Female under-representation in STE: The case of the Federal University of Espírito Santo

Subrepresentación femenina en CTI: El caso de la Universidad Federal de Espírito Santo

Susane Petinelli-Souza
susane.souza@ufes.br
Universidade Federal de Espírito Santo - Brasil

Elisabete Corcetti
elisabetecor@ifes.edu.br
Instituto Federal de Espírito Santo - Brasil

Maurício Sartori
msartori@ifes.edu.br
Instituto Federal de Espírito Santo - Brasil

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Abstract

Despite educational advances in Brazil, female representation in science, technology and engineering (STE) is still something to be achieved. Women and men still tend to focus on different areas, on occupational segregation. The aim of the article is to analyze female underrepresentation in the courses at the Technological Center of a public university in Brazil. It was found that the sexual division of labor and education can reinforce certain gender stereotypes. The analyzed data indicate that more men than women take courses in the areas of exact sciences and engineering and that, among women, brown and black women are represented in fewer numbers. Therefore, there is a gender gap in female participation in STE at the investigated university.

Keywords: female underrepresentation; STE; gender; race; Brasil.

Resumen

A pesar de los avances educativos en Brasil, la representación femenina en ciencia, tecnología e ingeniería (CTI) es todavía algo por lograr. Las mujeres y los hombres todavía tienden a centrarse en áreas diferentes, en la segregación ocupacional. El objetivo del artículo es analizar la subrepresentación femenina en los cursos del Centro Tecnológico de una universidad pública de Brasil. Se encontró que la división sexual del trabajo y la educación puede reforzar ciertos estereotipos de género. Los datos analizados indican que más hombres que mujeres toman cursos en las áreas de ciencias exactas e ingeniería y que, entre las mujeres, las mujeres morenas y negras están representadas en menor número. Por tanto, existe una brecha de género en la participación femenina en CTI en la universidad investigada.

Palabras clave: subrepresentación femenina; CTI; género, raza, Brasil.

1. Introduction

Currently, more women earn bachelor's degrees in fields related to exact sciences and engineering than in the past, in a clear process of improving the status of women in these areas (Carli *et al*., 2016). Still, women are outnumbered by their male counterparts.

The 2017 Higher Education Census, produced by the Anísio Teixeira National Institute of Educational Studies and Research (INEP, 2019), in Brazil, reveals the importance of continuing to address gender and race/ethnicity inequalities in higher education. With regard to participation by gender, out of the 20 most popular degree courses, which include 5.432.301 enrolled graduates, representing 65,6% of the total, it is possible to identify that 14 of these courses have a predominance of women, they are as follows: Education (92,5%), Social Services (90,1%), Nutrition (85,2%), Nursing (84,0%), Psychology (80,5%), Dentistry (72.2%), Pharmacy (71,9%), Physical Therapy (79,0%), Staff Management/Human Resources (78,0%), Architecture and Urban planning (66,6%), Medicine (58,2%), Accounting (57,0%), Law (55,3%), and Government (54,9%).

The courses with male predominance, in turn, are: Mechanical Engineering (89.7%), Civil Engineering (69.5%), Production Engineering (65.0%), Physical Education (65.0%), Physical Education Teacher Training (59.8%) and Entrepreneurship (52.4%). Thus, according to Carvalho & Rabay (2013), women continue to be the majority in traditionally female courses, such as Social Work, Nursing, Nutrition, Psychology, Literature, Teaching and other degrees. While prestigious scientific careers in Physics, Mathematics, Computing and Engineering remain male fields of knowledge and culture.

It is noted that there have been many changes in the workforce and education during the last decades: women have expanded their representation, had salary gains in towards more equitable pay and more recognition through grants, publications and awards. Despite these changes, differences persist in the fields of science, technology, engineering and mathematics (Charlesworth & Banaji, 2019).

In classes in the areas of exact sciences and engineering, at university, men usually outnumber women, sometimes with a ratio of 3: 1, given the distorted gender proportions (Dasgupta & Stout, 2014). There are few female students and few female teachers, reinforcing the rarefied female presence in these areas.

When considering aspects related to gender in the sciences, we found that negative stereotypes persist and images of the role of women in the sciences may be a little more positive, but have not been radically reformulated (Etzkowitz, Kemelgor & Uzzi, 2003).

Science is fundamentally hierarchical, it is an institutional medium of power, marked by an inequality of status and rewards, with the attributes valued by science being more attributed to men compared to women (Fox, 2006).

