. Do you know? The PF3 hair let's say it's a red one.

Turn 365 PF1: A light brown

Turn 366 A5: It's a redhead

Turn 367 PF2: Let's think of a redhead, and yours is black.

Turn 368 A11: Brown!

Turn 369 PF1: A dark brown

Turn 370 PF2: Does chemically (structurally) have your hair related to hers? In hair there is a substance called melanin, this melanin (FIGURE 6)

Turn 371 PF1: Wait for the signal people (rings the school sign).

Turn 372 PF2: Melanin is formed by two producing cells, called eumelanin and pheomelanin. Eumelanin produces the colors from brown to black, and pheomelanin produces from blonde to red. So what's yours?

Turn 373 A11: The first

Turn 374 PF1 and PF3: The first

Turn 375 PF1: The name is complicated (laughs), it's a big name.

Turn 376 PF2: Look, pheomelanin and from blond to red and eumelanin from black to brown

Turn 377 A11: Eumelanin

Turn 378 PF3: Brown. Brown, dark brown, etc.

Turn 379 PF1: So, we see that most have brown hair is not. And brown and black, the hair in this room is all dark. It means that we produce more of this second type of melanin in our hair, it is the one that has more concentration in our hair. They put their structures there, I know they are there, they come back there (FIGURE 7).

Turn 380 FP2: A pheomelanin.

Turn 381 PF1: This one is that it is in greater concentration in our threads, that is why our hair is darker, and brown, brown to black. Everyone here except for PF3.

Turn 382 A5: And the blonde.

Turn 383 A6: And the other's

Turn 384 A12: He said that this is where the blonde was.

Turn 385 PF1: [...] it is this structure and we have more in our hair. In this room, this varies from person to person. (REFERRING TO EUMELANINE AND FEOMELANIN, FIGURE 7)

Turn 386 PF2: But like PF3 said, and now I'm going to ask the question for you, so what's the use of the hair?

Turn 387 A18: To give a "hand"

Turn 388 PF3: Also, to embellish people?

Turn 390 A5: And protect the scalp ...

Turn 391 PF3: Of what?

Turn 392 A18: From the sun

Turn 393 A5: Two solar rays.

Turn 394 PF3: What else?

Turn 395 A5: From pollution.

Turn 396 PF3: It's true people.

FIGURE 6. Image resource used in pedagogical intervention, according to Turn 347. (Translation made by us). Google Images. Accessed on 29/09/2018

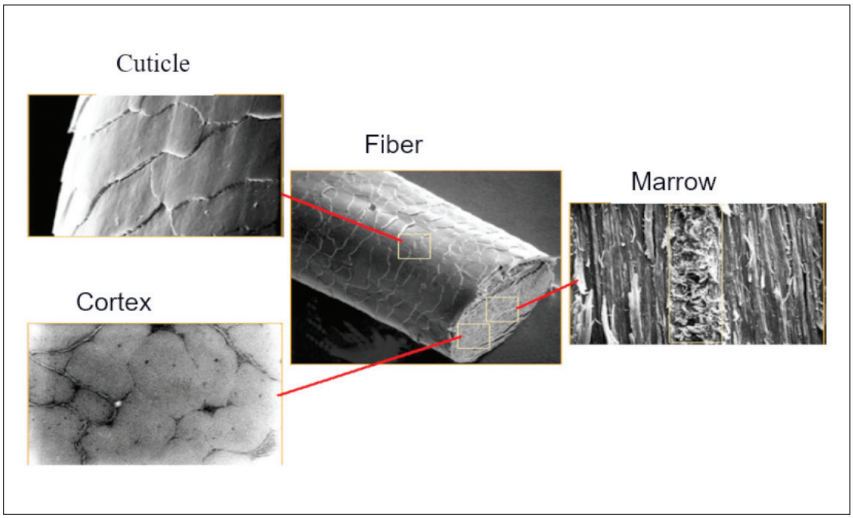
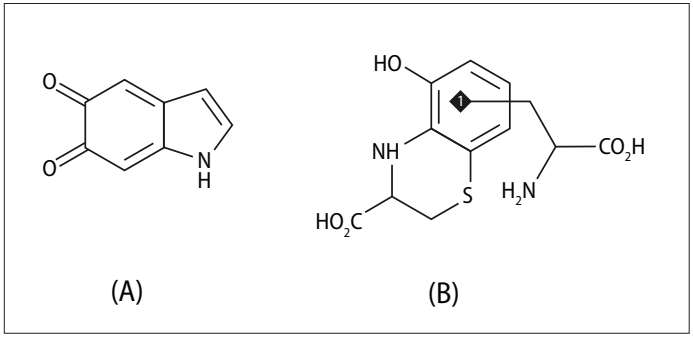
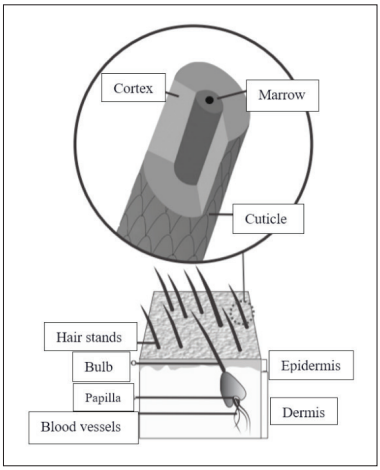


