



# **DIVERSITY IN STEM: BRAZILIAN EXPERIENCE**

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CREDITS: the original template was created by the University of Warwick (UK) and it was modified to reflect Brazilian reality

## CAREER CHOICE: IS IT REALLY ON THE INDIVIDUALS?

**“Gender, ethnicity, social and economic background and disability affects choice , possibly because of self limiting effects on:**

- academic self concept **“I’m not good at science”**
- career identity **“I don’t know anyone who does that job”**
- STEM careers awareness is also limited by:
  - lack of **visibility** of breadth of STEM options
  - stereotyped **images and perceptions** of people working in traditionally conceived STEM jobs.”



# HISTORICAL PERSPECTIVE



Africans thrown overboard from a slave ship, Brazil, ca. 1830s. This woodcut was originally published in *The Liberator*, the American abolitionist newspaper, 7 Jan. 1832 (vol. 11, p. 2) [Library of USA Congress photo, LC-USZ62-30833]. CREDIT: <https://slaveryandremembrance.org/articles/article/?id=A0035>

- The Portuguese arrived in Brazil in 1500
- Indigenous genocide (conflicts, diseases, slavery): a estimated population of 3 million people in 1500 reached its lowest level (70.000) in 1957<sup>1</sup>.
- Human trafficking of ~ 4-5 million black Africans to Brazil from 1530 to 1831 (officially). The trafficking of black Africans continued illegally until 1856<sup>2</sup>
- After decades of enslaved revolts, organization of “quilombos” (communities organized by fugitive slaves), and the abolitionist movements, the slavery was abolished in 1888<sup>2</sup>.

[1] ARAÚJO, Carlos Eduardo Moreira. Fim do tráfico. In: SCHWARCZ, Lília Moritz e GOMES, Flávio (orgs.). *Dicionário da escravidão e liberdade*. São Paulo: Companhia das Letras, 2018.

[2] <https://www.ufrgs.br/humanista/2021/09/24/genocidio-indigena-entenda-os-riscos-e-preocupacoes-que-a-populacao-nativa-do-brasil-enfrenta/>

# HISTORICAL PERSPECTIVE: LITERACY AND SCHOOLS

- 1872 Census: illiteracy rates among enslaved population was 99.91%<sup>3</sup>.
- Formal school education of slaves and black women was completely forbidden in Brazil, and free black men were not authorized to attend classes in schools until 1878<sup>3</sup>.
- Homeschooling was very important at that time and teaching of reading and writing, sometimes also counting, both for black enslaved boys and girls, was linked to teaching of a specialized trade, which could increase the revenue of their owners<sup>3</sup>.
- When possible, those who could write and read would teach these skills to their family and communities<sup>3</sup>.
- A few informal schools lead mainly by free black people (no governmental support) taught mainly free black boys (but not only!) reading and writing<sup>4</sup>: education was recognized as an important tool for black people, for several reasons.

Quem deſejar pôr negros ou negras de 8 até 10 annos de idade a apprender o officio de jardineiro, cocheiro, ou cozinheiro, e além disto a ler, escrever, contar, e cozer, dirija-se á casa de *Carles Durand, e Comp.*, na *Direita N.º 9*. As condições são as seguintes: 1.º De-ve ter boa constituição e boa saúde, e ter tudo beixigas naturais ou vacinadas. 2.º Ter ao me- nos 2 camizas, 2 calças, e 1 jaqueta: 3.º Nos primeiros tres mezes o Senhor poderá tirar o escravo; depois de tres mezes deverá deixa-lo tres annos á pessoa que delle se encarregar, a qual se obriga a fazelo aprender tudo que o Senhor houver destinado, e demais os diversos conhecimentos elementares indicados.

Source: Gazeta do Rio de Janeiro, 1819, p. 02.

*[Whoever wishes black men or women aged 8 to 10 to learn the trades of gardener, coachman, or cook; and furthermore, to read, to write, to count, and to sew, please find Carlos Durand Inc. at Direita Street, no. 9. Conditions are as follows: 1. To have a good build and to be on good health; and to have had smallpox naturally or to have been vaccinated against it. 2. To have at least 2 shirts, 2 pants, and 1 jacket. 3. During the first three months, the owner may take his slaves back. After three months, the owner shall leave them under the responsibility of the person in charge of them for three years. Such person commits to teach them everything the owner has requested, as well as all other basic knowledge required.]*

Para ago, ou que se deſeja ensinar a ler, escrever, e contar, em huma roſsa, o que procura-se hum homem, que sirva para ensinar a ler, escrever, e contar, em huma roſsa, o que apparecer procure ajustar-se em casa do Capitão *José Carvalho de Souza*, na rua das *Violas, N.º 12*.

