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Gender inequality and bias in the hiring process of female physics teachers in Brazilian private schools: an analysis of the Basic Education Census (Censo Escolar da Educação Básica) covering the period between 2014 and 2021[+*]

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Abstract

The female presence in Physics has been the object of study in recent years, motivated by the gender disparity in the area. However, the presence of women teaching physics in 9-12 schools, both public and private, is still a little discussed topic. The present work aims to present a comparative study regarding the presence of women as Physics teachers in public and private schools, in addition to evaluating and quantifying their training. It is characterized by a descriptive survey research with a quantitative approach and analyzes the data gathered by an yearly survey of elementary through high school national education system (Censo Escolar da Educação Básica) conducted by INEP, an agency of the Ministry of Education from 2014 to 2021 using Python programming language in order to observe if any trend of change could be observed over this time interval. The data obtained indicate that over the period there was no significant change in the female presence in the

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role of Physics teacher, as well as it was observed that the distribution of this presence varies between Brazilian regions and states. It was also verified that an adequate professional training of both men and women does not reach 50% of the total number of teachers in this discipline, a fact that had already been pointed out in works by other authors. An important aspect that we highlight is that the percentage of female Physics teachers is lower in private schools than in public schools and that the workload of women is, on average, lower than that of men in both administrative facilities. The work suggests that there may be a gender bias in the hiring of teachers, especially in private schools, as if women were not seen as competent to teach this subject.

Keywords: *Women in Physics; Female Physics Teachers; Physics Teaching; Gender Inequality in Physics.*

I. Introduction

Female presence in the Physics community has been studied during the last years, motivated by the enormous gender disparities in the area. A recent report from the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2018) states that only 28% of the researchers in the areas of Science, Technology, Engineering, and Mathematics (STEM) are female. In Brazil, if we focus solely the Physics community, we see that the women participation stays between 25% to 30% at the undergraduate level, between 15 and 20% in graduate school, and close to 10% when we consider the level of recipients of the productivity grant in research (PQ) from the National Council for Scientific and Technological Development (CNPq), that corresponds to the higher level of the academic career (AREAS; ABREU *et al.*, 2020; MEC/INEP, 2017; SAITOVITCH; LIMA; BARBOSA, 2015; MENEZES; BRITO; ANTENEODO, 2019).

However, the presence of women teaching Physics at the Basic Education level, both in the public and in the private sectors, is still a theme that has driven fewer discussions. Nascimento (2020) used data collected in 2018 by the National Institute for Educational Studies and Research Anisio Teixeira (INEP) to point out that the fraction of female teachers of Physics in the public sector of basic education is close to 30%, a fraction that is similar to the female students enrolled in college level teacher's licensing programs (MEC/INEP, 2017). And what can we say about this issue in the private sector, would the fraction be the same? The usual hiring practices in the private sector are different from those of the schools in the public sector. In the latter, be them municipal, state or federal public institutions, the hiring procedures are based on the results of public contests involving disciplinary content knowledge exams, CV evaluation and sometimes classroom performance evaluation, while in private schools the hiring usually starts by a private indication followed by an interview, and

this process may be influenced by a bias, even if not by design (GEORGI, 2000; BLACKBURN, 2017; WILLIS: MEHTA; DAVIS, 2020; MOHAMED MAHMOUD, 2022), that affects women in the careers in the areas of Science and Technology and exclude them from selective processes.

The present work has as its objective to analyze comparatively the female presence in the faculty of Physics teaching in the public and private sectors in Brazil. We will also analyze and compare the pre-service training of female and male teachers in these sectors. These analyses aim to collect information still not known in the Physics Education Research community in the country that may be useful in future studies focusing the female presence in Physics and Physics education communities.

II. Methodology and data collection

The present work can be characterized as research that aims to provide a descriptive and quantitative survey based on microdata from the Basic Education School Census running from 2014 to 2020 that were available at the INEP[3] website up until February of 2022. These data were analyzed using Python[4] – which is a programming language of high performance and commonly used in big data science – and the number of female and male Physics teachers were filtered by region using as a counting criterion the identification number of the teacher, a technique that prevents multiple counts of the same individual in the administration data of both public and private schools. In other words, if an individual teaches in more than one public or private school, it will not be counted more than once in each institution. Nevertheless, if the individual teaches both in public and a private school, it will be counted in both sectors.

In relation to the binary language of male and female genders that we are using in this paper, we must state that the questionnaire that the above-mentioned Census uses allows only for this binary choice of gender and does not provide an option for individuals that do not identify themselves as non-binary, agender or some other gender identification. It is also not possible to get information about the presence in the faculties there were transgender individuals or if these individuals were classified in relation to the biological gender at birth or in relation to the gender with which they identify the best, because these questionnaires were filled by the school administrators and not by the teachers themselves. The mere fact that the school managers were the ones responding the survey may raise some other discussions about race/gender identification bias and even the lack of reliable information about special needs of these teachers, an issue that we intend to examine in future work.

The temporal window from 2014 to 2021 was chosen due to the availability of data up to the moment when INEP blocked access to alter the format in which they will be presented in the future. We needed such a window to assess if some results presented in the papers (RAMOS; IBALDO; MARTINS, 2021; NASCIMENTO, 2020) for the years of 2018 and 2019 were consistent with other years, or if some temporal tendency of change in the

fraction of females and males in the public and private sectors of Brazilian basic education could be identified.

