Impact Assessment of an Affirmative Action to Promote Diversity, Equity, Inclusion, and Respect in Brazilian Chemistry during the COVID-19 Pandemic

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ABSTRACT: In December 2019, the institutional affirmative action “Onde elas estão?” (“Where are they?”) was launched for the mitigation of gender inequality in the STEM disciplines in Brazil, coincidentally in the same period which the first reports of the COVID-19 pandemic appeared in the city of Wuhan, China. Unfortunately, when evaluating the initiative through different approaches belonging to the Diversity, Equity, Inclusion, and Respect (DEIR) theories, the presence of implicit biases and the invisibility of underrepresented minorities was observed. Approximately 77.5% of the female scientists participating in the initiative were white and belonging to the wealthiest regions (75%) and with the greatest contribution to Brazil’s Gross Domestic Product (GDP). On the other hand, Black, Indigenous, and Asian female chemists were not identified, nor were female chemists belonging to the North Region (Brazilian Amazon Region). The DEIR practice “Onde elas estão?” has an important role in the dissemination of highly qualified Brazilian female chemists and provides an important source of engagement and sense of community for future generations of female students to avoid abandoning STEM subjects. However, adjustments are needed that take into account greater Diversity, Inclusion, Equity, and Respect.

KEYWORDS: Curriculum, Laboratory Instruction, Learning Theories, Women in Chemistry, Inclusive Teaching, Broadening Participation, Cultural Relevance, STEM Pathways, Marginalized Populations

INTRODUCTION

On June 4, 2020, the world was still trying to adapt to the terrible effects of the escalating exponential spread of the pandemic contagion of the new Coronavirus SARS-CoV-2 (COVID-19),^{1–3} as well as watching closely the developments of the outraged racial protests and violent people who called for justice in the face of the brutal murder of African American George Floyd by a white policeman in the United States of America (USA).^{3,4} In this context of intense social tension, the international scientific community found itself completely perplexed and highly indignant when faced with inconceivably offensive, sexist, racist, and xenophobic statements,³ written in the essay “Organic synthesis—Where now? Is 30 years old. A reflection on the current state of affairs”, published online by the prestigious *Angewandte Chemie* international edition of the German Chemical Society.^{4,5} Overnight, in the face of the huge negative repercussions on different social networks and the numerous public statements of repudiation released by important scientific institutions around the world, the publisher Wiley Online Library intervened and withdrew the article,^{4,6} as well as started an investigative process that culminated in the temporary suspension of two editors from *Angewandte Chemie* and the permanent expulsion of the two

reviewers of the article from the journal’s staff of reviewers.^{5,6} This scandal has reached great proportions,^{4,5} as the *Angewandte Chemie* is one of the main chemistry journals in the world (impact factor = 15.34 in 2020), with published articles by several Nobel Prize winners in Chemistry.⁵

Gender and race/ethnicity inequality in science in general, and in chemistry in particular, is not a new topic,^{3,7–9} but it arouses an increasing interest, especially when unfortunate situations such as the one previously described occur.^{3,5} In Brazil, the second country with the highest number of fatalities^{1,2,5} due to the COVID-19 pandemic (over 560,000 deaths by the first week of August 2021),^{10–12} studies on gender and race/ethnicity issues included in theories of Diversity, Equity, Inclusion, and Respect (DEIR) in Science, Technology, Engineering, and Mathematics (STEM) disci-

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plines acquired a new power and urgency due to the new reality imposed by successive partial lockdowns, which were adopted governmentally as a way of nonpharmacological containment of the successive waves of the COVID-19 pandemic.^{5,8,9,12,13}

Since March 2020,^{1,2,5} university professors who teach chemistry in Brazil have been working exclusively remotely in what has become a perverse reality for women teachers, who have found themselves, overnight, forced to compromise their professional leadership achievements (lectures, research groups, writing articles, etc.),^{8,9,12} due to the adoption of a double working day in which they are divided between didactic activities and the necessary care for the family and the raising of children.^{2,5,8,12,13} Besides, the COVID-19 pandemic is so far the most emblematic disease of the Anthropocene^{1,2,14} and has the potential to further intensify the high rate of dropout and abandonment of female students^{3,5,15} and other underrepresented minorities in many STEM disciplines,^{9,10} which in full pandemic when faced with a sexist, nondiversified and noninclusive academic environment, prefer to abandon it, as is observed in the STEM disciplines of the United States of America (USA).^{3,16}