FIGURE 7. Chemical structures of eumelanin (A) and pheomelanin (B) molecules, mentioned in Turn 372 (OLIVEIRA *et al.*, 2014, page 2)



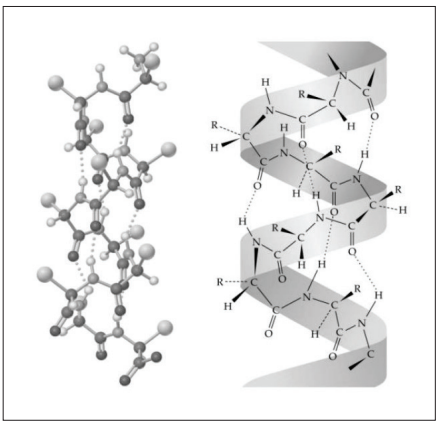
One of the main objectives of Science/Chemistry is to understand the molecules of structure-activity relationships. In this IP we present the relationships between the structure and activity of the hair-forming molecules, which basically *"consists of a wire embedded in a follicle under the skin (capillary bulb or root) where cells multiply continuously, biologically active part of the hair, and the wire itself as the outer part of the skin"* (OLIVEIRA *et al.*, 2014, p. 1037), as shown in Figure 8.

FIGURE 8. Structure of the hair follicle under the skin (OLIVEIRA *et al.*, 2014, p. 2; Translation made by us)



Hair is composed mainly of keratin (Figure 9), a mechanically hard protein that is *"present in all superior vertebrates, in nails, through horns and feathers"* (TORRES *et al.*, 2005, p. 24).

FIGURE 9. Structure of Keratin. (OLIVEIRA, 2013, without pagination). Accessed on 29/09/2018