In addition to filtering the data through the individual's identification number, we selected for the variable "IN_DISC_FISICA", that is used in the database to indicate whether that professional teaches a Physics class. It is pertinent to stress that in this type of counting procedure we did not select only for teachers that had graduated from a pre-service licensing program in Physics, but rather we collected all the individuals that were actually teaching a Physics class, irrespective of the specific licensing program they did graduate from, or even if they did not have a degree in any program. To filter for the type of degree an individual held, we used the dataset variables "CO_CURSO_1", "CO_CURSO_2" and "CO_CURSO_3", that identify the codes of the particular licensing program that issued the degree held by the teacher, observing that each individual may have registered up to three different licensing degrees in the census database. This information allowed us to calculate the number of teachers with a degree issued by a licensing program in the discipline of Physics as one of the three informed. We were also able to compute how many of these teachers in charge of teaching Physics had a degree in Mathematics – instead of Physics – since it had already been observed that it is common for schools to hire Mathematics graduates when candidates holding a Physics degree were not available, as reported by dos Santos and Curi (2012). Our data support these results: we did observe in the temporal window analyzed that, other than most teachers in charge of Physics classes in the basic education segment not holding a licensing degree in the discipline, the number of those holding a Mathematics licensing degree instead is larger than those holding a Physics degree in the larger part of that period. This fact had already been reported by dos Santos and Curi (2012) as well as in the technical report authored by Beltrão and collaborators (2020).

The 2021 data were obtained through the platform Fala.BR[5] via request based on the Access to Information Law (Law n.12.527/2011), since, as of March 2021, INEP changed the way the Census microdata are disclosed. After this change, the teachers' information was excluded and only summarized data from the schools were made public. Information regarding the new presentation format is available in Technical Note No. 14/2021/CGIM/DAEB (INEP, 2021). For us to have access to the complete data it would be necessary to request access to sensitive data. As our intention was to have access only to the number of teachers by region and by type of school (public and private), this information was requested exclusively for the year 2021 and was sent to us by email in format .CSV. Thus, the temporal sequence obtained was presented in the form of graphs, presented in the data analysis section, and the 2021 numbers remain within the range of the values calculated by us, which proves that our form of calculation is consistent with the INEP calculation method.

III. Presentation and Analysis of Data

The teaching career in Basic Education in Brazil is mostly female. In the 2020 census, the total number of female teachers registered in the School Census was 2,064,159, in contrast to 476,680 men; that is, the number of female teachers is four times greater than the number of male teachers. This gender disparity in teaching is discussed by Vianna (2013), who points out that such feminization occurred, especially in the scope of elementary school, concomitantly with the process of career devaluation, with the prevalence of low wages and poor working conditions, a process that began in the nineteenth century, intensifying with the institution of public schools in the mid-twentieth century. When we look at physics, the situation is reversed, and the area shows a strong male predominance. In 2020, according to the microdata of the School Census of Basic Education, the total number of male teachers teaching Physics in Brazil was 34,289 while the total number of women was 25,560.

Another interesting fact is that, if we do not filter the professors by the identification code, we realize that the number of times men appear as physics teachers in 2020 is equal to 193,495 while the number of female registrations is equal to 105,018, which means that, on average, each man is registered 5.6 times in the system while each woman appears, on average, 4.1 times. This indicates that in addition to having more men teaching Physics, they work in more schools, that is, they have a greater workload than women, which directly impacts their salaries. This difference in the workload can be justified by the fact that in our society most of the domestic work, including the care of children and the elderly, is still up to women work that makes up for a double or even triple day of unpaid work (FEDERICI, 2018). It is worth mentioning here, which we will discuss in more detail below, that not all these men and women are graduates in Physics and that, in fact, the percentage of graduates in Physics does not reach 50% of the teachers who work in this discipline.

We will present below graphs of the temporal sequences of the percentages of physics teachers for each region of Brazil, separated by segment (public and private). The objective of our analysis is to compare how the distribution of women in public and private schools occurs and how these women are trained compared to men. Na article by Nascimento (2020) and our work presented in a National Symposium on Physics Teaching (RAMOS; IBALDO; MARTINS , 2021) have already shown that, in the national average, women represent one third of the total number of graduates in Physics. However, when we analyze the different regions and states, we see that this percentage varies greatly. It is also worth noting the percentage of graduates in relation to the total number of teachers who teach Physics, since not all of these are, in fact, licensed in the area. In this work we calculate, within the total of women and men who teach Physics, how many are in fact licensed in the discipline and we analyze the distributions of these percentages across the Brazilian regions and the states also. In a first analysis, our work with data from the 2019 Basic Education Census (RAMOS; IBALDO; MARTINS, 2021) suggested the presence of a gender bias in the hiring of physics professionals in private schools. To verify whether this result was a one-off

case for that year or if it was something systematic, we extended the analysis to the period from 2014 to 2021. The results presented below point to a behavior that remains over the years and that should be better studied, since in all Brazilian regions the percentage of women teaching Physics in private schools is always lower than the total percentage of women teaching Physics in each region, a disparity that becomes even more evident when compared to the percentage of women working in public schools.

III.1 Distribution of women physics teachers by region and by administrative unit

Figures 1 and 2 show, respectively, the percentages of women teaching Physics in public and private schools in each of the Brazilian regions in the period from 2014 to 2021.

