

Meninas do radium: digital media as an instrument for gender inclusion in physics during the covid-19 pandemic in Brazil

Meninas do radium: as mídias digitais como instrumento para inclusão de gênero na física durante a pandemia de covid-19 no Brasil

Viviane Morcelle^{1,2*}, Thainá Neves¹, Gabrielle Freitas¹, Liliane Morcelle³, Cecília Barbosa⁴, Vanessa Ferreira², Érico Mata¹, Karine Gagno², Juliana Coutinho⁵, Amanda Souza¹, Antonio Carlos Fontes dos Santos⁶, Marcos da Silva Gonçalves⁷

¹DEFIS, Universidade Federal Rural do Rio de Janeiro, BR 465 Km 07 - CEP: 23897-000 – Seropédica, RJ, Brasil.

²PPGEduCIMAT, Universidade Federal Rural do Rio de Janeiro, BR 465 Km 07 - CEP: 23897-000 – Seropédica, RJ, Brasil.

³HESFA, Universidade Federal do Rio de Janeiro, Av. Pres. Vargas, 2863 – CEP: 20210-030 - Rio de Janeiro, RJ, Brasil.

⁴FISMAT, Universidade de Pernambuco, Rua Benfica, 455 – CEP: 50720-001 – Recife, PE, Brasil.

⁵PEMAT, Universidade Federal do Rio de Janeiro, Avenida Athos da Silveira Ramos, 149 – CEP: 21941-909 – Ilha do Fundão, RJ, Brasil.

⁶Instituto de Física, Universidade Federal do Rio de Janeiro - CEP: 21941-972 – Rio de Janeiro, RJ, Brasil.

⁷Pré- Vestibular Amar em Ensinar - CEP: 25010-000 – Duque de Caxias, RJ, Brasil.

*E-mail: vivianemorcelle@gmail.com

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Abstract

In the exact sciences we find an extremely restrictive scenario for women, especially black women, who are unlikely to be able to ascend in their careers and be awarded with grants. The “Meninas do Radium: A Periferia também faz Ciência” is a project of the Physics department of UFRRJ, which aims to develop research and extension activities, aimed at gender equity in this field within an intersectional perspective, in terms of gender, race, class and anti-ableism. After the start of the covid-19 pandemic, it was necessary to migrate to virtual spaces, which presented itself as a challenge. The first digital activity was a short course of Nuclear Physics, exclusively for women. We started a channel on YouTube where we present Lives and workshops, almost exclusively taught by women. The relevance achieved by the project, made possible by the use of digital media, took him from the Rio de Janeiro’s periphery to the rest of Brazil. In addition to gender inclusion, we observed comments on racial, class and human rights issues. We hope to continue to inspire students and researchers in the Exact Sciences as well as to enter this debate.

Keywords: Gender questions; Pandemic; Inclusion; Physics; Digital media.

Resumo

Nas ciências exatas encontramos um cenário extremamente restritivo para as mulheres, principalmente as negras, que dificultam a ascensão na carreira e obterem bolsas de pesquisa. O “Meninas do Radium: A Periferia também faz Ciência” é um projeto do departamento de Física da UFRRJ, que desenvolve atividades de pesquisa e extensão, visando a equidade de gênero neste campo em uma perspectiva interseccional, em termos de gênero, raça, classe e anti-capacitismo. Após o início da pandemia covid-19, foi necessário migrar para espaços virtuais, o que se apresentou como um desafio. A primeira atividade digital foi um minicurso de Física Nuclear, exclusivo para mulheres. Começamos um canal no YouTube, onde apresentamos Lives e workshops, quase exclusivamente ministrados por mulheres. A relevância alcançada pelo projeto, devido às mídias digitais, o levou da periferia do Rio de Janeiro para o resto do Brasil. Além da inclusão de gênero, observamos discussões sobre questões raciais, de classe e direitos humanos. Esperamos continuar a inspirar estudantes e pesquisadores nas Ciências Exatas, bem como a entrarem neste debate.