In June 2020, M. S. Sanford, then director of the *Journal of the American Chemical Society* (JACS), published an editorial in which she highlighted the need to take practical action to combat systemic inequalities and unjustified prejudices against women and the underrepresented minorities in the field of chemistry.⁴ Among the various suggestions offered for measures to promote a more equitable environment in chemistry, it is worth mentioning the adoption of affirmative actions that actively promote and defend underrepresented women and minorities, amplifying their voices, publicizing their work and their trajectories.⁴ In total agreement with this suggestion, the Brazilian Chemical Society (Portuguese acronym: SBQ) has been developing an DEIR affirmative action entitled “Onde elas estão?” (“Where are they?”),¹⁷ in which a biweekly female scientist associate of SBQ would be interviewed and expose a little of her trajectory so that it would serve as an inspiration for women colleagues, current chemistry students, and future generations of female researchers and workers in this area, both in academia and industry, thereby recognizing the value of female professional representativeness.

Coincidentally, but without any kind of an established relationship, the DEIR affirmative action “Where are they?” started in December 2019,¹⁷ the same date as the first COVID-19 report in the Chinese city of Wuhan.^{1,2} However, no matter how emblematic and necessary that actions of this type are performed, there is still a need for constant assessment of their real effectiveness and whether they are capable, even if involuntarily, of repeating undesirable exclusion patterns of underrepresented minorities, even more vulnerable, such as, for example, making the presence of Black female professionals and Indigenous female scientists in the field of chemistry and other STEM disciplines invisible. This is an essential fact, because for almost 350 years Brazil was the country that received the most enslaved Africans in the entire western hemisphere;¹⁸ even today it has the majority of its population made up of nonwhites (54%),^{18,19} and as seen in the USA it is a long way from being considered a racial democracy. The purpose of this study was to investigate whether gender, race/ethnicity, geographic, and socioeconomic origins are adequately associated with the DEIR affirmative action “Where are they?” during the COVID-19 pandemic in Brazil.

METHODOLOGY

The SBQ was founded in 1977 and is the main chemical society in Brazil, with approximately 4,000 members. However, since its foundation, SBQ has only had one female chemist holding the presidency of the institution and for only one term (2008).²⁰ SBQ is extremely active in its social media, communicating almost daily with all of its 4,000 associates through home page, an exclusive electronic newsletter via e-mail, as well as investing in other current social media: Facebook page (14,582 followers), Twitter profile (3,551 followers), and the Instagram page (2,530 followers). In 2019, SBQ met to an old demand from female chemists and created the “SBQ Women Nucleus” (Portuguese: “Núcleo Mulheres SBQ”) with the purpose of providing data and highlighting the great women’s contributions in the chemistry scene in Brazil, as well as stimulating debate and reducing gender inequality in the Chemistry area at all levels of education, and contributing to the formation of female leaders in academia and industry.

Since the biweekly initiative “Where are they?” started in December 2019 by “SBQ Women Nucleus”, 40 female professional scientists associated with SBQ have been interviewed.¹⁷ The “Where are they?” project was developed with the sole and exclusive purpose of presenting different female chemist colleagues of SBQ to serve as a source of inspiration and contact for other female chemist colleagues and future generations of female professionals in Brazilian chemistry; it does not have a defined a conclusion deadline, as well as no future institutional developments, and its results are evaluated by the dissemination reach of the different social media used by SBQ (home page, newsletter, Facebook, Twitter, and Instagram).

The interviews are accompanied by face photos, as well as some personal and professional information that provide a small overview of the professional trajectory of the female scientist to disseminate her research, as well as inspiring current and future female generations in the area of chemistry and other disciplines STEM, whether in academia or industry.¹⁷ This DEIR initiative is extremely important because although women in Brazilian chemistry are in practically equal conditions (49%) compared to men,^{5,20,21} reflecting almost the same female proportion of the Brazilian population (51.8% of approximately 213 million people),¹⁹ even so, profound gender inequalities are identified concerning the professional prestige obtained (scissors effect, glass ceiling, leaky pipeline)⁵ and in the country’s territorial distribution,^{5,19,20} which became even more accentuated during the COVID-19 pandemic.^{5,9,10,12,13}