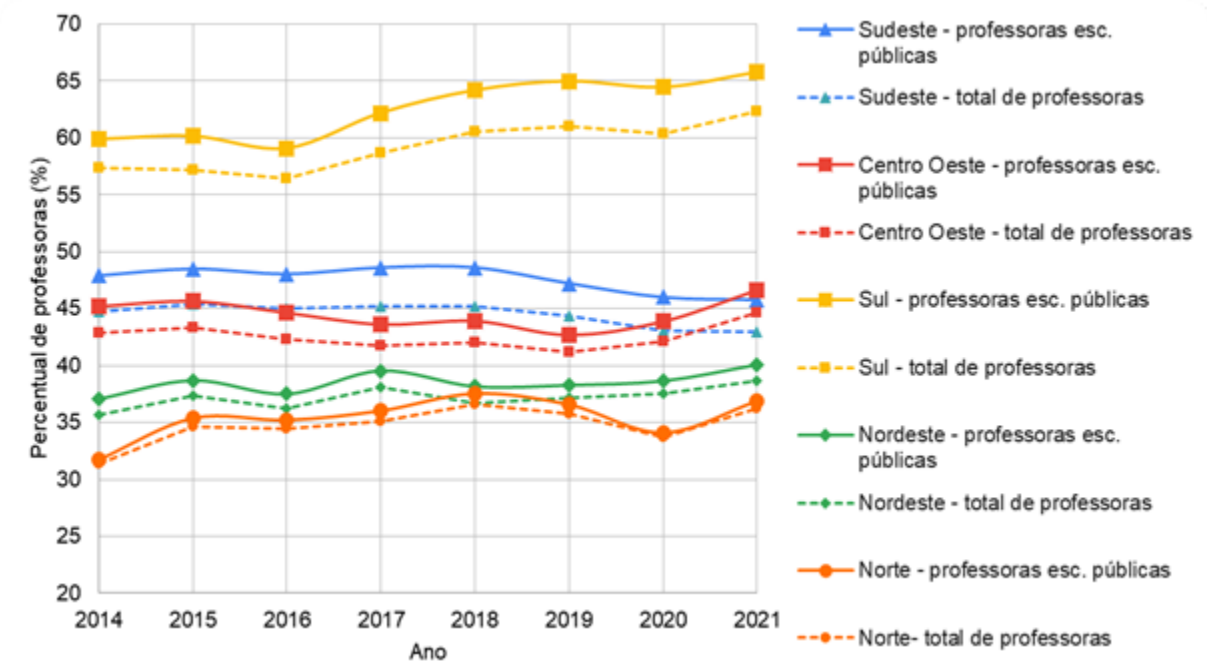

Fig. 1: Total percentage of women who teach Physics (dashed lines) and percentage of women who teach Physics in public schools (solid lines) for each Brazilian region in the period from 2014 to 2021. Source: Microdata from the Basic Education Census.

For the Southeast region we can observe that out of the total of teachers who teach Physics, the percentage of women is between 42% and 45%. However, when we observe the distribution separated by class of administrative unit, while the percentage of women who teach Physics in public schools varies between 45% and 48%, in private schools this percentage varies between 30% and 32%.

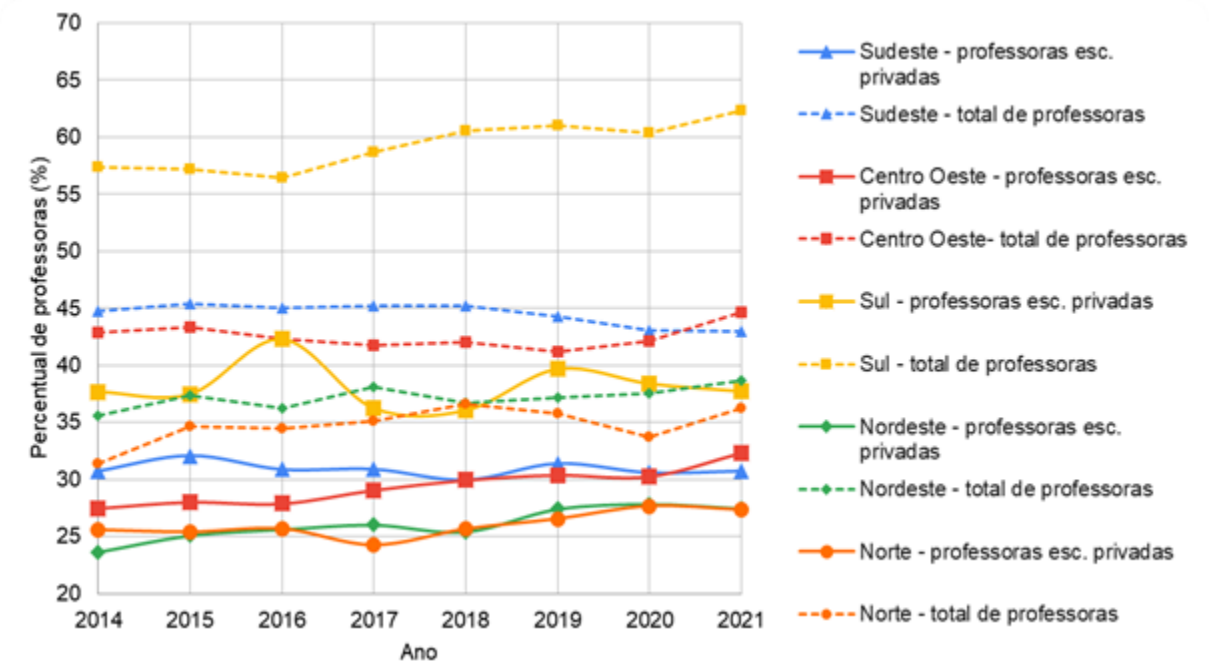

Fig. 2: Total percentage of women who teach Physics (dashed lines) and percentage of women who teach Physics in private schools (solid lines) for each Brazilian region in the period from 2014 to 2021. Source: Microdata from the Basic Education Census.

Although the number of teachers of Physics in the Midwest region is of the order of one fifth of the total number of teachers in the Southeast region in absolute numbers, in percentage numbers the behavior over the years is quite similar to that of the Southeast region. Here, women account for just over 40% of the total physics teachers. However, when we observe the distribution in public and private schools, we see that in public schools the percentage of women is slightly higher than the total percentage, reaching 46% in 2021, while in private schools this percentage does not exceed 32%.