Palavras chaves: Questões de gênero; Pandemia; Inclusão; Física; Mídias digitais.

I. INTRODUCTION

Feminism is a social and political movement that seeks gender equity in its essence. However, the movement is not static, having gone through several waves, seeking to aggregate the demands of an increasing number of women. Since women are characterized as a very heterogeneous group in society, different aspects of the feminist movement emerge which makes it, mistakenly, be seen by many people as something that is inaccurate or without a defined direction.

“A Vindication of the Rights of Woman” written by Mary Wollstonecraft and published in 1791, where the author discusses the downgrading of women, the lack of financial autonomy, the absence of political rights and still hollered for social justice (Estacheski and Medeiros, 2017). This important work is published under the shadow of the Enlightenment movement, which, with its French revolution, only guaranteed rights to white and wealthy men. Among these and many other reasons, it is considered the starting point of the feminist movement, even though many works only recognize its beginning by associating it with the first wave.

The first wave started in the late 19th and early 20th centuries with women, known as *suffragettes* (Rosa and Silva, 2015) mainly seeking the right to vote, inheritance and employment, among others. The second wave started around the 1960s, and was mainly fighting for the right of the body, sexual pleasure, birth control, in addition to the struggles for political, economic and social rights; within this scenario, class issues started to play a relevant role, highlighting the different cuts under which women experience. The third wave had its spark at the end of the second wave in 1980, when black women were crying out for their rights within feminism, since only the rights of white women were being conquered, initiating black feminism (McCann et al, 2019).

The feminism struggle received attention again at the beginning of 2010 with the new generation of feminists, having as main tool the internet, as examples, the hashtags #METOO and #BlackLivesMatter were spread all over the world. This movement has also reached research laboratories and women are beginning to demand not only their rights, but also those of their predecessors through the recognition of their contributions to science as in the case of Lise Meitner.

Currently, a small number of women researchers are able to ascend and acquire a productivity scholarship in Exact Sciences at the National Council for Scientific and Technological Development (CNPq) in Brazil. If we talk about black women, the number is even smaller. When it comes to transgender women, there is not even the recognition with in the academy, so, being invisible, these women suffer from a process of social exclusion that can start from childhood, even in basic education, often making it impossible to enter higher education, and even finishing high school (Silva and Souza, 2019), reinforcing a stigma of male intellectual and social superiority.

Women in the exact sciences are still subjected to a patriarchal scenario with a strong gender inequality, which presents itself through various faces such as the Scissors and Matilda effects. The Scissors effect deals with the fact that the percentage of female participation has been decreasing in relation to male participation over time, including the rise in career. It gets its name from the percentage graph of the sexes in relation to the performance that resembles scissors, having gender stereotypes as one of its possible causes (Menezes, Brito and Anteneodo, 2016); in the case of the Matilda effect, it concerns the invisibility of women scientists and the attribution of their deeds to men. The name derives from Matilda Joslyn Gage, given in 1993 by the historian Margaret W. Rossiter (Nahra and Costa, 2020). Such facts demonstrate how women are excluded throughout their professional trajectory within the University, since graduation. After 200 years of the beginning of feminism, the struggle continues today and includes the search for space in universities, especially with regard to access, permanence and career advancement in the area of Exact Sciences (Morcelle, Freitas and Ludwig, 2019).

The “Meninas do Radium: A periferia também faz Ciência” is a research and extension project of the Physics Department of the Federal Rural University of Rio de Janeiro (UFRRJ), located in Seropédica, where not all neighborhoods in the municipality have paved streets, electricity and running water, at Baixada Fluminense, periphery of the state of Rio de Janeiro. The project mainly seeks gender equity in the exact sciences, in addition to broach racial issues, human rights, among other social issues related to minority groups, through research and extension actions in order to relate to social identities. Having as parameters the goals 5 "Achieve gender equality and empower all women and girls" and 10 "Reduce Inequalities" of the UN Sustainable Development (Nations, 2021).