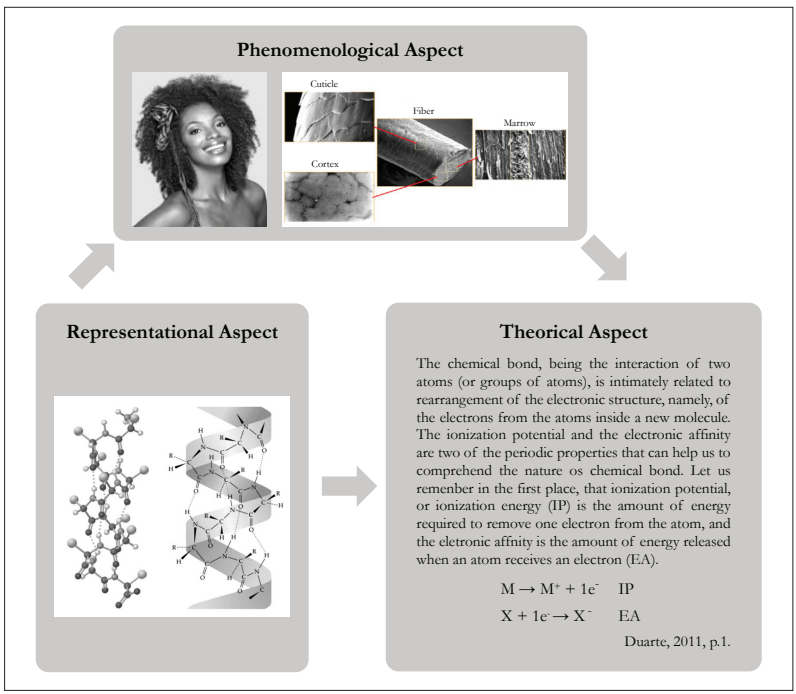
The students recognize that the hair, besides an element of identity (**Turns 386 to 389**), is also important for protection of the solar rays, which is done through the melanin present in it which is also responsible for its coloration (**Turns 390 to 396**). Hair has nerve receptors that act as sensors, which lead to increased head protection when needed (ROBBINS, 1994).

On **Turn 372**, the teacher in initial training discusses how each person's hair color is genetically defined.

> "The natural hair color is genetically controlled and is often associated with different racial groups. However, it is known that the substance that gives color to human hair is the pigment melanin present in the cortex and marrow. Melanin is formed by melanocyte-producing pigment cells, which produce two types of melanin: eumelanin and pheomelanin "(OLIVEIRA *et al.*, 2014, p. 2; translation made by us).

The IP planning considered the presentation of the chemical knowledge from the establishment of the interrelations between its representational, phenomenological and theoretical aspects, as described in the diagram below (Figure 10). According to Mortimer *et al.* (2000), *"the phenomenological aspect concerns the phenomena of interest in chemistry, whether concrete and visible, such as the change of physical state of a substance, are those to which we have access only indirectly"*, the aspect theorist says about the relationship between *"information of atomic-molecular nature involving, therefore, explanations based on abstract models and which include entities not directly perceptible, such as atoms, molecules, ions, electrons, etc."* and, finally, the aspect representational *"that includes information inherent in the chemical language, such as formulas and chemical equations, model representations, graphs and mathematical equations"* (p. 276).

FIGURE 10. Presentation of the chemical knowledge



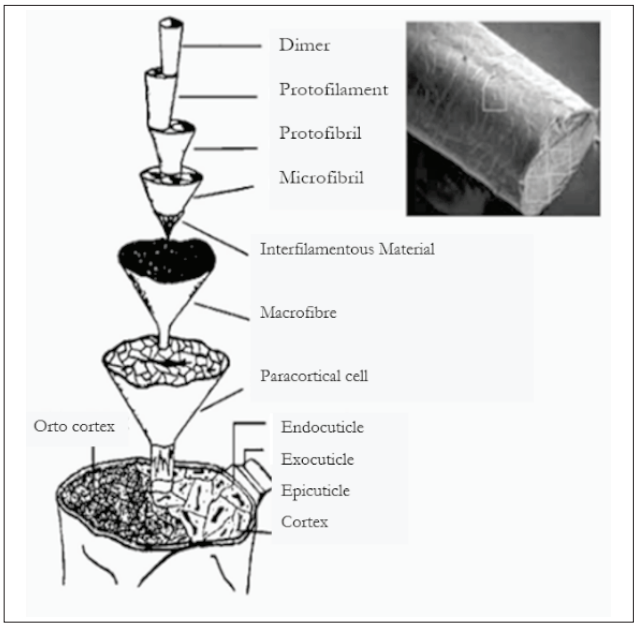
In **Turns 348 to 350** the students refer to the theoretical aspect of chemical knowledge, which in this case is the concept of chemical bonds and relate this to the phenomenological aspect, that is, the shape and texture of the hair (**Turn 364**), as planned by the structure of our IP. From **360 to 370 turns** the students and teachers refer to the symbology of Science - the chemical structure of keratin, its organic function and the structure-property relationship of this protein in terms of melanin composition - establish relationships and meaning with the phenomenological aspect - the shape and texture of different types of hair, as in the case of different hair colors, due to the production of different proteins that are genetically determined: eumelanin and pheomelanin according to the **Turns 364-385**.