Women and men still tend to focus on jobs in different areas, in an occupational segregation. Jobs traditionally associated with men generally pay better than jobs dominated by women. However, these jobs do not pay less because they require fewer skills, but rather because it is women who carry them out. Moreover, when more women enter a profession previously dominated by men, wages end up being reduced, which shows that female work continues to be undervalued (Miller & Vagins, 2018).

Ribeiro, Komatsu & Menezes-Filho (2020) conducted an analysis of wage differences, taking into account race, gender, professions and public and private schools in Brazil, and identified that the average wages of white men are higher in all professions and the wages of black women are lower in all professions. In this scenario, the average wages of white men come to be double the average wages of black women. In this way, being female or not being white, as well as studied in public school during high school, generates an intensified drop in average wages. The authors conclude that these inequalities are explained by historical gender and race discrimination that are reflected in wage differences.

Therefore, sexist and androcentric discrimination in the social structures of the sciences, in the conceptions of technology and in education itself result in an underrepresentation of women in Science and Technology, generated by the assumption that women would be unable to compete in these careers, lacking the necessary skills (Harding, 2003).

The objective of the paper is to investigate the representation of women in courses in the science, technology and engineering of the Technological Center of the Federal University of Espírito Santo, in Brazil. The area of mathematics will not be considered in the study, because the investigated Technological Center does not offer a mathematics course. To proceed with the analysis, aspects related to the sexual division of labor, education and gender stereotypes and race in the field of science and technology were considered.

Considering that the gender gap in participation in certain professional and performance fields is still a complex issue to be resolved, this study aims to give visibility to this problem. Therefore, the article intends to analyze female underrepresentation in science, technology and engineering put this theme in evidence.

Studying the various aspects of gender, particularly in science and technology, besides being relevant, can serve as a source of inspiration for public policies and government programs that seek to promote change and encourage female participation in the area (Santiago & Dias, 2019).

The study is organized as follows: introduction, sexual division of labor in science and technology, education in science, technology and engineering, method and scope, analysis and discussion of results and conclusions.

2. Sexual division of labor in science and technology

At the first conference of the Third World Organization for Women in Science in 1988, there was already a not optimistic view regarding the status of women working in science. In relation to Latin America, especially those countries that have already reached a higher level of economic growth, although improvements are visible due to the efforts undertaken since the 1950s and measures promoted by governments related to the planning of scientific and technological development, and the control of the exodus of scientists to advanced countries, the degree of dependence is still great, and the working conditions are unsatisfactory (Tabak, 2002).

For the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2019), there is a gender gap in science and women represent a minority of the world's researchers. Despite the growing demand for internationally comparable statistics on women's participation in Science, national data and their use in policymaking often remain limited.

UNESCO played an important role in the impetus behind the studies and research carried out during the 1970s and 1980s on women in the field of science and technology. One of the most important events of the late twentieth century was the International Conference on Women promoted by the United Nations in the capital of China, Beijing, in 1995. Its decisions and recommendations would affect the life of half the world's population. The event was attended by tens of thousands of women from all continents, who took part in the gigantic forum, that happened parallel to the meetings of the delegations of the governments of member countries. It was noted that the systemic and systematic persistence of the situation of discrimination of women continues to hinder their development as human beings, as well as their contribution to world development. The Beijing platform for action recommended expanding women's access to vocational training, continuing education and the area of science and technology (Tabak, 2002).

More recently, the BRICS (made up of Brazil, Russia, India, China and South Africa) was created to foster cooperation between countries that aspired to an international order based on multi-polarity, equity and democracy. At the 10th BRICS Presidential Summit in Johannesburg, 2018, one of the issues of interest was female participation in science.

In Brazil, the main stimulus policy to increase the participation of women in science and technology was implemented through the Women and Science Program. It was launched in 2005, based on the work carried out by an inter-ministerial group composed of the Special Department of Public Policies for Women (SPM), the Ministry of Science and Technology (MCT), the National Council for Scientific and Technological Development (CNPq), the Ministry of Education (MEC), among other participants. The program aimed to stimulate scientific production and reflection on gender relations, women and feminism in the country and to promote the participation of women in the field of sciences and academic careers. The main actions of the program were the award Building Gender Equality, the edicts Gender Relations, Women and Feminisms and the meeting Thinking Gender and Sciences (CNPq, 2020).

For young scientists, the program Woman and Science launched, in 2014, the panel "Young Researchers" with the aim of disseminating the work of young Brazilian scientists, researchers of recognized academic merit, who have stood out since their time as students, building an academic life of national and international recognition. Another important action was "Female Pioneers of Science in Brazil", alongside the Department of Policies for Women of the President of Brazil and the CNPq. It aimed to give visibility to the history of women researchers who participated and contributed in a relevant way to scientific development and to the formation of human resources for science and technology in Brazil. This initiative was launched in 2013 and had seven editions until 2018 (CNPq, 2020).