The project started in 2018, having its first performance in the National Week of Science and Technology of UFRRJ, an event that aims to intensify the activities of popularization of science, whose theme of the year was “Science for the Reduction of Inequalities” (SNCT, 2018). Until the quarantine was declared, due to the covid-19 pandemic, the project's work was entirely in person, promoting scientific dissemination through conversation circles, lectures, workshops, short courses and round tables between members of the university, the external community and public schools from the outskirts of the city of Rio de Janeiro and the Baixada Fluminense, taking the history of science, human rights and physics as the basis from an intersectional perspective.

When the activities in person were suspended, there had to be an adaptation of the project, which started to operate remotely. It was the starting point to it actually enter the virtual spaces, adapting all activities to this context of social isolation. The beginning of the digital activities of Meninas do Radium was an exclusive mini-course for women entitled “Introduction to Nuclear Physics and Applications”, in June 2020, taught in a virtual learning environment (VLE). Then, we started a YouTube channel where periodical workshops are almost exclusively taught by women. So far, there have been twelve lives and four short courses. We promote reading discussion activities about books and articles on different VLE platforms. We also started to work in other social networks such as Facebook, Instagram and WhatsApp, having our own channels. In addition to having attended several invitations to events and interviews.

The migration of the in-person project to digital media has made consumers of social networks and digital platforms subject to our networks and content producers. One of the results was the importance achieved by our project, which left the periphery of the metropolitan region of Rio de Janeiro to the rest of Brazil and also brought other viewers, which included family members of students and members of society in general. Such a range would not be possible without the use of digital media, as according to Lemos (2003) the internet is consolidated as the most powerful communication tool, given from its popularization arising from the cyberculture movements that started in the 1980s. This fact explains the great use of social networks among young people. However, it is still important to reflect why among so many channels on YouTube focused on the theme of scientific dissemination and even issues of women in Physics, as a recent channel and for beginners, the Meninas do Radium got a prominent role.

In our project, when we think about Science, we do it in order to overcome inequalities and we seek to discuss the difficulties imposed on women to pursue a career in exact sciences, as well as to introduce tools so that they can have access and permanence equal to men, mainly in the Brazilian socio-political scenario. For this, from the scientific dissemination made by women on the live stream, in addition to debating the topics pertinent to science, we relate it to gender issues as well as to the trajectory of the speaker herself. Thus, bringing students to discuss their issues during the live streams and we seek to encourage them, in addition to listening to them and talking.

What expresses the importance of the work we do and the role of digital media for the dissemination of science and gender inclusion made by women for women is the great reception by the female public, who not only make their complaints in private, but also feel represented in our lives to talk about the barriers they face, as well as to report the importance of the project for gender inclusion.

Our lectures were presented on YouTube or Instagram, where participants performed a previous registration for later issuance of certificates. For this paper, only three online lectures given by “Meninas do Radium” in 2020 were chosen, so that both the comments contained in the live stream chat and the responses to the registration form could be analyzed, mainly from the perspective of gender, human rights and racial issues. In addition, we have investigated the reports received using documentary analysis as a research tool, categorizing the comments according to Bardin's content analysis, for a quali-quantitative research in order to understand whether it is indeed possible to promote inclusion through digital media, even more so in a scenario as adverse as the one we experience with the covid-19 pandemic.

II. METHODOLOGY

The methodological proposal is a quali-quantitative research, according to Minayo, who reports,

The difference between qualitative and quantitative lies on its nature. As social scientists working with statistics, only the sensitive, ecological, morphological and concrete region of the phenomena are apprehended, the qualitative approach delves into the world of the meanings of human actions and relations, a side that is not perceptible and cannot be captured in equations, averages and statistics. (Minayo, 2001, p. 22)

In the perspective of Denzin and Lincoln (2006, p. 16), "the word qualitative implies an emphasis on the qualities of the entities and on the processes that cannot be examined or measured experimentally in terms of quantity, volume, intensity or frequency".