In **Turn 381**, once again the theoretical aspect, the concept of concentration, is mobilized by students and teachers when they establish relationships between different aspects of chemical knowledge to understand the concept of chemical bonds.

In brief the students the this gang were from different series, so the approach regarding the representational field of chemical language, according Mortimer and colleagues (1999) refers to the symbolic part of the Science/Chemistry was considered considering that most of the students were in the 3rd grade of high school and that all the students seem to mobilize the concept of 'connections' present in the hair and how they can be broken with use of procedures for straightening, coloring and discoloration, which were discussed in another PI that can be observed from **Turns 348 to 351**. They also referred to the structure/bonding and hair properties ratio, such as **Turns 350, 351, 352, 353** and **354** when referring to the strength and malleability associated with disulfide bonds.

Likewise, the phenomenological aspect of chemical bonds refers to concrete knowledge and establishing the link between concrete and abstract is a complex task. Abstract thinking deals with conceptualization, with the generalization of the concept and in the specific case of the concept of chemical bonds and chemical bonding forces. We consider that the diverse nature of the presentation of the phenomena that can be understood by this statement makes the communication between concrete and abstract thought complicated, to the point that it was necessary, as in turn 349, that the teacher appealed to the imagery resources presented in Figure 11 , for which the establishment of the bond, that is to say, as the cysteine thioester bonds, or the exocutyl or endocutyl structure, or the lysine, arginine and aspartic acid are the amino acids which, with their three-dimensional spiral structures, form the keratin and hence the structure of the hair.

FIGURE 11. Morphological structure of hair (PINHEIRO *et al.*, 2013). Accessed on 29/09/2018



The elaborations of theoretical systems go beyond the limit of the sensory that describes, catalogs, exposes and schematizes external manifestations of the processes of reality, but they are two moments present in the process of cognition (ECHEVERRIA, 1993). Our results show that teachers (Turns 347, 349, 325-360, 363, 365, 367, 369-372, 374, 376, 378, 379-381, 385, 386, 388 and 389) attempt to establish the relations between the observations and interpretations made by the students for the presented phenomenon (the constitution of the hair) and the explanation of this at the atomic-molecular level.

The teachers instruct the students to analyze the concept from the point of view of scientific knowledge and not from their common-sense conceptions, as in the following round:

> "Turn 355 PF2: So what should we remember, as the A5 said, is that hair good or bad? [...] One of the characteristics of the threads is the malleability. In the cortex we still find varying amounts of pigments and it is he who determines the coloration of the hair. In the cortex there are also the physical properties and they are related to the structure and the resistance of the hair. In the medulla we have a hollow shaft, go there PF1 shows there the image" (Translation made by us).

According to Abraham *et al.* (2009), smoothing:

> "Consists in the temporary or permanent breaking of the chemical bonds that maintain the three-dimensional structure of the keratin molecule in its original rigid form. These are divided into strong bonds (disulfide bonds) and weak bonds (hydrogen bonds, Van der Waals forces and ion bonds). The weak forces are broken in the simple act of wetting the hair. The weaker chemical bonds result from the attraction of positive and negative charges. There are temporary smoothing, which uses physico-chemical techniques, such as the dryer and the *piastra* ("flat iron"), as well as the "hot comb" technique. Temporary, as they last until the next wash. [...] The definitive straightening is aimed at breaking the disulfide bridges of keratin. They may be based on sodium hydroxide, lithium and potassium, guanidine hydroxide (calcium hydroxide plus guanidine carbonate), ammonium bisulfites and thioglycollate or ethanolamine, which use chemical reduction reactions (ABRAHAM *et al*., 2009, p. 178; translation made by us).