In the ranking of the Global Gender Gap Index 2020 Brazil is in the 92nd position (out of a total of 153 countries) in terms of gender equality. It is important to consider that Brazil is one of the 15 most populous countries in the world and that more than 60% of its women are in the labor market. This position was achieved due to several aspects, among them the economic one, due to the existence of wage differences between men and women and due to underrepresentation in many areas of professional activity, such as in the political field (WEF, 2020). According to the report, the country is ranked 35th in the educational field – which shows that educational policies still need to overcome obstacles for further economic and social changes to occur in the country.

In Brazil, despite all the social transformations and actions aimed at women, they still face obstacles to enter the world of science. The study by Grossi, Bernardes, Lopes and Andalécio (2016) investigated the profile of women's participation in research, of 4,970 women who defended their doctoral theses between the years 2000 and 2013. The study pointed to a steady growth in the number of women completing their PhD per year.

However, despite these efforts, many female students, who show interest in the exact sciences during high school, change areas of interest at university and in their professional lives (Clark Blickenstaff, 2005).

In addition, the entry of women into scientific careers is a relatively recent phenomenon. Just over a century ago, women were still prevented from seeking degrees and advanced science training at most universities in Europe. In their youth, during the late nineteenth century, for example, Marie Curie and Lise Meitner received part of their training through courses offered in the living rooms of the homes of male academics (Etzkowitz *et al*., 2003).

Men make up the majority of scientists and engineers in most industrialized countries, and although the percentages vary from field to field, the overall pattern is evident. In addition, an increasing number of women does not necessarily alter the gender and hierarchy patterns in science. Women have long been present in science, although they are not in valued, highly rewarded or visible roles (Clark Blickenstaff, 2005; Fox, 2006).

The professionalization of the sciences and their incorporation into universities during the nineteenth century put the experimental sciences, which became increasingly technologically sophisticated, beyond the reach of even the most interested women. Only in the 1970s did women's access to the laboratory benches again reach the previous levels of the eighteenth century, a less institutionalized age for the sciences, when upper-class women had open access to scientific work through their families and network of relationships. Although women gained formal access to university-level science education in the late nineteenth century, informal barriers persist into the Twenty-First Century (Etzkowitz *et al*., 2003).

Science reproduces gender stratification, since science is disproportionately done and controlled by men and men are more likely to be located in universities than in colleges and are in more valued areas such as the physical sciences, mathematics, computer science and engineering. Thus, gender shapes participation, location, classification and performance in science and due to the power, that science exerts, in addition to reflecting the existing gender stratification in society, it also helps to expand this system (Fox, 2006).

Another idea is that science is inherently masculine in its structure and epistemology. This is the position taken by feminist critics of science. Many literature reviews leave this material out. However, it seems naive to pretend that science is above criticism, and this material could provide information on how to proceed to reform science education. Science is based on positivist objective rationality, which is seen by some scholars as entirely masculine and therefore less attractive to women (Clark Blickenstaff, 2005).

Science as a human construct is not exempt from the multiple forms of prejudice and discrimination of gender, ethnicity and race, and social class (Silva & Ribeiro, 2014). Therefore, it is necessary to move away from the position of a white male, denying a supposed universal subject of knowledge to enable other views, including those of women, as well as valuing local knowledge (Haraway, 1995).

Feminist analyzes indicate how modern sciences have been integrated into gender relations in their historical time periods. Thus, some important themes accompany these analyzes, such as sexist and androcentric discrimination in the processes and results of scientific research, in the social structures of the sciences, in the science of education, in the conceptions of technology and in the epistemologies and philosophies of science (Harding, 2010).

Consistently, logic in the field of science prescribes the understood male side of a series of dualisms, such as objectivity versus subjectivity, rationality versus irrationality or emotions, mind versus matter or body, hard"natural sciences versus soft social sciences (Harding, 2003).

Science and technology have distorted and reductionist conceptions in the production of knowledge and its relationship with society, both are rooted in a development model still based on technological determinism, in which decisions follow technocracy, feed the ideas of neutrality, autonomy and scientific objectivity, tending to be based on values such as efficiency, domination and control of nature (Cabral, 2019).

Experts have been addressing the theories and practices of the area of Science and Technology through different perspectives produced by the women's movement, both in Europe and in the United States, questioning how science and technology discriminates against women's interests. These experts want to know how a sexist social structure in science and society produces patterns of knowledge, but also of ignorance in the sciences (Harding 2010).