Source: Gazeta do Rio de Janeiro, 1815, p. 02.

*[A man is wanted to teach reading, writing, and counting at a farm. Whoever is interested please present himself at the house of Captain José Carvalho de Souza at Violas Street, no. 12.]*

Quem quizer vender algum escravo, que saiba bem ler e escrever, fale com o *Tabelião Mata* na rua do *Tijolo N.º 8*.

Source: Idade D'Ouro do Brazil, 1814, p. 02.

*[Whoever wishes to sell a slave who knows how to read and to write well, please contact Notary Mata at Tijolo Street, no. 8.]*

Na casa N.º 49 junto á ponte de *Calumbi*, desapareceu hum escravo cabra, de nome *Silverio*, de meia idade, alto, magro, de officio de *Alfaiate*, que sabe ler, e escrever, e jun- to com elle sua mulher de nome *Francisca*, com cabello e feições de *India*, baixa, e no estado de prenhez, quem der delles noticia na mesina casa receberá boas alviçaras.

Source: Gazeta do Rio de Janeiro, 1820, p. 02.

*[At house no. 49 by Calumbi Bridge, a mixed-raced slave called Silverio disappeared. He is middle-aged, tall, thin and works as a tailor. He knows how to read and to write. His wife, Francisca, also disappeared with him. She has the hair and the facial features of an indigenous woman. She is short and impregnated. Whoever has any information on them, please present it at that house, and a handsome reward shall be paid.]*

[3] Reading and writing learning among enslaved black people in Brazil: stories of the "unrecorded". Eliane Peres. Cadernos de História da Educação, v.19, n.1, p.149-166, jan./abr. 2020 e-ISSN: 1982-7806 <https://doi.org/10.14393/che-v19n1-2020-10>

[4] [https://meuartigo.brasilescota.uol.com.br/educacao/educacao-questao-cor-trajetoria-educacional-dos-negros-brasil.htm#\\_ftn4](https://meuartigo.brasilescota.uol.com.br/educacao/educacao-questao-cor-trajetoria-educacional-dos-negros-brasil.htm#_ftn4)

# THE POWER OF EDUCATION



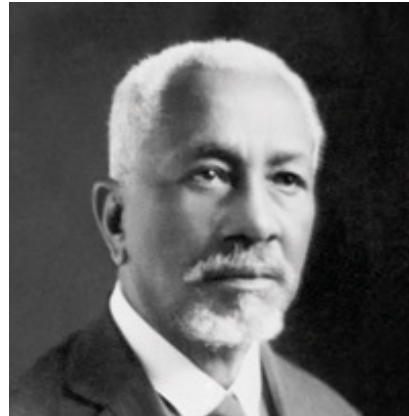
ANDRÉ REBOUÇAS

(1838 – 1898), Free black man, Engineer, Abolitionist

- Learned how to read and write with his father
- Had formal education and obtained his degree at a military college. He went to Europe for 2 years for further studies
- Parents: Antônio P. Rebouças (free black man, imperial counselor, lawyer) and Carolina P. Rebouças (white, a merchant's daughter)

[6] <http://www.letras.ufmg.br/literafro/ensaistas/1421-andre-reboucas>

[7] [https://www.gov.br/arquivonacional/pt-br/sites\\_eventos/sites-tematicos-1/brasil-oitocentista/conheca-o-acervo/andre-pinto-reboucas-ov](https://www.gov.br/arquivonacional/pt-br/sites_eventos/sites-tematicos-1/brasil-oitocentista/conheca-o-acervo/andre-pinto-reboucas-ov)



THEODORO SAMPAIO

(1855 – 1937), Free black man, Math Teacher and Engineer

- He went to a private school and then to a college
- Parents: Manoel F. Sampaio (white, catholic priest) and Domingas da Paixão (Enslaved woman)
- Paid for the freedom of his mother and three brothers

[8] <http://www.museuafrobrasil.org.br/pesquisa/hist%C3%B3ria-e-mem%C3%B3ria/historia-e-memoria/2014/07/17/theodoro-sampaio>



ENEDINA ALVES MARQUES

(1913 – 1981), first black woman to graduate in Civil Engineer in Brazil

- She went to a private school as a child, public school during the high school and graduated at a public state University in Parana (South Brazil)
- Parents: Paulo Marques e Virgília Alves de Marques, black couple who left a rural area looking for better life conditions in the city.