In the Northeast region, the percentage of women in private schools is between 25 and 27%, while in public schools this percentage follows the total percentage of women who teach Physics and is between 37 and 40%, being, therefore, lower than the percentages of women in the Southeast and Midwest regions.

A profile of distribution of women similar to the profile of the Northeast region appears in the North region. Although the Northeast region has about 3 times more teachers than the North Region in absolute numbers (ranging around 12000 men and 7000 women, while in the North region the total number varies around 4000 men and about 2200 women), the two are similar in presenting the lowest female representation among teachers of Physics of Basic Education. In this region, both the total percentage of women and the percentage of women teaching in public schools varies between 31% and 37%, while the percentage of women in private schools varies between 25% and 27%.

The South Region presents a quite different behavior from the other regions of the country. In the total number of physics teachers, the number of women who teach physics is higher than that of men, reaching a percentage of 62% in 2021. When we separate the data by teachers who work in public and private schools, women are also in greater numbers in public schools, reaching a percentage of almost 66%. On the other hand, in private schools the situation is reversed, and women are around 38% of the total of physics teachers. It is worth calling attention to the year 2016, in which the percentage of women in private schools was the highest in the period analyzed, reaching 42.3%, showing a decrease in the following year and returning to the percentage of 36%.

III.2 Distribution by states in 2020

Figures 3 and 4 show the percentage of physics teachers in public and private schools distributed by state for the year 2020. This form of presentation lets us visualize in more detail what happens in each region.

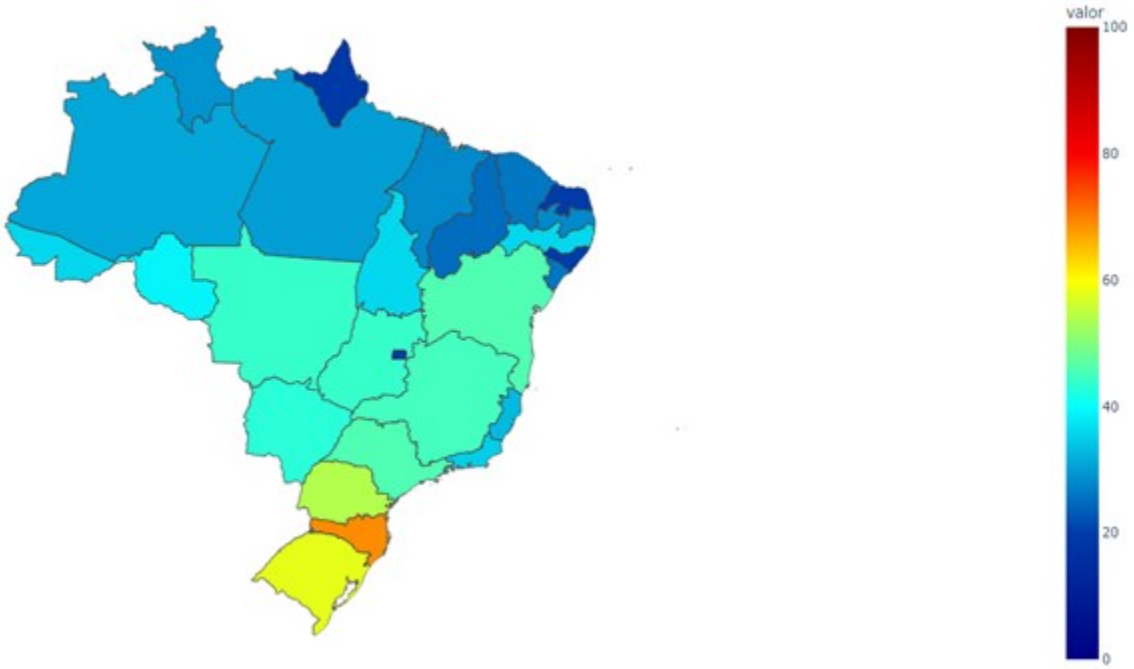

Fig. 3: Percentage of physics teachers in public schools distributed by states and the Federal District in 2020. Data source: Microdata from the 2020 Basic Education Census. (Figure made by the first author from the analysis of the microdata)