Still, the current picture shows that the sexual division of scientific work persists (Abreu, Oliveira, Vieira and Marcondes, 2016), and this division of labor based on gender ends up leaving to women the responsibility of caring for children and the home, to the detriment of their careers (Wienclaw, 2011).

Traditionally, a division of labor based on gender still persists, because while men work outside the home, women remain, in many cases, primarily responsible for the care of the home and children. There is a search for work-family balance and the reconciliation of roles to play: woman, mother, wife, scientist, because small children affect women's careers, including restrictions on women's travel to conferences and events in their professional field (Wienclaw, 2011; Silva & Ribeiro, 2014; Dasgupta & Stout, 2014; Miller & Vagins, 2018).

This division causes many women to abandon their own interests in favour of the interests of their husband and children. The constitutive terms of liberal political discourse and practice - individual, autonomy, self-interest-fundamentally depend on this process of self-denial from a set of activities marked as feminine (Oksala, 2013).

The subordination of gender and the restrictions exerted in women's lives no longer correspond to a state of personal subjugation, both result from cultural and systemic processes that end up retransmitting the actions of many people, including being retransmitted in the market context (Fraser, 2011).

In Brazil, women's earnings are lower because women are concentrated in precarious occupations, with shorter working hours and with less legal protection. Even women with high education do not overcome the wage gap, given that they are still a minority in careers and professional niches that are more valued. There is a narrowing of the wage gap between the genders, however, the process is slow (Abreu *et al*., 2016).

Discourses and social practices that diminish or exclude women based on their gender are considered gender bias, although this type of prejudice does not affect all women equally and may occur in either a subtle or more explicit way (Silva & Ribeiro, 2014).

Gender stereotypes, gender bias and sexist practices are also observed in the educational system. Therefore, aspects related to education in science, technology and engineering will be dealt with next.

3. Education in science, technology and engineering

In the developing world, the lack of economic resources and social welfare services for families signals the fact that domestic obligations lead to girls leaving school, long before they get any science education or, for some, without even achieving literacy (Harding 2003).

Formal education is the area in which Brazilian women have achieved greater progress in recent decades, since women are able to advance in the educational system and represent the majority of those enrolled in and graduated from high school and upper levels of the educational system. However, the greater presence of women in higher education does not mean a homogeneous distribution in the various areas of knowledge, given that women are mostly in other areas of knowledge, with low representation in exact sciences and engineering, which is also observed in many countries (Abreu *et al*., 2016).

The number of women with university degrees has increased. In fact, from women who have already overcome the disadvantage they had in the educational area compared to men. According to the Institute of Technological Research, from the 1960s and 1970s, in Brazil, the participation of women in science and technology increased significantly, with one of the reasons being the performance of the feminist movement of the time (Grossi *et al*., 2016).

Previous research on gender-related aspects in science, technology and engineering has focused on the differences between male and female cognitive abilities. But stereotypes, which are beliefs about gender and science, can be even more influential. The relative lack of adaptation between the female gender role and the stereotypical role of scientist can cause women to be seen as overly communal and even too passive to succeed in the field. Therefore, it is important that people become aware of these possible biases to try to compensate for them in the evaluation of women and girls in science and technology (Carli *et al*., 2016).

Socialization in gender roles affects the educational experience, especially when teaching styles are distorted in favour of a gender (Etzkowitz *et al*., 2003). Most often, education is an important predictor of socioeconomic status, influencing the achievement of higher-paying jobs. In school, if one gender receives substantially different treatment relative to another and this differential treatment results in lower expectations or a lower quality education, obtaining jobs with lower status and income, then the education system has failed to promote equal opportunities (Wienclaw, 2011). However, despite this consideration, the idea that education alone is sufficient for women's careers in science is questionable (Fox, 2006).

Even when girls and women have an affinity with the area of science and technology, many lose interest and do not go on to advanced courses and careers in this area, representing an exodus of talents that could become the next generations of scientists, engineers and technology creators (Dasgupta &Stout, 2014). The removal of women from scientific careers considered as harder sciences seems to be associated with the social edification of gender (Grossi *et al*., 2016).

Therefore, the importance of promoting equity in the educational process lies precisely in the fact that it is in the classroom that boys and girls learn to conform to gender roles and stereotypes or to break free from them (Wienclaw, 2011). Once women get to university, they are bombarded with subtle messages and not-so-subtle messages that signal that they don't belong in the careers of physical sciences, computer science, engineering, and maths. Doubts about belonging can hinder women's access and persistence in higher education, making them question whether their skills, interests and aspirations are compatible with the field. The lack of belonging and even of feeling displaced in the field comes from the widespread stereotype that these fields of knowledge are for men. Another point is that the science and technology faculty members are much more likely to be men than women and when women act as teachers in the field their presence in classrooms brings benefits to female students (Dasgupta & Stout, 2014).