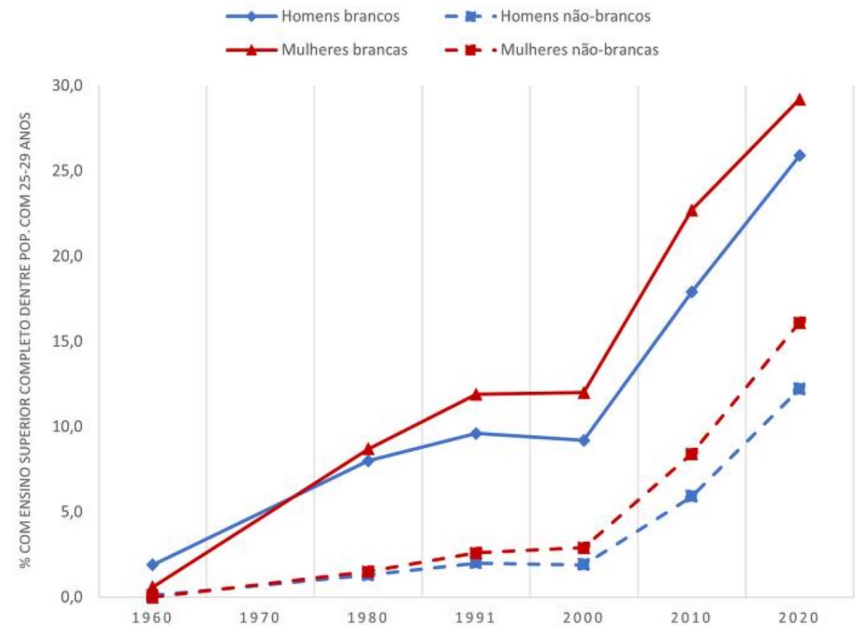
[9] <https://agenciabrasil.ebc.com.br/educacao/noticia/2023-01/primeira-engenheira-negra-do-brasil-completaria-110-anos>



# WHY PUBLIC POLICIES MATTER

- Before 1808 Brazilian elite would travel to Portugal (mainly Coimbra University) or other European countries in order to have a Bachelor degree
- Public Colleges of Law, Medicine and Engineering were created in the country
- First public University created in 1920 and more built along the the XX century. It is not only a place to prepare professionals for the market, but also to do research
- Starting in 1968 the number of private Universities increase and public Universities start to have evening classes to attend working class people.
- Starting in 2004 several public policies, including affirmative actions, were implemented in order to democratize the access to higher education

[6] <https://iqc.org.br/observatorio/artigos/educacao/a-historia-do-ensino-superior-brasileiro/>



Data from demographic census 1960-2010 and PNAD, published at: <https://www1.folha.uol.com.br/blogs/politicas-e-justica/2023/05/politicas-de-acao-afirmativa-20.shtml>