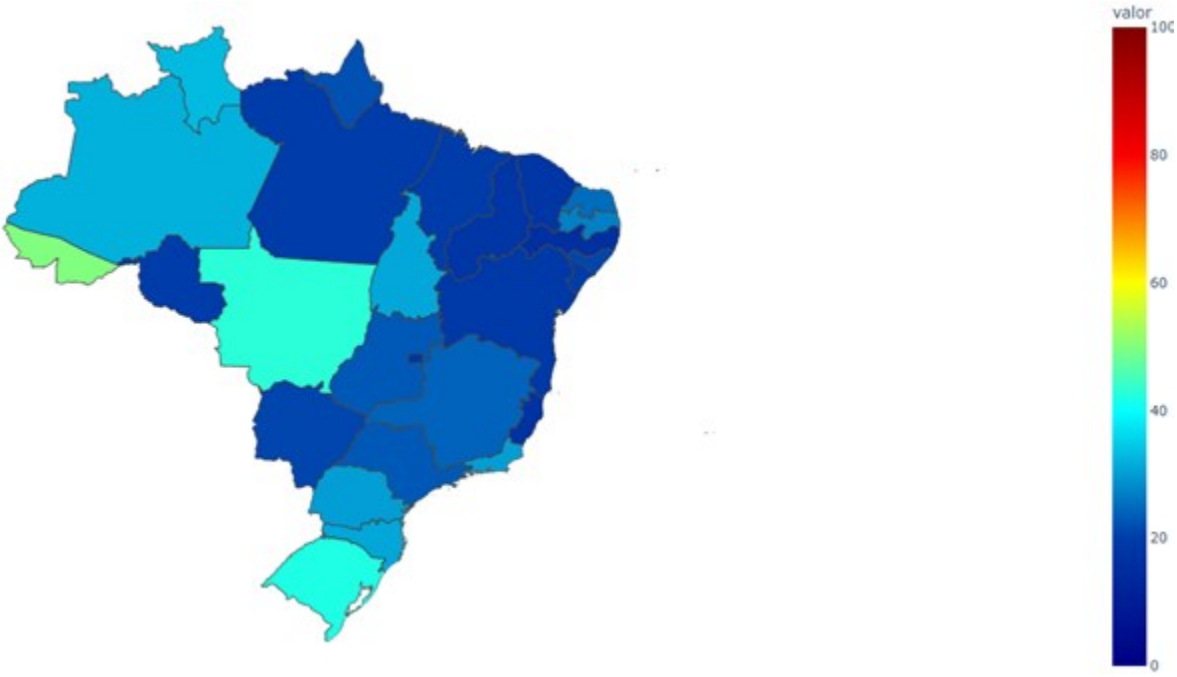

Fig. 4: Percentage of physics teachers in private schools distributed by states and the Federal District in 2020. Data source: Microdata from the 2020 Basic Education Census. (Figure made by the first author from the analysis of the microdata)

We can observe in the figures that the high percentage of physics teachers in public schools in the South region gains even greater prominence in the state of Santa Catarina, where it reaches 69%. Another curious fact appears in the state of Acre when we look at private schools. The fact is that this high value in percentage terms (50%) corresponds to a total of only 7 teachers. With these two exceptions, the two figures reveal how female participation is still small in the teaching of Physics in most states, being especially lower in private schools and suggesting with greater clarity a gender bias in hiring. It should be noted here that these maps present the total number of physics teachers, regardless of their licensing degree. The next section discusses the adequacy of the training of these professionals in comparison with that of men.

III.3 Training of men and women by region and by public and private schools

Figures 5 and 6 show the percentages of women enrolled in Physics licensing degree programs in 2020 and women who got their degree in 2020, respectively. These values were obtained from the microdata of the 2020 Higher Education Census[6] and are important to compare to what we observe in the percentages of teachers with degrees in Physics working in classrooms.

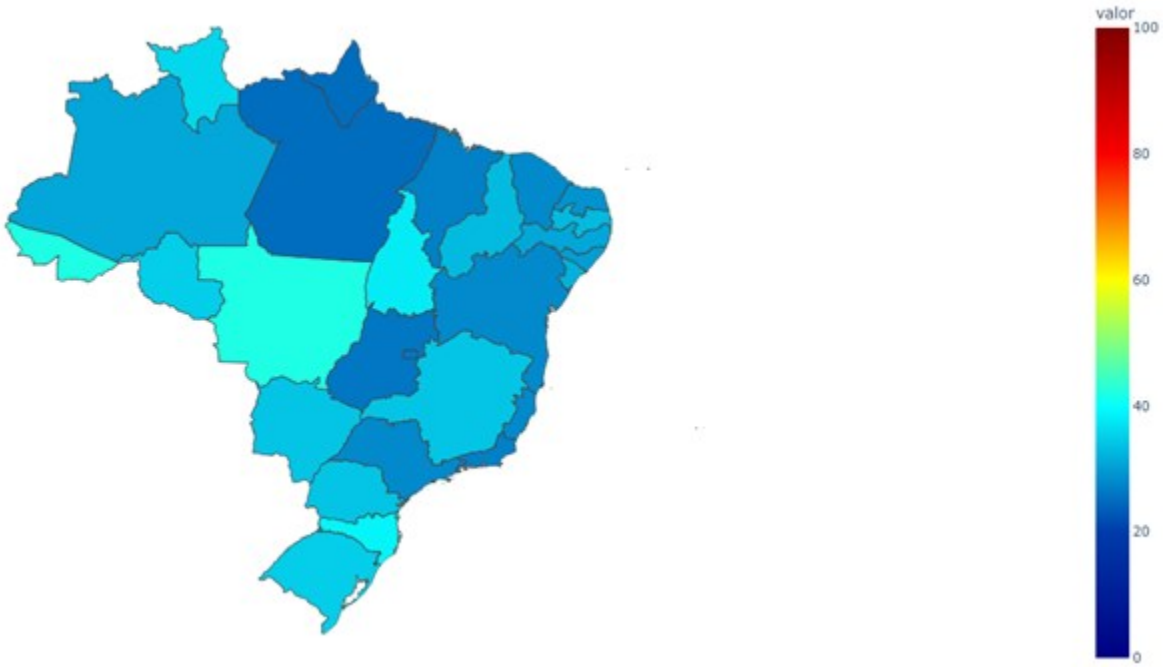

Fig. 5: Percentage of women enrolled in Physics degree courses distributed by States and Federal District in 2020. Data source: Microdata from the 2020 Higher Education Census. (Figure made by the first author)