Brazil is the second largest consumer market in the world in the hair market. With 12.4% of the world share is behind only the US. Our country is an international reference in hair treatment for the Middle East and Europe. According to the Brazilian Association of Hygiene, Perfumery and Cosmetics Industries (ABIHPEC, 2015), consumption in the hair market in 2012 was R $ 18.1 billion. According to the Eromonitor Institute, Brazil ranks first in the world ranking in the straightening products market. In the last five years the segment of products for progressive brush (chemical smoothing) grew by 20%. Research, such as that performed by the Electronic Pharmacy Magazine, indicates that two out of five Brazilian women have smoothed hair (FERREIRA and BRAGA, 2016).

Both hair and skin color play a fundamental role in the construction of black identity and are considered symbolic expressions in Brazil, because together they locate social subjects within an ethnic / racial group. However, we agree with SANTOS and collaborators (2012) that within the society that rules and stereotypes the black race, their hair is seen as bad, so *"in some cases the black's attempt to re-signify his aesthetic through mechanical devices, such as the smoothing through the so-called pots or the base of chemicals, is actually a way of trying to get out of the place of the inferiority to which it was imposed on account of its biological traits"*(without pagination). We will now analyze the third extract that deals with this subject in Chemistry class.

EXTRACT 3. Chemistry and straightening processes

Turn 759 PF1: Look, has anybody ever used flat iron ?[3]

Turn 760 A7: A12 has.

Turn 761 A5: A8 has.

Turn 762 PF1: Who has never used a flat iron?

Turn 763 A5: Me.

Turn 764 PF1: Have you ever been close to someone who was straightening hair with a flat iron?

Turn 765 A5: Many times.

Turn 766 A10: I've straightened my brother's hair.

Turn 767 PF1: What does the flat iron do to straighten the hair? Does it straighten your hair based on what?

Turn 768 A5: Heat.

Turn 769 A7: Heat.

Turn 770 PF1: To break which bonds?

Turn 771 A9: Saline bonds.

Turn 772 PF1: Saline, very well, saline or ionic bonds, it's the same, we use different names but they are the same links. With temperature, by the temperature we break the weaker bonds than those of disulfide which are the saline bonds. When we use the flat iron a lot of time in a single part of the hair what happens?

Turn 773 A11: The hair gets marked.

Turn 774 A7: It burns.

Turn 775 PF1: What else?

Turn 776 A7: It burns.

Turn 777 A9: The hair gets burned.

Turn 778 A5: It stinks.

Turn 779 PF1: What do you observe?

Turn 780 A7: A smoke.

Turn 781 A10: A smell.

Turn 782 PF1: A smoke, a smell, why? Because it's burning your hair, you're literally burning your hair..

Turn 783 A5: It's the same as the video of the woman using the *babyliss*[4] .

Turn 784 A9: Then when she let it go her hair falls off.

Turn 785 A7: She curls her hair and when she's done her hair falls.

Turn 786 PF1: Did you see her video?

Turn 787 A7, A9, A5: Yes.

Turn 788 A9: It was bad.

Turn 789 A6: I think she use it for a long time.

Turn 790 A5: She's crazy.

Turn 791 A7: But I think she had passed some product.

Turn 792 A6: No, it wasn't, It was the time she stayed with the *babyliss* in her hair, it took too long to let go.

Turn 793 PF1: Anyway, time is very important whem using a flat iron, if you leave it in your hair a lot of time it starts to literally burn your hair and this will break more than the saline bonds, it will break those other ones, the ...

Turn 794 ALL STUDENTS: Disulfide.

Turn 795 PF1: Very well, you guys are very smart, but look, you know the reason for that smell? You know?

Turn 796 A5: No.

Turn 797 A9: Smells burned hair.

Turn 798 PF1: But when we burn paper, the smell is the same?

Turn 799 A5: What's that?

Turn 800 PF3: Just a minute, we'll figure it out.

Turn 814 PF1: Please go back (in the slides) in the structure of the disulfide. Look when we submit the hair to excessive temperature, when we are passing the straightening the smell begins to bother, it affects the atmosphere a bad smell, the atmosphere smells bad.

Turn 815 PF1: Look (the slide), this hair has a very beautiful story behind it.

Turn 816 A5: From behind.