We are talking about the importance of the representativeness of female teachers who can inspire and serve as an example for girls and women in choosing careers. For Etzkowitz *et al.* (2003), the effect of culturally constructed gender roles persists in science and other professions through the social meanings associated with gender. Instead of a fluid perspective of human attributes that can be maintained by members of both sexes, it is mistakenly assumed that behavioral characteristics are innate and immutable, biologically male or female.

Debates around the causes of gender disparities in science and technology are based on three interrelated ideas. Gender disparities may arise from Innate and/or socially determined gender differences in relation to their capability for the field; from innate and/or socially determined gender differences in relation to field preferences added to lifestyle; and from explicit and implicit biases of men and women (Charlesworth & Banaji, 2019).

Regarding stereotypes, people often perceive women as deficient in the traits necessary to be considered successful scientists, producing a prejudice towards women scientists. The content of stereotypes about women and men and the similarity or difference in relation to the social role of scientist, are essential to understand prejudice and gender discrimination. Women are considered more community-minded and more passive than a scientist should be, and women are perceived as less similar to scientists than men (Carli *et al*., 2016). Gender stereotypes shape our perceptions and these shapes our reality, devaluing female speech and work, and on the other hand, valuing male speech and work. Social categories such as race and ethnicity, social class and age intersect with gender to produce stereotypes that differ in symbolic meaning and functioning, often producing a dehumanization of certain social groups (Valentine, Trautner & Spade, 2019).

Science reproduces the existing gender stratification in society to the extent that it is disproportionately made by men and is controlled by them; gender shapes participation, position, classification and performance in science and technology, such as computer science and engineering; science is a source of power and is characterized by gender divisions and hierarchies, including in productivity. Moreover, due to its powerful domains, science not only reflects, but also serves to expand gender stratification in society (Fox, 2006). Women's lives cannot be objectively understood through scientific structures that have complex systems of notions and categories elaborated by men, and are therefore resistant to women's projects (Harding, 2010).

4. Method and scope

UFES was created as a state institution in 1954, being transformed into a federal institution in 1961. The objective of the paper is to investigate the representation of women in courses in science, technology and engineering of the Technological Center of the Federal University of Espírito Santo, in Brazil. The area of mathematics will not be considered in the study, because the investigated Technological Center does not offer a mathematics course. This is a study with a quantitative approach, in which a comparative analysis of the data extracted from the database of the educational institution was carried out. Data were collected on the number of male and female students and on the number of male and female teachers to verify how female representation in the science and technology area of the university served as the field for this study.

For the analysis, the sample group was formed by the students who entered the higher-level courses of the UFES Technological Center between 2009 and 2018. The data were organized creating samples stratified by sex and by course. The treatment of the data also considered racial and time aspects when analysing the results of female students. In this way, it was possible to verify if there was any variation in the number of black female students in the analyzed period.

5. Analysis and discussion of results

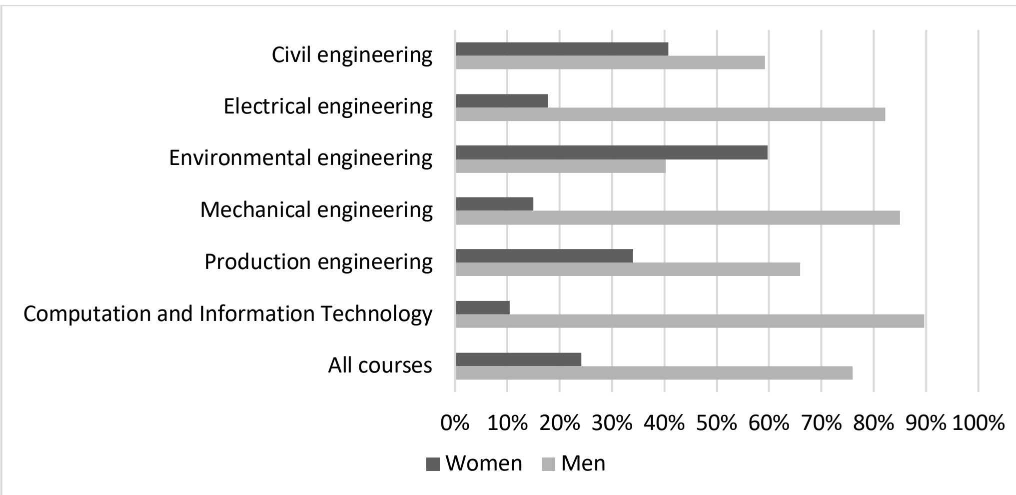
The implementation of the Brazilian University Reform, begun in 1971, transformed the Polytechnic School into a Technological Center. In 2020, the UFES Technology Center is composed of the higher-level courses of computer science, computer engineering, environmental engineering, civil engineering, electrical engineering, mechanical engineering and production engineering. In the analysis, the data from the Computer Science and Engineering courses were gathered in the area of Computing and IT (Information Technology).