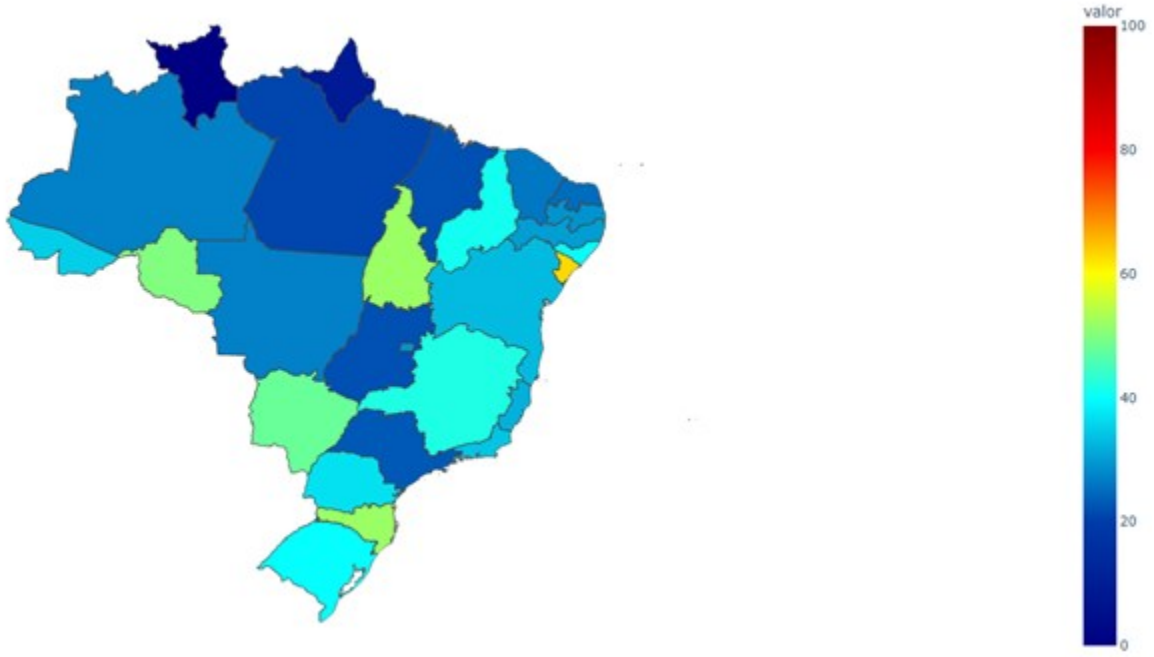

Figure 6: Percentage of women graduating from Physics Degree courses distributed by States and Federal District in 2020. Data source: Microdata from the 2020 Higher Education Census. (Figure made by the first author)

The map in Figure 5 shows that the states with the highest percentage of women enrolled are Mato Grosso and Acre with 42%, followed by Santa Catarina with 39% and Tocantins, with 38%. Of these, the state with the highest absolute value is Santa Catarina, with 488 women enrolled. The states with the lowest percentage of women enrolled are Pará and Amapá, with 25%, and absolute values of 226 and 83 women, respectively. From this image it is possible to perceive that the distribution of women in Physics courses is not homogeneous throughout the states; however, it is important to note that in no state does this share reach 50%.

In Figure 6, it is possible to see that the Brazilian state with the highest percentage of women graduating in 2020 is Sergipe, with 62% and a total of 10 women. The states of Tocantins and Santa Catarina have a percentage of 52%, with absolute values equal, respectively, to 12 and 140 women. Rondônia and Mato Grosso do Sul have 50% and 48%, with values equal to 9 and 16 women. The other states have percentages lower than 42%. It is noteworthy the state of Roraima, which did not have any women graduating from the licensing degree programs in Physics that year. From the map, it is possible to see that in some states the percentage of women graduating is greater than 50%; in them there are more women than men getting a degree in physics. However, the number of graduates is less than 10% of those enrolled in most states, and only the state of Santa Catarina presents a better result, with the number of women graduates reaching 30% of the total number of women enrolled in 2020.

Regarding the training of Physics teachers who work in Basic Education, as we said earlier, we analyzed the percentage of men and women who are licensed in Physics for each region in relation to the total number of Physics teachers, and we also compared this training in the public and private segments. For the analysis, we used only the data from 2014 to 2020, since the 2021 data were obtained through the Access to Information Law and did not contain the data related to teacher licensing degree. We also analyzed the percentages of physics teachers who have a degree in mathematics and who do not have a degree in physics. We identified in preliminary analyses what had already been reported in dos Santos and Curi (2012), namely, that a large part of physics teachers is actually licensed in Mathematics and often the number of teachers licensed in this second discipline exceeds the number of graduates in Physics. These results show how there is still a deficit of teachers with adequate training in this area, which can have a significant impact on the education of students.

In the Southeast Region, which is the region with the largest number of teachers and the second largest in the offering of undergraduate licensing programs, behind only the Northeast Region (INEP, 2020), in 2020 the percentage of physics teachers licensed in physics was around 20% of the total. In the period from 2014 to 2018 this number was around 16%, showing a slight increase from 2019. Similar percentages are observed if we limit ourselves only to the public sector. However, in private schools the percentage was significantly higher, ranging from 21 to 27% of women who teach in this sector in the same

period. However, when we analyze the percentage of women graduates in relation to the total number of licensed teachers in the Southeast region, we found values ranging between 33 and 35% in public schools, and values between 19 and 20% in private schools. This result shows that, when we look only at teachers with degrees in Physics, the percentage of women licensed in public schools remains close to the 30% cited by Nascimento (2020), which does not happen in private schools. On the fact that the percentage of women teaching Physics is lower in private schools, this is also reflected in the percentage of women graduates when compared to the total number of licensed teachers. To have a better understanding of the reasons for this disparity in training, studies are needed to better investigate the criteria for hiring teachers in private schools.

When we look at the degrees held by male teachers in the Southeast, we find that, out of the total number of physics teachers, the percentage of graduates is around 30% in the period from 2014 to 2018, with a slight increase in the years 2019 and 2020, reaching 35% in 2020. In public schools, this percentage varies around 30%, while in private schools the percentage of men licensed in the discipline reaches 46% in the year 2020.

In the Midwest region, the percentage of women with degrees in Physics is around 8 to 10% of the total number of women who teach Physics. In absolute numbers, the number of women physics teachers in this region remains around 2200, while the graduates of this group remain between 180 and 270 throughout the period from 2014 to 2020. It should be noted here that the number of female Physics teachers with a degree in Mathematics in this region was 770 (35%) in 2014 and decreases over the years to the value of 519 (26% of the total of Physics teachers) in 2020. When we observe the public schools, the percentage of women graduated in Physics among all those who teach the discipline follows the same percentage values of the total of Physics teachers licensed in the region, that is, around 8 to 10%. When we look at private schools, the percentage of graduates among the total number of teachers rises to about 15 to 18%.