The methodological basis used in our work was the Content Analysis proposed by Laurence Bardin (1977), with a focus on categorical analysis. We performed the analysis of the comments of the spectators of three lectures given by the research and extension project "Meninas do Radium: A periferia também faz Ciência", with remote work through digital media, due to the covid-19 pandemic. The first lecture to be analyzed was "Mulheres na Ciência: Impacto das Questões de Gênero e covid-19" ("Women in science: Impact of gender issues and covid-19"), held on June 30th of 2020, with the aim of promoting gender issues, as they perpetuate and reverberate in the current context and impacts of this during the pandemic. The second had the title: "A construção do lugar social das mulheres no Brasil moderno e as contribuições da História" ("The construction of the women social place in modern Brazil and the contributions of history"), and it was carried out on September 16th of 2020, with the objective of thinking about the contributions of history and its methods in the understanding of the construction of the social place of women in modern Brazil. The last lecture, entitled "Cientistas: Rebeldes e Insubordinadas" ("Scientists: Rebels and Insubordinates"), was performed on the October 21st of 2020, with aspects that deal with making women who contributed to the Exact and Natural Sciences visible, such as Physics, discussion of systems of oppression that are perpetuated to the present day, in addition to a brief presentation of questions about the representativeness of the 2020 Nobel Prize.

The products mentioned above were transmitted through social networks, such as the YouTube channel and the Instagram profile. The lectures were organized as follows: Initial contact with the researcher who gave the lecture, then a collaborative card was built, a mini summary was developed with all the necessary links to be sent to viewers through social networks and- mail, and a post was also made on social networks about the lecture that would be presented, by Meninas do Radium and also by other partner groups. The three lectures were of a scientific nature and were given by women. Gender issues were raised by the people who were watching, and even by the Meninas do Radium team in order to foster discussions.

To carry out the analysis, we extracted excerpts from the comments that characterized the record units and enabled the creation of categories according to the themes of the lectures, using as theoretical framework authors who discuss the issues mentioned above, such as: Lélia Gonzalez, Simone de Beauvoir, Angela Davis, Sueli Carneiro. For the elaboration of the categories, excerpts from the comments were highlighted that involve axes with the themes: gender, gender violence, gender and race, social class, gender and human rights, the awakening to become a researcher, the representativeness of the work of a teacher in students' lives and empowerment.

The three lectures were open to the general public, which does not allow us to have total control of who was watching. However, from the registration forms made available so that we could issue certificates, it was possible to determine a large part of our audience in relation to gender, race, location etc.

III. RESULTS AND DISCUSSION

In this section, we introduce the results obtained from the analysis of the registration forms and the comments made by the public of the three lectures quoted, all held in the year 2020. Finally, we bring a reflection on these results.

From the point of view of the audience, the results demonstrate that: with respect to the locality, as we are located in the State of Rio de Janeiro, it ends that, on average, 64% of our audience is also from this state. The second most representative Brazilian state is the one in São Paulo, with 11% of the spectators of these three live streams, however we also had the participation of people from all Brazilian regions besides the Southeast. Although we are at a university on the outskirts of the metropolitan region in the state of Rio de Janeiro, we have a large concentration of listeners in the capital, the city of Rio de Janeiro (32%), followed by two of the cities that comprise UFRRJ's campus, the Seropédica headquarters (11%) and the Multidisciplinary Institute's city, Nova Iguaçu (7%), and other people are divided by interior and peripheral regions, in Rio de Janeiro and in other states. Our audience, mainly due to our themes and reception environment, is mostly female (72%), 28% male and less than 1% non-binary, 97% of them are cisgender and 3% are transgender people. Regarding their sexuality, 67% identify themselves as heterosexual. In racial terms, we always try to encourage debates, so that we have: white (43%) and non-white (57%), in this category we have a majority of black people (55%), indigenous people (2%) and Asian people (0, 3%), the other 0.3% belong to those who declared to have no ethnicity. In all of these three lectures, only one person had some kind of specific need, low vision. As for schooling and research areas, 70% of our viewers had their undergraduate degree still in progress, 13% graduated, 8% with a master's degree, 7% already with doctorates and 5% of high school students. Of all these people, the course with the largest number is the Degree in Physics (more than 40%), but we can also observe the participation of people from other areas, such as chemistry (9%), and less expressive numbers of courses such as History, Pedagogy, Tourism,

Geology, and several areas of Bachelor of Physics. And in 50% of the cases, these listeners studied at the Federal Rural University of Rio de Janeiro, the other institutions are very dispersed in their representation.