Turn 817 PF1: But let's talk about the smell and after I'll tell the story of hair.

Turn 821 PF1: Why does it smell differently, what am I burning? The hair. And what's in the hair?

Turn 822 A18: Disulfide bonds.

Turn 823 PF1: Disulfide bonds involve sulfur. Have you ever smelled a rotten egg?

Turn 824 A5: Rotten egg.

Turn 825 PF1: Of old egg forgotten in the fridge, when you break it is not a characteristic scent too? All because of the sulfur, you are burning sulfur and you are generating this substance with the most unpleasant smell, hydrogen sulfide. Is that why you smelled it when we burned hair here (in a previous activity), did everyone understand that part? (FIGURE 13).

Turn 826 An: Yes.

Turn 827 PF1: Is that okay?

Turn 828 An: Yes.

Turn 829 PF1: Enough of this.

Turn 831 PF1: What we are going to do here, I have already said that another way for us to modify our hair and our identity is to change the color of it, which is the famous dyeing, but before I dye any hair, for example, if you want to dye your hair black, what do you do?

Turn 832 A9: I go to the pharmacy, buy the black hair dye and apply it.

Turn 833 PF1: Do you bleach it first?

Turn 834 A9: No.

Turn 835 PF1: Why?

Turn 836 A9: Because the black dye colors faster.

Turn 837 A5: Because black dominates, doesn't it? Black is black.

Turn 838 PF1: So, if you were going to dye your hair in black you wouldn't bleach it cause you wouldn't need it, cause black is a darker shade than your hair, okay? But what if you wanted to dye it as a blonde?

Turn 839 A10: Then it has to bleach.

Turn 840 PF1: That's because the process was going to take longer.

Turn 841 A9: Same for taking the black dye out of hair.

Turn 842 PF1: What do we do first?

Turn 843 A5: Bleach it.

Turn 844 PF1: What do we use to do that?

Turn 845 A5: Hydrogen peroxide.

Turn 846 A9: Hydrogen peroxide.

Turn 847 A5: And ammonium chloride.

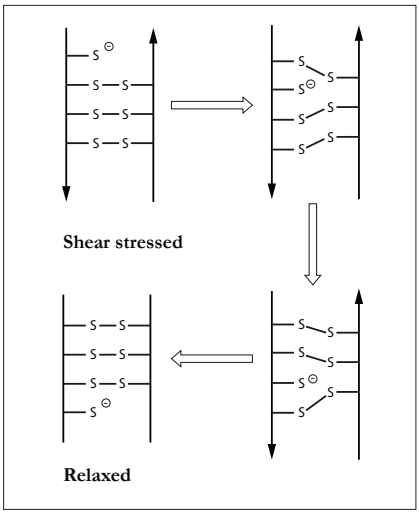
Turn 848 PF1: Guess what we're doing here now?

Turn 849 A5: Bleach A7's hair.

Turn 850 A7: Never.

Turn 851 PF1: No.

FIGURE 13. Different steps of breaking human hair disulfide bonds (MELLO, 2010)



This extract presents two important moments of the PI, the realization of small experiences that the students made to understand the concepts. In the first experiment, the students burned a small lock of hair; and hair discoloration (Figure 14).

FIGURE 14. Photographic record of a PI moment in which the students were preparing to discolor the wick of hair

When the hair was burnt the students noticed the characteristic odor and were instigated to think what conferred such odor. According to Voet *et al.* (1995) and Jones *et al.* (1997), hair is composed basically of keratin, a protein characterized by its high sulfur content derived from cystine. According to Naito *et al.* (1996), this protein forms a network of crosslinks through disulfide bonds (Figure 13), which gives the hair some mechanical and chemical resistance. Thus, many of the morphological structures of hair vary their physical and chemical characteristics because of the presence of groups containing the sulfur atom.

The characteristic smell of burnt hair comes from breakages of disulfide bonds, as shown in **Turn 759 to 828**, where teachers discuss the breakage of such bonds by the use of flat iron.