Female Population in Brazil

The Brazilian Institute of Geography and Statistics (Portuguese acronym: IBGE), the body responsible for census research in Brazil, classifies the Brazilian population into five groups of “color or race”: *Branco, Preta, Parda, Amarela* and *Indígena* (Here Translated: White, Black, Multiracial, Asian and Indigenous).^{9,19,20} Although the Brazilian census is not updated, due to the COVID-19 pandemic, the most recent data from the 2010 Census stratify the female population in Brazil as follows: White (48.6%), Black (6.6%), Multiracial (42.5%), Asian (0.5%), and Indigenous (0.2%).^{19,22,23}

The 213 million Brazilian citizens are distributed in five major administrative regions: Central-West (7.8%), Northeast (27.1%), North (8.8%), Southeast (42.0%), and South (14.3%).²³ Besides, these regions have the following classification in the contribution of Brazil’s Gross Domestic

Product (GDP): Southeast (53%) > South (16.2%) > Northeast (13.1%) > Central-West (10.0%) > North (4.7%).²³

RESULTS AND DISCUSSION

The “Where are they?” project developed by “SBQ Women Nucleus” presents huge advantages, including its low cost and ease of implementation, high capacity for synchronous online to tens of thousands of followers in different free social networks, allowing for visibility of the career trajectories of female chemists professionally affected by the COVID-19 pandemic, as well as being easily adapted and deployed in other contexts in chemistry, or other STEM disciplines, in developing countries heavily impacted by measures to contain the spread of COVID-19. However, as should be done in any DEIR initiative, the evaluation of the success of an affirmative action in the STEM disciplines cannot be restricted solely and exclusively to its purely quantitative aspects,¹⁶ and one must constantly consider whether negative behaviors or implicit biases are being reproduced, even if unintentional, that invisibilize one or more even more underrepresented segments within the target audience of interest of the DEIR affirmative action.

Ethnic-Racial Assessment of the DEIR Initiative “Where are they?”

As can be seen in Table 1, the choice of women scientists in the “Where are they?” initiative, although extremely

Table 1. Ethnic-Racial Distribution of Scientists Listed in the “Where Are They?” Affirmative Action

	Distribution (%)				
	White	Black	Multiracial	Asian	Indigenous
Female Chemists	77.5	0	22.5	0	0

commendable as a DEIR practice for the promotion of female professional dissemination in favor of a reduction of gender inequality in the area of chemistry and other STEM disciplines in Brazil, it simply does not reproduce, so far, a real ethnic-racial distribution of the country's female population. There was a lack of greater sensitivity in promoting an equitable and diversified selection in which it privileged and amplified the dissemination of the trajectories of women belonging to underrepresented racial minorities, a pioneering identity action that values gender equality, as well as not respecting the demographic proportionality of professionals of Multiracial female chemists, almost half (22.5%) compared to this stratum in the Brazilian population (42.5%).^{22,23} On the other hand, when making a selection with 77.5% of white professional women, when this ethnicity does not correspond to even 50% of the Brazilian population,^{9,20} it ends up reinforcing the implicit bias and the negative implicit stereotype rooted in Brazilian society that chemistry, as well as the other STEM areas,⁸ would be a professional activity preferably belonging to successful white people (men/women), which influences the smaller proportion of Black and Indigenous girl students who choose a STEM career when compared to the higher percentage of Black and Indigenous boys who choose chemistry as a future scientific career in Brazil.²⁴

Wilson-Kennedy et al.²⁵ showed that the distribution of African Americans who received a bachelor's and doctor's degree at North American universities in 2018 oscillated at something close to 8% and 3%, respectively. Although we do

not have the updated data for the percentage distribution of Black and Indigenous women who have a bachelor's or doctorate in chemistry in Brazil, we can deduce that these figures are quite low, since in 2010 Black Brazilians represented only 29% of master and doctorate students in Brazil, 3% of PhD supervisors,^{8,9} and only 0.03% of the total of approximately 200 thousand doctors working in Brazil.¹⁸ However small the percentage contribution of these professionals to Brazilian chemistry is, they exist and have their own fascinating and diversified professional trajectories, which must be considered with an extreme degree of priority to avoid masking or a false sense of whitening of this science, providing a strengthening in racial struggles that preach a more inclusive, diversified, equitable, and respectful area of chemistry concerning underrepresented minorities.²⁵

Regional Evaluation of the DEIR Initiative

Since the southeast region is the most populous, the richest, and the one with the largest number of postgraduate programs in chemistry (22)²⁰ in Brazil, it would be natural that the number of scientists disclosed in affirmative action belonged to this region (50%), if the selection criteria were strictly demographic and not to be a DEIR practice (Figure 1).