# WHY PUBLIC POLICIES IN STEM MATTER

## Proporção de negros e brancos por curso universitário

Cursos de ciências sociais e humanas

**Ciência Política**  
2.604 alunos



**1 negro para cada 5 brancos**

**Pedagogia**  
729.100 alunos



**1 negro para cada 4 brancos**

**Filosofia**  
28.433 alunos

**História**  
97.831 alunos

**Letras**  
179.438 alunos

**Ciências Sociais:** 28.986 alunos



**1 negro para cada 3 brancos**

## Proporção de negros e brancos por curso universitário

Cursos de engenharia, ciências exatas, da saúde e biológicas

**Medicina**  
150.581 alunos

**Veterinária**  
93.964 alunos



**1 negro para cada 16 brancos**

**Arquitetura e Urbanismo**  
168.369 alunos

**Odontologia**  
115.706 alunos



**1 negro para cada 12 brancos**

**Finanças, bancos e seguros:** 305 alunos



**1 negro para cada 10 brancos**

**Engenharias:** 1.006.599 alunos



**1 negro para cada 9 brancos**

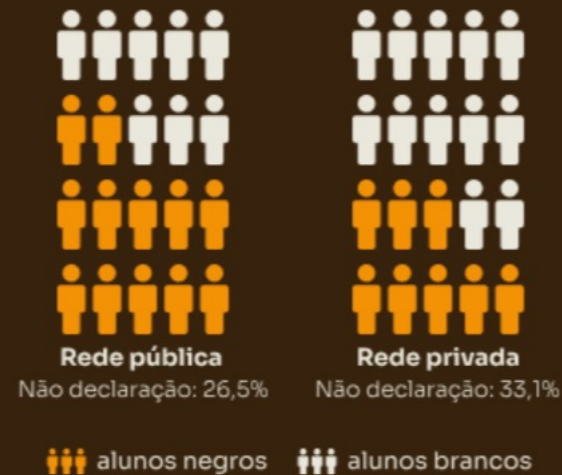
# CHALLENGES TO INCREASE DIVERSITY IN STEM

- In 2023, Public State schools: 83.6%, Public Federal schools: 3.1%, Private schools: 12.8%, Public city schools: 0.5%<sup>10</sup>
- Students of private schools have better chances to be approved in the admission exam of Public Universities<sup>11</sup>
- There are more black students in public than in private schools
- There is a lack of Science teachers in Public high schools leading to considerable worse entry exams results for students therein

[10] <https://agenciagov.ebc.com.br/noticias/202402/mec-e-inep-divulgam-resultados-do-censo-escolar2023#:~:text=O%20cen%C3%A1rio%20C3%A9%20de%20retomada,6%25%20entre%202019%20e%202021.&text=78%2C1%25%20dos%20alunos%20da,est%C3%A3o%20matriculados%20na%20rede%20p%C3%ABblica.&text=21%2C9%25%20dos%20alunos%20da,est%C3%A3o%20matriculados%20na%20rede%20privada.>

[11] Centro de Estudos e Dados sobre Desigualdades Raciais (Cedra)

Para cada 15 estudantes negros havia 10 brancos na rede pública de Educação Básica. Já na rede privada, havia 6 estudantes negros para cada 10 brancos, em 2019.



Fonte: INEP. Censo Escolar da Educação Básica.



# CHALLENGES TO INCREASE DIVERSITY IN STEM

## Course drop out:

	<b>Estatística</b>	<b>Química</b>	<b>Matemática</b>	<b>Física</b>	<b>Computação</b>	<b>Geral</b>
<b>Origem escolar</b>						
Ensino Público	54,8%	44,4%	72,0%	56,7%	77,8%	57,0%
Ensino Privado	45,2%	54,6%	28,0%	43,3%	22,2%	38,7%

Source:: Léo Manoel L.S Garcia; Raquel S. Gomes; Causes of dropout in exact science courses: a review of academic production. Revista Educar Mais 2022 | Volume 6 | Pág. 937 a 957;

DOI: <https://doi.org/10.15536/reducarmais.6.2022.2970>

Mathematics, Physics and Chemistry have lower admission scores (400-600 points), but it might be challenging to advance and get a degree for several reasons...



# CHALLENGES TO INCREASE DIVERSITY IN STEM

**Tabela 7:** Causas da evasão por curso

<b>Curso</b>	<b>Causas de evasão</b>		
Estatística	Dificuldade e Desempenho acadêmico	Falta de tempo para conciliar trabalho e estudo	Ingresso no curso por falta de opção
Química	Situação financeira	Dificuldade e Desempenho acadêmico	Insatisfação com o curso/Não gostou
Matemática	Falta de tempo para conciliar trabalho e estudo	Falta de conhecimento do ensino médio	Vocacionais
Física	Falta de tempo para conciliar trabalho e estudo	Dificuldade e Desempenho acadêmico	Falta de conhecimento do ensino médio
Computação	Didática e metodologia dos professores	Dificuldade e Desempenho acadêmico	Infraestrutura

Source: Léo Manoel L.S Garcia; Raquel S. Gomes; Causes of dropout in exact science courses: a review of academic production. Revista Educar Mais 2022 | Volume 6 | Pág. 937 a 957; DOI: <https://doi.org/10.15536/reducarmais.6.2022.2970>



We just described socio-economical disparities.  
For a more complete picture, we now turn to race based  
policies.