The data collected on the teachers who work at the Technological Center of the investigated University indicate that among the 155 teachers who work in higher education courses, 111 are men and 44 are women, that is, 39.6% of the teachers are women. Among the courses of the Technological Center, those that have more women acting as teachers are the civil engineering course, with 13 women and the area of computing and information technology, with 11 women. While the courses that have the least female teachers are mechanical engineering, production engineering and environmental engineering, both with only 4 women each.

The reason why so few women enter the area of science and technology compared to other areas such as arts, humanities and social services, is part of a complex set of aspects, such as social constructs of what is considered appropriate work for women and, therefore, issues of social identity and gender; barriers for women in this area of work; unequal resources and opportunities provided to women compared to men, both during the educational process and in their professional careers in science (Fox, 2006). In explanations of how and why gender inequality occurs, studies on women in science and technology highlight the role of sociocultural norms, organizations as gender-building sites, the area of science and technology as male, and the creation of barriers for women in this area of activity (Gupta, 2019).

Regarding the salary aspect in science and technology careers, second (Blau & Kahn, 2017; American Association of University Women, 2018; National Science Foundation, 2018; Charlesworth; Banaji, 2019) Women's pay is not equal to that of their male colleagues. However, in Brazil, most scientists are linked to state or federal public universities, and in the country's civil service, salaries for the same positions are equal for men and women. Even so, women remain under-represented in science, technology and engineering. Regarding the students, of the 4173 students in the sample, 3168 are men and 1005 are women, that is, only 24.08% are women. They are distributed in the courses or areas, as follows:

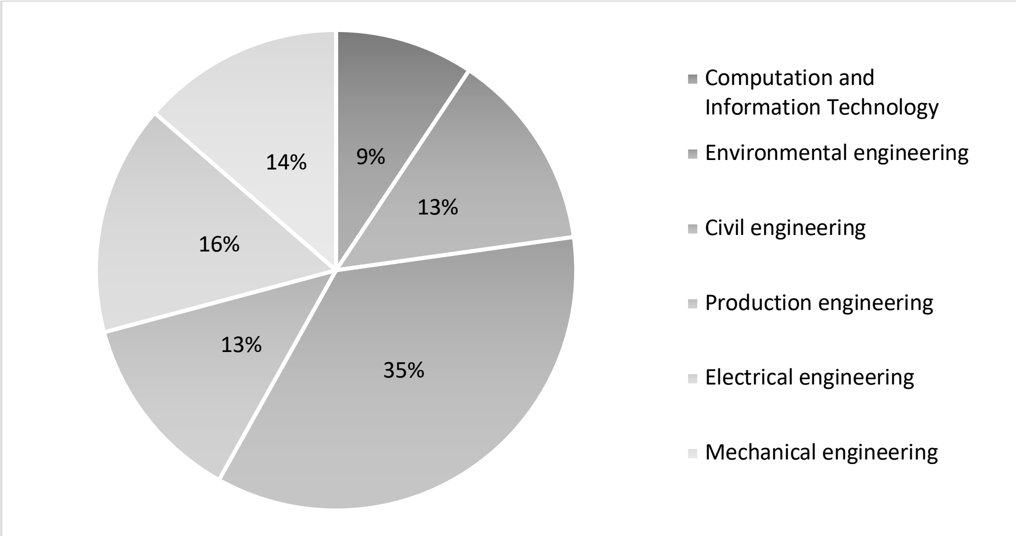
Figure 1. Distribution of men and women by course or area between 2009 and 2018



Source: Prepared by the authors, 2021.

The courses that have more women enrolled than men are environmental engineering and civil engineering, respectively. In the environmental engineering course, 59.73% are female students, while in the civil engineering course, 40.80% are women. Regarding the courses that have fewer women enrolled compared to men, the data indicates that the mechanical engineering course is composed of 14.94% of women and the computer and IT course is composed of 10.39% of women.