Figure 1. Regional distribution of the female scientists present in the “Where are they?” affirmative action.

However, in the second place in the South Region which, although it has fewer postgraduate programs in chemistry and a smaller number of professionals working in this science when compared to the Northeast Region,²⁰ obtained 2.5 times the number of scientists disclosed in this DEIR action: 25% and 10%, respectively. Finally, there was a similar tendency to favor women scientists in the affirmative action in economically wealthier administrative regions, since although the North Region has more inhabitants and has at least eight federal universities that offer the chemistry course,²⁰ as well as respective postgraduate programs in chemistry, there were no professionally active women scientists from the selected region to describe her trajectory, inspire and engage future local professionals, unlike the Central-West Region, where at least

15% of the participants in the “Where are they?” affirmative action are active professionals from that region.

Naidek et al.²⁰ warned that the gender disparity of chemistry professionals across Brazilian regions was extremely worrying since it would serve to perpetuate implicit biases, social stereotypes, and reference standards, as well as idealized models of female leaders that could at the same time inspire future generations from these predominant regions, such as discouraging new women chemistry students from underrepresented regions who would see success in their professional careers in chemistry as something distant and outside their regional reality.^{9,13} Therefore, it is necessary to focus efforts so that affirmative and identity action such as the one evaluated in this study “dialogue” more comprehensively with the different regional realities of a country of continental dimensions, such as Brazil. It is known that the economic prominence and long history of public investment gave priority to the economic wealthiest regions of Brazil for scientific development, but this DEIR action in progress may just collaborate to correct these distortions and demonstrate that even the most economically fragile, other Brazilian regions have female chemists doing high-quality science and who deserve to have their trajectories disclosed, thereby engaging underrepresented students to continue their STEM training.

An Intersectional Approach to Inequalities

At first, the two forms of inequality (racial and regional) present in the DEIR affirmative action “Where are they?” evaluated in this study can be considered independent and disconnected. However, when reflecting on the racial distribution of Brazil, it should be considered that the Northeast Region is the one with the highest proportion of African Brazilian people (11.9%), followed by the Southeast Region (9.9%), Central-West (9.2%), North (7.3%), and South (4.6%).²⁶ In turn, the Multiracial population is the majority in the North Region (72.2%), the Northeast Region (62.5%), and the Central-West Region (53.4%), declining significantly in the Southeast Region (39%) and in the South Region (21.3%). Finally, the White population is predominant in the South Region (73.2%) and in the Southeast Region (50.1%), declining significantly in the Central-West Region (36.2%), Northeast Region (24.7%), and being quite reduced in the North Region (19.1%). Obviously, that simply selecting more scientists from the Central-West, North, and Northeast regions would not be an automatic guarantee in increasing the ethnic-racial diversity of the women scientists participating in the “Where are they?” identity action, but would undoubtedly provide an exchange of information more diversified, inclusive and enriching professional experiences and life trajectories so necessary to Brazilian chemistry.

A successful DEIR initiative must consider the need for the real inclusion of underrepresented groups belonging to the target audience, considering their perspectives, experiences, gender, race, ethnicity, as well as their regional and socioeconomic backgrounds.²⁷ The “SBQ Women Nucleus” to review its selection criteria for the “Where are they?” initiative in order to effectively promote diversity among the members chosen for this affirmative action and thereby increase engagement, as well as the sense of belonging and community of female chemistry professionals of different races, ethnicities, geographic, and socioeconomic backgrounds.

Gender and Race Inequality in Brazilian Science during the COVID-19 Pandemic

Staniscuaski et al.¹³ conducted a research in the first year of the COVID-19 pandemic with 3,345 Brazilian academics (males and females) and identified that nonpharmacological control measures (lockdowns and social distancing) negatively impacted, mainly, female scientists, a fact corroborated by Soares et al.,^{2,5,10,12} who evaluated the working conditions of chemistry teachers in schools and universities in Rio de Janeiro in the same period. However, even among female academics, an inequality was observed in the face of the impacts of the COVID-19 pandemic; nonwhite female scientists (Black and Multiracial) are the most strongly impacted on their academic careers and intellectual productivity (regardless of being mothers or not), followed by white female scientists with children and, later, by white female academics without children.^{8,9,13}