At this moment, it is noticed that all the students have gone through the situation of straightening the hair, using the flat iron or with extremely aggressive chemical processes for the structure and integrity of the hair. Teaching Science is also teaching about the nature of Science. It should be pointed out that *"[…] the social and political segregation to which women were historically led had resulted in their wide invisibility as subject, including as subject of Science [...]"* (LOURO, 2003, page 20, translation made by myself). However, when we add to this analysis the racial's perspective our results show that the great use of hair stylers indicates the quest to conform to the standards of a white supremacist society in which *"they insist on taking advantage*

of the insecurity that black women feel with respect to our value" in this society (HOOKS, 2005, without pagination, translation made by myself).

We agree with Gomes that:

> The hair of black people in Brazilian society expresses the racial conflict experienced by blacks and whites in our country. It is a collective conflict in which we all participate. Considering the historical construction of Brazilian racism, in the case of blacks what differs is that this ethnic/racial segment has been relegated to being at the pole of the one who undergoes the process of political, economic and cultural domination and to white being in the dominant pole. This rigid separation is not passively accepted by blacks. Therefore, political practices are built, cultural practices are reinvented. The black's hair, seen as "bad", is an expression of racism and racial inequality that falls on this subject. Seeing the black's hair as "bad" and white as "good" expresses a conflict. Therefore, changing the hair can mean the black's attempt to leave the place of inferiority or the introjection of it. It can also represent a sense of autonomy, expressed in the bold and creative ways of using hair. We are, hence, in a zone of tension. From it emerges a pattern of real body beauty and an ideal. In Brazil, this ideal pattern is white, but the real is black and mestizo. The treatment given to hair can be considered one of the ways to express this tension. The consciousness or the masking of this conflict, lived in the esthetics of the black body, marks the life and the trajectory of the subjects. Therefore, for black people, intervention in hair and body is more than a matter of vanity or esthetic treatment. It's identity (GOMES, 2012, p. 3, translation made by us).

The next moment the students did a discoloration of a strand of hair. It is known that the process of discoloration and coloring can also cause numerous damages to the threads, however it is something common and naturalized, mainly among women. The discoloration consists of depigmenting the hair. What gives the color of hair is melanin. According to Oliveira (2013):

> The natural coloration of hair is determined by the melanin granules present in the cortex region. Melanin (the same as that found in the skin) is also responsible for photoprotection of the fiber against the ultraviolet radiation we receive daily from the sun. There are two types of melanin: eumelanins, which give a brown to black color, and pheomelanins, which give a reddish color. The different proportions and dispersions of these melanins are responsible for the great variability of known colorations for natural hair. In esthetic procedures, when you want to dye the hair with a lighter color it already has, it is necessary to make a discoloration, involving oxidizing agents. The hydrogen peroxide dissolves the melanin granules and the bleaching is intensified by the persulfate ion, present in decolorizing powders. The permanent dye acts on the cortex, diffusing into it the precursors of pigments that will polymerize inside the hair fiber, acquiring a size that prevents their exit. The cuticle is not colored, remains transparent. When the strands grow, the most recent stretch of hair is the root, which will have the natural coloration of the hair given by melanin, and it is therefore necessary to retouch it. There are also temporary or semipermanent dyes (for example, lead acetate) whose formulation contains

> compounds of high molar mass that will penetrate partially into the cortex or only be deposit on the cuticle surface, leaving after a few washes (OLIVEIRA, 2013, without pagination, translation made by us).

These aspects were also addressed during PI. With the execution of this experiment students were able to observe closely the chemical transformations present during the discoloration and, also, the damages caused.

Straightening promotes a change in the conformation of the chemical bonds present in the cortex region of the hair strand, *"the chemical bonds that occur between the constituent amino acids of keratin maintain the three-dimensional structure of its molecule. The process of straightening consists of temporary or permanent breaking of these chemical bonds, as a result the loss of the three-dimensional structure of the keratin molecule"* (ABRAHAM *et al.*, 2010, p. 178, translation made by myself).