Figure 2. Distribution of women enrolled by course between 2009 and 2018



Source: Prepared by the authors, 2021.

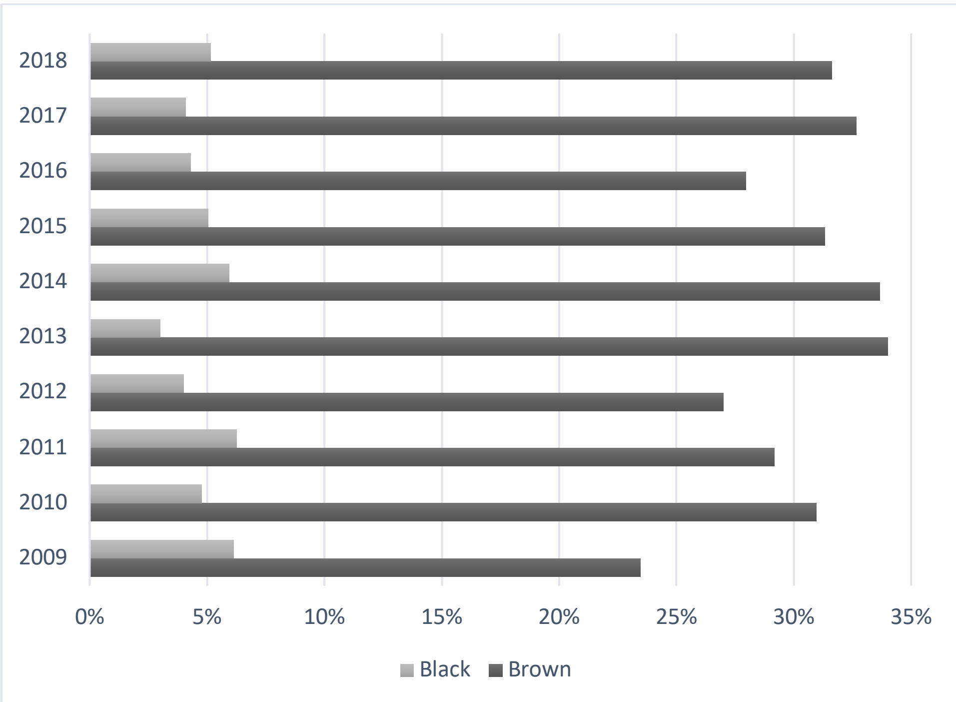
In the analysis of the distribution of women enrolled by course it was possible to verify that the areas that have more female students are civil engineering (35%) and electrical engineering (16%), respectively. And those with fewer female students are computing and IT, with only 9% women. The lack of female role-models from childhood and the lack of female teachers in computer science, can lead young people to interrupt their training in the area of computer science, since they understand that they do not belong in this field (Charlesworth and Banaji, 2019). Women remain underrepresented in higher education in the United States, particularly in computer science and engineering, and female representation is decreasing in the area of computing (Fox, 2006).

In Brazil, the female presence is modest in the areas of computing and IT. Although the number of women practically doubled from 2007 to 2017 (21,253 to 40,492), the number of men in this market also increased, so that the share of women decreased to 20%. This field is also characterized by the wage gap and the fall in the participation of women in managerial and leadership positions in recent years. Despite women in this area having an educational background, often at the master's and doctoral levels, they still receive less for the same positions (SOFTEX, 2019).

In the areas of engineering, the female share represents only 16% of the total number of professionals. Something similar happens in the career of university professors, in part, a reflection of the small number of women with specific training in these areas of activity. Therefore, also among researchers, female participation remains modest in engineering and technological fields (Abreu *et al*., 2016). According to Carvalhaes & Ribeiro (2019), the different degrees are not equal in terms of the gains they bring to graduates, since differences in access and completion among university students in terms of class, gender and ethnicity/race can generate inequalities between these groups in the labor market, even if their access to higher education is not marked by systemic inequalities.

According to the same authors, although women are the majority in Brazilian higher education and in other countries, the pattern of choice of higher education courses is still highly structured according to the gender dimension, with women overrepresented in higher education courses of lower prestige and with worse results in the labor market, while men are concentrated in the courses of higher prestige and higher salary returns.

Figure 3. Distribution of black and brown women enrolled per course between 2009 and 2018



Source: Prepared by the authors, 2021.