The data obtained from the lecture "Mulheres na Ciência: Impacto das Questões de Gênero e covid-19" ("Women in Science: Impact of Gender Issues and covid-19") and organized in table I, show that this was not very productive in relation to collective exchanges, despite having many people actively participating in the conversations in the chat, only 6 managed to expose their perceptions and hold discussions in the virtual environment. We believe that some individuals have difficulties in interacting through digital media, collective exchanges were few, for some, in person contact is more productive, considering the difficulty of virtual interaction, due to the fact that these interactions were previously almost exclusively in person. Another relevant factor for this issue is the fear that some people have of public exposure, especially with regard to gender issues in their various expressions. The fact that a current topic, which addresses the covid-19 pandemic, does not move so many comments, leaves the perception of how fear, concern and insecurity bring together silence in response to difficult times, while highlighting the impacts on gender issues.

TABLE I. Axis and theme review: "Mulheres na Ciência: Impacto das Questões de Gênero e covid-19".

Categories	Axis	Absolute Frequency	Relative Frequency
Category 1	Gender	4	10%
Category 2	Become a researcher	2	05%
Category 3	Compliments to the project	34	85%
Total analyses:		40	100%

One should stress that only through education, we can propagate themes that involve gender, actions to deconstruct stereotypes, make these people not perceive themselves invisible, especially those belonging to marginalized groups, and that they can believe in their potential for entering the exact sciences or any area of their desire, and being a researcher is not just an idealization but the realization of a career.

In the lecture "A construção do lugar social das mulheres no Brasil moderno e as contribuições da História" ("The construction of the social place of women in modern Brazil and the contributions of History"), only 13 people were able to ask questions or put their perceptions. It is observed how difficult these issues are to be problematized. It is essential to continue the discussions, fostering the above axes is just a small step towards propagation. Analyzing table II, it is possible to observe that we have gender (17%) and gender violence (10%) as the most discussed topics, followed by the tie (7%) of the issues of gender and race and gender and human rights, which were approached in a way that fits with the discussions of the presentation that debated the situations of women in the Brazilian prison system.

TABLE II. Axis and theme review: "A construção do lugar social das mulheres no Brasil moderno e as contribuições da História".

Categories	Axis	Absolute Frequency	Relative Frequency
Category 1	Gender	5	17%
Category 2	Gender Violence	3	10%
Category 3	Class Issues	2	07%
Category 4	Gender and race	1	02%
Category 5	Gender and human rights	2	07%
Category 6	Compliments to the project	17	57%
Total analyses:		30	100,00%

In an intersectional perspective, without the class, race and gender triad it is impossible to have a feminist struggle and gender inclusion, so it is necessary to promote these themes, actions to encourage peripheral women and black women to seek Universities, stimulate interest in the sciences and be able to make them feel represented in this field. It is important to highlight that black women suffer invisibility, regardless of their position in society. So, talking about the construction of gender and race equity in the exact sciences is urgent, taking into account that in our group we have future teachers.

The analysis of table III deals with the lecture "Cientistas: Rebeldes e Insubordinadas" ("Scientists: Rebels and Insubordinates"), shows us that again we had 13 comments from people who managed to collectivize knowledge, asking questions to the researcher, reflections, with the axis of representativeness of the work of a teacher in the live stream (23%), was the theme with the greatest exchange between the researcher and the participants, who felt represented, identified with the speaker who made the explanation about the scientists. Gender (17%) as the third most commented, highlighted in all lectures given, in this way, shows the important place it occupies in the spaces of discussion,

however, here marked by gender violence, among them the imposter syndrome that is present in 67% of the speeches in this axis of analysis, these comments bring speeches of how much the students feel disqualified by their teachers, reducing their participation in scientific careers, passing through violations that interfere with the emotional field. Empowerment is actively present with the intersectional issues of gender and race (7%) and class (3%), and raises discussions about the valorization of the human being, regardless of race, gender or social class.