# HOW CAN WE INCREASE DIVERSITY IN STEM UNDER SUCH ADVERSE CONDITIONS?

MNU helped to create and implement educational policies such as:

- **Law 10.639/2003:** Teaching of Afro-Brazilian and African History and Culture is compulsory<sup>12</sup>
- **Lei 12.711/2012:** affirmative action in public Universities, to benefit either black students or individuals who have studied in public schools<sup>12</sup>
- **Law 12.990/2014:** reserves 20% of the vacancies in federal public service for black people when more than three positions are available<sup>12</sup>
- The changes over the last 30 years, although still small, raised awareness on the existence of racism in Brazil. And the Brazilian Academia started to take some actions:



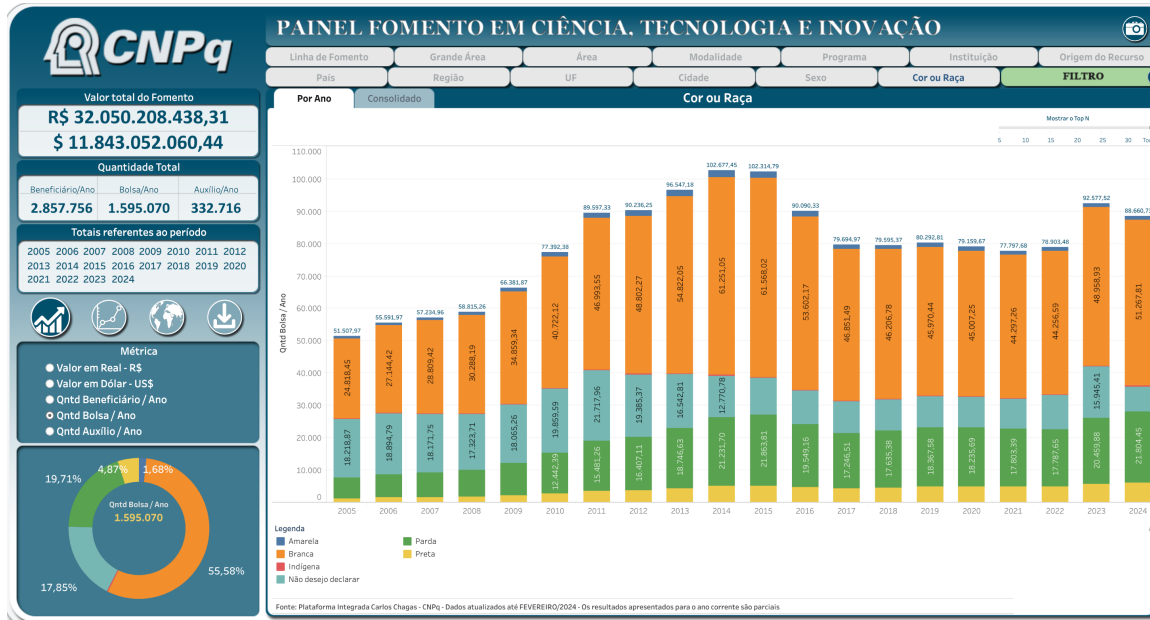
Unified Black Movement – Since 1978 fighting against racism and for life!

Source: <https://jornalempoderado.com.br/editorial/entidades/mnu-movimento-negro-unificado/>

[12]<https://meuartigo.brasilecola.uol.com.br/educacao/educacao-questao-cor-trajetoria-educacional-dos-negros-brasil.htm>



# HOW CAN WE INCREASE DIVERSITY IN STEM UNDER SUCH ADVERSE CONDITIONS?



## Lattes Panel

Source: <http://bi.cnpq.br/painel/fomento-cti/>

Call for proposals specific for black women for a 1-year PhD exchange program or a Postdoctoral fellowship abroad<sup>13</sup>

[13] <https://www.gov.br/cnpq/pt-br/assuntos/noticias/cnpq-em-acao/inscricoes-abertas-para-a-chamada-atlanticas-programa-beatriz-nascimento-de-mulheres-na-ciencia>





# HOW CAN WE INCREASE DIVERSITY IN STEM UNDER SUCH ADVERSE CONDITIONS?

- Undergrad fellowship for black and former students of public schools<sup>14</sup>
- Call for projects on Public Policies (any area, including education)<sup>15</sup>
- Call for projects to improve Public Schools in Sao Paulo<sup>16</sup>