Regarding race and ethnicity, data shows that among female students, 61.5% are white, 0.5% are asian, 30% are brown, 5% are black and 3% did not declare a race. It should be noted that the investigated University follows the parameters of the Brazilian Institute of Geography and Statistics (IBGE) when investigating race and ethnicity via self-declaration, that is, how each one perceives himself in relation to his skin color. In addition, african americans are considered as the sum of black and brown race. Thus, it can be stated that among the female students of the Technological Center, 35% are african american.

It was also possible to verify that, since the implementation of racial quotas, in 2013, there was an increase in the number of black and brown women students, with a decrease in 2016, probably due to the political and economic crisis in the country, which demonstrates the difficulty in remaining studying.

Although women of both races (brown and black) constitute more than half of the brazilian population, they remain underrepresented in several areas of activity. In Brazil, the further one advances in the hierarchy of positions of status and power in public and private organizations, there is a masculinization and bleaching, with fewer and fewer women and fewer african american people, and, therefore, fewer african american women in these spaces (IBGE, 2019).

According to the data, from an intersectional perspective, it is possible to assert that black women, in addition to the impact in relation to gender, suffer an impact in relation to race (Miller & Vagins, 2018).

According to Carvalhaes & Ribeiro (2019), from 2010 onwards there was a huge expansion of the access of african americans to higher education, due to the expansion of the system and inclusion policies, such as the quota law 12,711 of August 29th, 2012, however, african americans, and especially african american women, remain under-represented in the most prestigious courses. Whites are more likely to access more privileged courses and african americans are more likely to enter less prestigious courses.

The authors conclude that there are distinct opportunities that present themselves for men and women, for whites and african americans, and for people whose parents had degrees in distinct levels of education and differences in social class. Therefore, in Brazil, despite advances, social and racial inequalities still imply different educational opportunities.

Racism is presented as another form of oppression, and if black women born in third world countries, developing or underdeveloped are considered, in which slavery and colonial exploitation remain in the national identity, a social order supposedly democratic, keeping gender relations intact according to color and race (Carneiro, 2014).

According to Dasgupta & Stout (2014), no isolated cause creates the escape of girls and women from the field of science and technology. Stereotypes consistently portray ideal scientists and engineers as men. The incompatibility between male stereotypes of the area and female expectations of gender role create barriers to women's participation in science and technology at all stages of life. Learning environments and professional environments that promote belonging are more likely to succeed in recruiting, retaining and advancing girls and women in science and technology.

Thus, it is important to eliminate economic barriers, as well as gender and race barriers, in order to increase the participation of female students and female teachers in the area.

6. Conclusions

From the data collected in the higher education courses of the Technological Center of the Federal University of Espírito Santo, it is possible to verify that women are underrepresented among teachers and among students. Therefore, the data analyzed indicates that more men than women enter courses in the areas of exact sciences and engineering and that, among women (brown and black) are represented in fewer numbers, indicating that, despite advances in entry systems and public policies of quotas, there remains an underrepresentation of racial groups in the courses considered of greater prestige.

With this, as women move into the academic and non-academic workforce, they continue to be represented in fewer numbers than men (Charlesworth & Banaji, 2019). To change this scenario, some educational actions that can promote female participation in Science and Technology are pointed out by (Clark Blickenstaff, 2005). According to the author, since childhood it is necessary to ensure that students have equal access to the resources of teachers and the classroom. Providing examples and tasks that emphasize the ways in which science can improve the quality of life for living things is important.

Work with cooperative activities, avoiding the division of students by sex in competitions or even in the spatial organization of chairs as well. Eliminate sexist language and images from teaching materials, as well as not tolerating sexist language or behavior in the classroom. In addition, it is necessary to recognize the political nature of scientific research.

However, at the university there is no action aimed at attracting more women to the courses analyzed in this study. There is also no action to attract more female teachers to this area of knowledge still dominated by men. The integration of gender and gender analysis in science and technology domains is of paramount importance, from considerations in establishing research priorities to guidelines for establishing best practices in formulating research questions and interpreting data. By integrating gender and gender analysis into their work, researchers can increase excellence and social responsibility in science and engineering (Tannenbaum, Ellis, Eyssel, Zou & Schiebinger, 2019).

Regarding race, the university, despite having a quota program for students, black students are still the minority in these courses, which may signal financial difficulties that prevent entry and permanence in the educational institution.

Therefore, encouraging an education that recognizes women who have contributed and contribute to the production of knowledge in science, technology and engineering, encouraging the broad adoption of practices that do not reinforce gender stereotypes among male and female teachers, as well as reinforcing the role of the school in de-constructing racism, can be an important step in promoting women's participation in this area. Equity, the sooner it is practiced, will allow an end to the under-representation of girls and women in science, technology and engineering.

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