TABLE III. Axis and theme review: "Cientistas: Rebeldes e Insubordinadas".

Categories	Axis	Absolute Frequency	Relative Frequency
Category 1	Gender Violence	3	10%
Category 2	Representativeness	7	23%
Category 3	Gender and race	2	07%
Category 4	Class issues	1	03%
Category 5	Compliments to the project	17	57%
Total analyses:		30	100%

In all three lives, something that can be observed very clearly is the appreciation that all people following the transmission feel and felt for the project "Meninas do Radium". Throughout the presentations and even with comments about considering the project very important for their life. Another important fact that we can notice is the growing number of comments pertinent to the discussions of gender, race and class, in addition to the more touches focused on Human Rights and the understanding of the importance of representativeness in the academic and school environment, as a whole.

From the specific analysis of each transmission, and with the improved visualization in table IV, we can infer that our project, "Meninas do Radium: A periferia também faz ciência", performed and continues to play a key role in fostering discussions about gender, race, class and science. We can observe this both in a more selfish way, which takes into account only the considerable number of compliments that the project received during the three lives that were separated for analysis, which indicates both that the subjects discussed in the lectures were pleasing to the public, and that digital media are shown as a good place to develop these debates, as we can see in a better way in table IV, where 68% of the comments of these lectures are directed to honor the work that the project was doing at those times. We can also look from the point of view that ignores people's feelings about our project and looks strictly at the discussions raised in the chats of the lectures, yet we managed to highlight the constructive environment that was formed during all of our live broadcasts. Which makes us move towards a more inclusive physics, in several aspects.

TABLE IV. Overview of the three transmissions.

Categories	Axis	Absolute Frequency	Relative Frequency
Category 1	Gender	9	09%
Category 2	Gender violence	6	06%
Category 3	Gender and race	3	03%
Category 4	Gender and human rights	2	02%
Category 5	Class issues	3	03%
Category 6	Become a researcher	2	02%
Category 7	Representativeness	7	07%
Category 8	Compliments to the project	68	68%
Total analyses:		100	100,00%

IV. CONCLUSION

Although there is a certain difficulty on the part of the spectators to express themselves in a virtual environment, also due to the fear of exposure, through the documentary analysis of the live streams analyzed, we obtained a coherent response with what was expected. There was hospitality from the public, especially women, evidenced by the praise given to the project and the number of Instagram followers that only grows with each new event. In addition, we were able to provide a space for discussion that encompasses science and gender from an intersectional perspective. The virtual environment proved to be a powerful tool for the work of Meninas do Radium, the reach achieved would not be possible only through in person work, although the countless difficulties, even in terms of health and connection, have harmed the project's members and viewers.

Another important result was the higher percentage of participants of the project's activities being of black people, opposing the reality of the exact sciences. This being demonstrated by recent data presented by Morcelle et al (2019), where this group is one of the most under-represented in STEM. So, we managed not only to reach, but to give voice to this group and that demonstrates the representativeness of Meninas do Radium and that we are contributing to the fight against racism.

We believe that during the pandemic scenario and changes in the practices of our in-person meetings, as well as the necessary isolation, we obtained good results throughout this project, so we will continue through live streams and other activities, proposing discussions about gender, racism, class issues, capacity building and plurality, building collectively with the public that interacts virtually through our virtual platforms, aiming to promote the valuation of these groups. This digital tool used during the covid-19 pandemic, will continue to help achieve the purposes and spread the project. It was noticeable that the women who participated in the live streams, trust us and feel represented.

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