For men in the Midwest region, the percentage of graduates in relation to the total number of physics teachers is between 23% and 29% over the period from 2014 to 2020. In public schools, this percentage is between 20 and 27%, while in private schools the percentage of licensed teachers reaches 46%.

In the South region, although in absolute numbers women are the majority, as we saw in the previous section, when we analyze the specific training, we found that only 20% of women have a degree in Physics throughout the period analyzed, while the percentage of men graduated in Physics grows from 35% in 2014 to an average of 42% in 2020. When we look at women and men with degrees in Mathematics, we see that women with degrees in Mathematics represent 37% of Physics teachers in 2014, and this percentage decreases over the years, standing at 27% in 2020. Still, in the entire period, the number of women with degrees in Mathematics and without a degree in Physics was higher than the total number of women with degrees in Physics in this region. Regarding men, the percentage of graduates in

Mathematics was always lower than the percentage of graduates in Physics, starting at 33% in 2014 and ending the period analyzed with 25% of Physics teachers licensed in Mathematics.

The Northeast region, which is the region with the largest offer of undergraduate courses (INEP, 2020) and the second in total of Physics teachers in Basic Education, is also the region of Brazil that has the lowest proportion of licensed Physics teachers. Of the total number of women who teach physics in this region, only 10% have a degree in physics. In private schools this percentage is slightly higher, reaching 16% in 2020. Even so, these values are still lower than the percentage of students enrolled in undergraduate courses, as can be seen in Figure 5. Again, this phenomenon needs further study to understand the reasons for this difference. On the other hand, the percentage of men with a licensing degree in Physics is around 26% in general and in public schools, while in private schools this percentage reaches 38%. When we analyze the graduates in Mathematics for this region, in 2020 we have that 25% of the total of women hold licensing degrees in this discipline and do not have training in Physics, while the total of men graduated in Mathematics corresponds to 33%, values that also appear when we analyze only the teachers at public schools. In private schools, the percentage of women with a degree in Mathematics is around 15% and the total of men around 18%.

In the North region, the total percentage of women with degrees in Physics reaches 16% in 2020, with a slight increase from 2014. While the percentage of graduates in Physics in public schools also follows this total value, a behavior that was also observed in other regions, in private schools the percentage is slightly higher, reaching 21% in 2020. When we analyze men, both the total percentage and the percentage of public-school teachers are around 28% in 2020, while the percentage of men with a degree in Physics in private schools reaches 44%. Regarding graduates in Mathematics, we have that the total of men licensed in this discipline is around 35% in total and 37% in public schools, while in private schools men with a degree in Mathematics correspond to about 20% of Physics teachers. Regarding women, both in the total of teachers and in the teachers at public schools, the percentage of graduates in Mathematics is around 27% and 28%, while in private schools this percentage begins at 21% in 2014 and reaches the lowest percentage in 2020, with only 11% of teachers licensed in Mathematics. This region had the lowest percentage of women holding a degree in Mathematics in the period analyzed.

Among the teachers' training, the degree in Mathematics is the most common pre-service training, followed by the degree in Physics, degree in Natural Sciences or Biology and degree in Chemistry. However, in all regions, there are teachers with remarkably diverse backgrounds, including Pedagogy and Agroecology. This variety of training can be partially explained by the lack of teachers with adequate training working in schools. Araújo and Vianna (2008a; 2008b) have already presented discussions about the lack of Physics graduates in classrooms. According to these authors, one of the justifications for the lack of these professionals would be the increase of vacancies over the years in basic education while

there was a gradual reduction of public funds for education. With this, while more classes emerged, the salary of teachers has decreased over the years, since this category faces a lack of adjustments, does not have good career plans, in addition to stress and mental overload, which cause the withdrawal of many professionals (POCKSZEVNICKI; BOCHECO, 2015). It should be noted here that the Law of Guidelines and Bases of National Education (LDB) does not forbid the allocation of teachers in areas other than their pre-service training. Therefore, although public competitions now require specific training in the specific area of activity, when these vacancies are not filled or become idle for reasons of absence, for example, teachers from other areas can be summoned to assume the function. In the case of vacant Physics, according to our results, Mathematics teachers are the ones who most commonly take the discipline.

Figure 7 shows the percentages of teachers licensed in Physics in relation to the total number of teachers licensed in Physics in public (a) and private (b) schools for each Brazilian state in 2020. It is possible to notice that the percentages of teachers holding a Physics degree in private schools are lower than 20% in most states, except for the states of Acre, Amazonas, Roraima and Rio Grande do Sul, where the percentages are above 30%. In public schools, states with a percentage below 20% are concentrated in part of the North and Northeast regions, Rio de Janeiro and the Federal District. The states of Minas Gerais, Paraná and Rio Grande do Sul stand out in public schools, where the percentages of women graduated in Physics in relation to the total number of licensed teachers are higher than 40%.