These facts reinforce the old perception that Brazilian academic institutions are characterized as a racially stratified environment, possessing totally unbalanced hierarchical relations of gender and race/ethnicity, and leaning toward the maintenance of the historically constructed *status quo* for the maintenance of the professional privileges of white male scientists.^{8,9,24} Brazilian female scientists, especially Multiracial, Black and Indigenous ones, would be inserted in a context of “subaltern inclusion”, in which the visibility of their professional careers would be very low or almost imperceptible, thus obtaining less academic prestige. Therefore, it is reinforced that any DEIR affirmative action, such as the one described in “Where are they?”, must necessarily consider in its formulation and later in its evaluations the nonreproduction of implicit biases that may bring invisibility and silencing to an even more underrepresented minority within the target audience, as well as the nonreproduction, even if unintentionally, of negative stereotypes that will profoundly impact the self-esteem, the engagement, and the sense of community of the underrepresented segment that it is desired to be included, in order to increase the diversity and representativeness of the different members that compose the STEM disciplines. This is even more so in a historical period such as the COVID-19 pandemic that is capable of generating an extreme feeling of pain, anxiety, anguish, and depression in groups stigmatized by historically persistent implicit negative stereotypes.^{8,9}

■ A NEW EQUILIBRIUM STATE IS POSSIBLE!

Under no circumstance are the criticisms raised by this communication intended to suggest that the affirmative action “Where are they?” finalized just the opposite. In an extremely difficult time, such as that experienced during the current COVID-19 pandemic,^{1–3} there is a need for a growing engagement of the academic chemistry community in Brazil.^{5,8,9} Additionally, institutional actions of feminine visibility such as “Where are they?” provide mitigation of gender inequality through the dissemination of the trajectories and careers of highly qualified professional scientists in the field of chemistry. The evaluations carried out throughout this text using the DEIR theory serves to point out opportunities for improvement, as well as to point to the need for continuous evaluation of institutional processes and practices that promote DEIR actions, and can serve as an alert to evaluate other DEIR practices that are internationally underway, as claiming DEIR

initiatives are better executed is also a moral imperative, because any other scenario is unfair and unacceptable.^{3,8}

Far from wanting to exhaust the topic, some alternatives and suggestions adapted from the most recent DEIR literature will be presented to improve the affirmative action “Where are they?”:

- Give preference to the dissemination of the trajectories and careers of women in chemistry belonging to underrepresented minorities (Black, Multiracial, Indigenous, Asian chemists).
- Invite chemistry scientists from Brazil’s economically poorest regions and who have a greater ethnic-racial diversity (North, Central-West, and Northeast).
- Invite chemistry scientists known to belong to the LGBTQIA+ community.
- Make the initiative weekly so that more female chemists can be contemplated by the initiative.
- Promote partnerships with the Basic Education (K-12) to publicize this initiative and inspire even younger generations of student girls.
- Transform the “Where are they?” affirmative action in an international bilingual project (Portuguese and English) so that it can also inspire other women in other countries in the chemistry area.

CONCLUSIONS

Far from wanting to make an in-depth assessment of the different approaches to DEIR theories, this communication was intended to show the “snapshot” of the current stage of development of institutional affirmative action “Where are they?”. This action has, to date, provided the dissemination of the trajectory and careers of 40 extremely qualified female scientists in the chemistry area, which in itself is already a source of engagement and inspiration for female professionals in the STEM disciplines, as well as the current female students and future generations of female chemists in Brazil, in such a difficult moment due to the COVID-19 pandemic.

Although meritorious and extremely praiseworthy, carrying out the analysis provided by the DEIR theories, it was observed that the identity practice in progress needs to adapt to guarantee the due, and necessary, visibility of underrepresented minorities belonging to the female gender in favor of a more equitable, diversified society that is inclusive and respectful. Even if unintentionally, negative behaviors and unacceptable implicit biases were reproduced in the selection of scientists who are part of the “Where are they?” affirmative action. This ended up making invisible, to institutional recognition, the scientific/industrial leadership role of Black, Indigenous, and Asian women in Brazilian chemistry, and other women who develop important contributions to the chemistry area and are professionally located in universities and industries in the Northern Region of Brazil. An alternative for affirmative actions such as the one reported in this study to be successful when adapted in other international contexts is that from the outline the use of an intersectional approach should be seriously considered, in which the selection criteria of the participants are as diverse as possible, taking into account the races/ethnicities that make up the country’s target audience, as well as regional/socioeconomic backgrounds and other relevant demographic characteristics of each country.

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Notes

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