[14] <https://fapesp.br/161720/bamula-edu/>

[15] <https://fapesp.br/19050/financiamento-de-chamada-programa-de-convocacao-em-politicas-publicas-sps/>

[16] <https://fapesp.br/sensinepublico>



## FINANCIAMENTO

### FAPESP cria plano para ampliar equidade, diversidade e inclusão

Dois coordenadores vão organizar ações, como edital de bolsas de iniciação científica para alunos cotistas



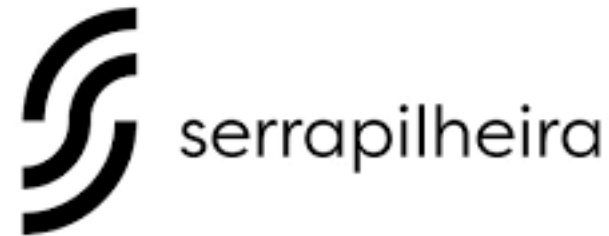
EDI committee coordinated by Profs. Ana Maria Fonseca de Almeida e Everardo Magalhães Carneiro, both from UNICAMP

Source: <https://revistapesquisa.fapesp.br/fapesp-cria-plano-para-ampliar-equidade-diversidade-e-inclusao/>



# HOW CAN WE INCREASE DIVERSITY IN STEM UNDER SUCH ADVERSE CONDITIONS?

- Evaluating inequalities in Science using data: affirmative action in postgraduate studies (Prof. Anna Venturini) and Race disparities in STEM (Prof. Luiz Augusto Campos)
- Diversity bonus of up to 30% of scientific projects for researchers committed to diversity actions
- Call for proposals specific for underrepresented groups in partnership with FAPERJ
- Diverse team to evaluate research proposals: 50% Europe/USA, 50% other countries and at least 20% non-white referees
- Oguntec Project (director: Lázaro Cunha) at Steve Biko Institute: 30 fellowships (24 months) for students who are participating in the project
- Pluralizar Project (UFSCar, Anton Castro Miguez): research fellowships to undergrad and graduate students from underrepresented groups
- Mukengi project (Mancala I., Rosani Mattos): it prepares black and indigenous researchers to carry out S&T research aimed at their communities.



Scientists selected in the exclusive call for black and indigenous scientists with representatives from Serrapilheira, Faperj and Professor Hélio Santos at the Serrapilheira Meetings in Tibau do Sul/RN, October 2023



# HOW CAN WE INCREASE DIVERSITY IN STEM UNDER SUCH ADVERSE CONDITIONS?



- Call for a 12-month postdoctoral fellowship for black females (2022) and black people (2023). 2024?



- Visits of scientists to public schools (“Physics at School”)
- Minicourses of modern physics for high school students from public schools
- Physics games: activity for middle school students from public schools
- Inspiring new generation to Physics: roundtables
- Workshops on diversity (2019, 2023)

<https://outreach.ictp-saifr.org/estudantes-de-ensino-medio/>  
<https://www.ictp-saifr.org/>



- ProFIS: during 24 months 120 students from public schools have classes of natural and human sciences. After this period, they can choose any undergrad course at UNICAMP
- PAAIS: public school students receive a bonus (up to 40 points) which is added to the final score of their exams of admission (ENEM).

<https://vestibulares.estrategia.com/porta/enem-e-vestibulares/estudantes-de-ensino-medio/unicamp/#:~:text=Anualmente%2C%20a%20unicamp%20seleciona%20120,de%20escolas%20p%C3%BAblicas%20de%20Campinas.>



Physics games at CEU Butantã

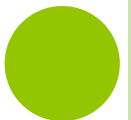


# HOW CAN WE INCREASE DIVERSITY IN STEM UNDER SUCH ADVERSE CONDITIONS?

Suggestions at a smaller scale (individual, groups, organizations):

- Improve the well being of poor/black students in Universities:
  - financially: fellowships and socioeconomic support
  - Fighting racism and harassment
  - Increasing the chance of underrepresented groups to access better opportunities in the job market: mentorship, language courses, workshops on Scientific writing, etc.
  - Organize seminars or group meetings in diversity
  - Invite sociologists or researchers on education if the intention is to have a more accurate view on the subject.

And still there is much more to be done!





# THANK YOU!