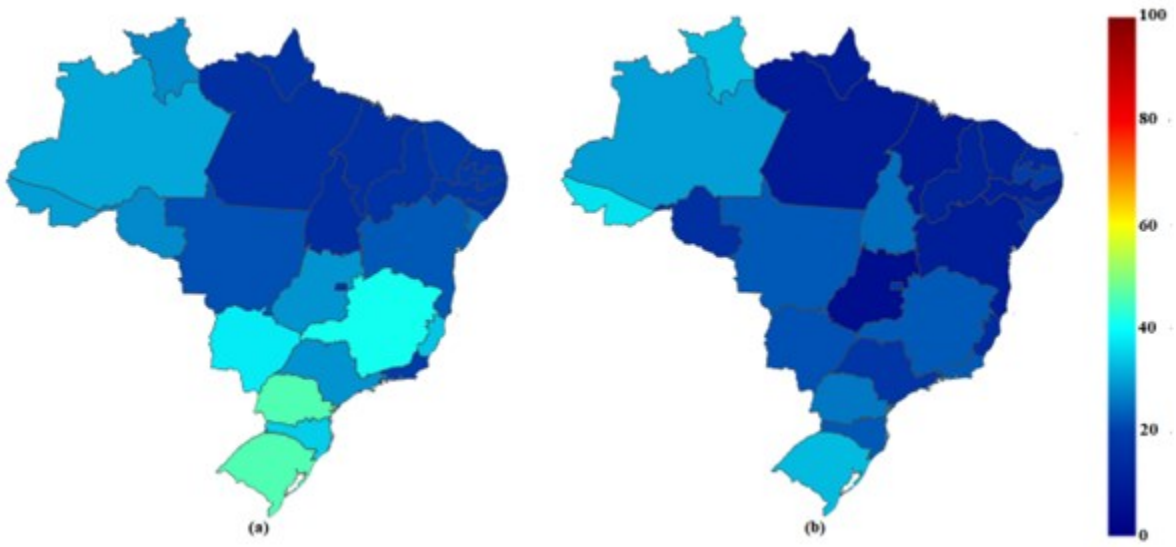

Fig. 7: Distribution of teachers licensed in Physics in relation to the total number of teachers licensed in Physics by state in the year 2020 in public schools (figure (a), left) and private (figure (b), right). Source: Microdata of Basic Education.

The lower percentages in private schools reflect the fact that in these schools the percentage of women is lower than the percentage of women who teach Physics in public schools. Even so, when we compare with the maps presented above, we notice that the percentage of women with degrees in Physics and working in the classroom is always lower than the percentage of women enrolled or graduating in Physics (Figures 5 and 6). As we discussed earlier, this difference is smaller in public schools and more pronounced in private schools, suggesting a greater difficulty for the insertion of women in the private sector.

IV. Final considerations

From the data presented, we can observe that the presence of women as teachers of Physics in Basic Education presents two distinct patterns when we differentiate between public and private schools: in public schools, the percentage of women teaching Physics is around 40% in all regions of Brazil, except in the South Region, where the number of women teaching this discipline exceeds the number of men. However, when we analyze the participation of women in private schools, this percentage drops to 30% and even to 27% in the Northeast and North regions, which are the two Brazilian regions that have the lowest percentages. This inequality leads us to suggest that hiring in private schools, which occurs through interviews and indications, leads to a gender bias characteristic of the areas of Science and Technology, in which women are not seen as competent, since logical reasoning and rationality are considered masculine characteristics (MENDICK, 2005; ROSENTHAL; REZENDE, 2017).

Another important aspect of the analysis was the observation that, on average, women have fewer registrations in the School Census in the role of Physics teachers, since we found an average value of 5.6 records on the platform for each man against an average value of 4.1 for women. These numbers indicate that, in addition to men being the majority of teachers, they also have a higher workload, which directly impacts their salaries. And this difference in the workload may be related to the fact that in our society women are still responsible for most of the domestic work, for the care of children and the elderly, being overwhelmed with a double or even a triple day of unpaid work that prevents them from dedicating more time to career and studies (FEDERICI, 2018). This particular data was obtained only for the national average and, therefore, a more detailed analysis would be necessary to better understand the dynamics of this proportion by Brazilian regions and states.

Throughout the period analyzed, which comprised the years between 2014 and 2021, no significant changes were observed in the distribution patterns of men and women in both public and private schools. When we analyze the total percentage of men and women teaching Physics, regardless of the degree they hold, and the percentage of graduates by region over the years, it is not possible to observe any variation that demonstrates a change in patterns. This indicates that there needs to be a greater discussion about the presence of women in the teaching of Physics.

In addition, when we analyzed the training of female and male teachers, we saw that not only the percentage of men graduated in Physics does not reach 50% of teachers, but also that the training of women is less adequate than that of men, that is, proportionally there are fewer women licensed in Physics exercising the profession than men. This can influence the way girls see who "belongs" to physics (HAZARI; TAI; SADLER, 2007; MURPHY; WHITELEGG, 2006; MUTJABA; REISS, 2013), conveying the message that men are better suited than women for this area.

Another prominent issue that we can observe is that, in private schools, the percentage of teachers with a degree in Physics is always higher than the percentage of teachers with the same specific training in public schools. Of course, we must consider that the number of public schools is much higher than the number of private schools and that, therefore, the lack of these professionals has a greater impact on public education. An observation that we consider important and somewhat problematic is that a large part of the professionals who teach Physics have, in fact, a degree in Mathematics, with the number of graduates in Mathematics being even higher than the number of graduates in Physics and also higher than the number of graduates in other areas of Science, such as Chemistry and Biology or Natural Sciences. This characteristic of the training leads us to reflect on the reason that leads education administrators to consider a Mathematics teacher to be more apt to teach Physics than a Chemistry or Biology teacher, for example. Given this scenario, it is possible to raise some questions that need further investigation, such as the fact that Physics may be seen as a discipline of primarily algebraic/mathematical character – therefore, with a high degree of abstraction – and not experimental, to the point of being associated more with teachers of Mathematics than with professionals with training in another area of experimental science in the lack of licensed teachers in the area. Another point that deserves reflection focuses on the possible impacts of inadequate teacher training on students' learning and interest in physics, as well as an investigation into the impacts that the lack of women graduates may have on the motivation of students to pursue careers in the areas of Science and Technology.

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