Abraham *et al.* (2010) state that:

> The weak forces are broken in the simple act of wetting the hair. The weaker chemical bonds result from the attraction of positive and negative charges. There is temporary straightening, which uses physico-chemical techniques, such as the dryer and the flat iron, as well as the "hot comb" technique. Temporary, as they last until the next wash. They need the hair to be previously wetted, so that the hydrogen bonds break down in the keratin hydrolysis process, thus allowing the temporary opening of its helical structure. With this, the hair becomes straight. Rapid dehydration with the dryer maintains the straight shape of the stem. The application of the flat iron molds the cells of the cuticle (scales) as if flattened parallel to the stem (ABRAHAM *et al.*, 2009, p. 178, translation made by us).

On the other hand, permanent or definitive straightening consists of disruption of keratin disulfide bonds, usually based on sodium hydroxide, lithium and potassium, guanidine hydroxide, bisulfites and ammonium thioglycolate or ethanolamine, which use chemical reduction reactions (ROBBINS, 2002).

According to Gomes (2002), a large proportion of black women who use the various types of hair straightening had suffered, mostly in their childhood and adolescence, some types of prejudice, as well as the difficulties they face in handling their hair for being curly. It is enough to remember the violent and cruel manner and it were imposed on the enslaved through the scraping of the hair, which defined them as inferior to the white class, leaving them with the feeling of mutilation, for to them the hair was considered as their identity and dignity. According to Gomes, *"hair has been one of the main symbols used in this process, for since slavery it has been used as one of the defining elements of the place of the subject within the Brazilian racial classification system"* (2002, p. 43).

SOME CONSIDERATIONS

To sum up our results point out that the planned and developed PI represented the conscious contact with the presentation of a non-hegemonic and Eurocentric Science to a multicultural society, as Brazilian society, and also allowed to foment a dialogue among the differences, to question discourses that reinforce the discriminations and stereotypes, planning pre-established contents, instituting a process for the constitution of teachers whom are sensitive to cultural diversity and able to recreate and create alternative practices that articulate the chemical knowledge and the gaze on Africanities; as well as the respect for the different cultures, including the specificities and the complexity of the treatment of the theme as the axis that shapes a proposal of teaching in the Chemistry classes.

It is possible to implement the law through discussions about the various chemical transformations, valuing the African legacy of Science, Technology, Culture and, above all, the identity by performing an epistemic shift in the Chemistry curriculum.

We believe that this alternative strengthens the rupture of the still naturalized vision of blacks as slaves, samba, football, religion or cuisine and begins to unveil the world of rationalization of African societies.

This proposal represented an alternative for the presentation of a non-universal Science/Chemistry: white, male, laboratory and European. As mediators of chemical knowledge, we are responsible for their presentation and for doing in the first moment, in other words, in high school contribute to deconstruct scientific racism.

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NOTES

[1] Amended by Law 11.645 which adds the obligation to teach indigenous history and culture.

[2] TIA CIATA (1854–1924): Hilária Batista de Almeida was born in Bahia in 1854. At the age of 22, she moved to Rio de Janeiro, in the exodus known as the Bahia diaspora. Respected mother of saint, Hilaria was confirmed in the saint as Ciata de Oxum, in the yard of Joao Alabá, in Rua Barão de São Felix, where also was the house of Dom Obá II and the famous tenement Cabeça de Porco – "Pig's head". The house of Tia Ciata was an obligatory stop, because it was the most famous and well respected by the community. To this day, the aunts are represented and honored in the parades, by the ward of the samba schools of Bahia (Heroes of the world, The color of the Culture, available in: http://antigo.acordacultura.org.br/herois/heroi/tiaciata>, accessed on: 29/09/2018).

[3] Hair Straighteners (INMETRO, 2005). Available in <http://www.inmetro.gov.br/consumidor/produtos/chapi nha.asp> Accessed in 29/09/2018.

[4] Curler. Student A5 refers to a video posted on the internet in which a teenager, in an attempt to demonstrate how to use a thermal curler, causes the breaking of part of her hair. (Available in <https://www.youtube.com/watch?v=kAITJRSmZWo>. Accessed in 03/02/2018).

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