

MAPPING GENDER EDUCATIONAL POLICIES IN STEM AREAS IN THE CONTEXT OF THE NEW BRAZILIAN HIGH SCHOOL EDUCATION

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ABSTRACT. This text presents an ongoing research that relates the policy mapping activity aimed at promoting gender-related issues in STEM (Science, Technology, Engineering, and Mathematics) conducted by the ELLAS research network (Equality in Leadership for Latin American STEM) to the Brazilian New High School policy. Through document analysis related to the policy, it is possible to identify indications of the gender demand in STEM within the national policy, stemming from the loan agreement with the World Bank.

KEYWORDS: STEM / equality / gender / educational policies / high school

MAPEO DE LAS POLÍTICAS DE EDUCACIÓN DE GÉNERO EN LAS ÁREAS STEM EN EL CONTEXTO DE LA NUEVA ESCUELA SECUNDARIA DE BRASIL

RESUMEN. Este texto presenta una investigación en curso que relaciona la actividad de mapeo de políticas destinadas a promover cuestiones relacionadas con el género en STEM (Ciencia, Tecnología, Ingeniería y Matemáticas) realizada por la red de investigación ELLAS (Equality in Leadership for Latin American STEM - Igualdad en el Liderazgo para STEM en América Latina) con la política brasileña de Nueva Escuela

Secundaria. A través del análisis de documentos relacionados con la política, es posible identificar indicios de la demanda de género en STEM dentro de la política nacional, derivados del acuerdo de préstamo con el Banco Mundial.

PALABRAS CLAVE: STEM / equidad / género / políticas educativas / educación secundaria

MAPEAMENTO DAS POLÍTICAS DE EDUCAÇÃO DE GÊNERO NAS ÁREAS DE STEM NO CONTEXTO DO NOVO ENSINO MÉDIO NO BRASIL

RESUMO. Este texto apresenta uma pesquisa em andamento que relaciona a atividade de mapeamento de políticas voltadas para questões de gênero em STEM (Ciência, Tecnologia, Engenharia e Matemática) conduzida pela rede de pesquisa ELLAS (Equality in Leadership for Latin American STEM Igualdade na Liderança para Mulheres em STEM na América Latina) com a política do Novo Ensino Médio Brasileiro. Através da análise de documentos relacionados à política, é possível identificar indícios da demanda de gênero em STEM dentro da política nacional, derivados do acordo de empréstimo com o Banco Mundial.

PALAVRAS-CHAVE: STEM / equidade / gênero / políticas educacionais / ensino médio

1. INTRODUCTION

The 2030 Agenda of the United Nations (UN), by establishing gender equality as one of the 17 Sustainable Development Goals (SDGs), recognizes the need to combat discrimination against women. This document represents a global partnership for a world of universal respect for human rights and highlights gender equality and the empowerment of all women and girls as a premise in goal 5. This is a challenge to be achieved in various sectors of society, particularly in fields known as STEM (Science, Technology, Engineering, and Math), where access is uneven between men and women (Noonan, 2017).

In this context of scarcity, the “Latin American Open Data for gender equality policies focusing on leadership in STEM” Research Project (IDRC, 2022), emerges as an initiative that integrates a research, teaching, and extension network called ELLAS (Equality in Leadership for Latin American STEM) in member countries: Brazil, Bolivia, Peru. The project’s theme is the advancement of institutional policies to promote gender equality in STEM. The project aims to map the initiatives and policies implemented so far in each country, as well as the contextual aspects that influence women’s careers in STEM (Maciel et al., 2023).

In Brazil, the Federal University of Mato Grosso (UFMT), the leading institution in the aforementioned project, has a group of researchers dedicated to the network’s activities on various fronts. One of these fronts is related to specific objective 1: Mapping the factors, actors, and policies that influence women’s careers in STEM, collecting related data, and analyzing this data. Through Activity 2: Mapping policies in each country, the aim is to identify government policies and policies from private organizations that promote opportunities for women in STEM fields.

To achieve this, this study highlights, within government policies, basic school education, which is an important stage to be mapped considering its role in the formative process of young individuals. Specifically, it addresses the final stage of Basic Education (comprising Early Childhood Education, Elementary School, and High School), which has recently undergone a “reform.”

This is a multifaceted stage with a profile that, as Bueno (2000) warned some time ago, lacks “an approach that considers the trajectory of policies for this level of education, the context in which they are developed, their foundations and implications, characteristics and motivations, as well as possible results and consequences.” According to Pimentel (2019), an essential normative instrument to ensure inclusive and equitable quality education in Brazilian Basic Education is the National Common Curricular Base (BNCC), as it defines the essential learning for all students (Brasil, 2017).

Therefore, the objective of this study is to map policies aligned with the BNCC that may influence the development of women’s careers in STEM, with a focus on high school education policy. This aims to contribute to the second research question of the

Ellas project, namely: What are the policies that could support the growth of women's careers in STEM?

2. FOUNDATIONS AND RESEARCH PATH

The conceptual foundations of this study focus on the gender-related concepts, factors, and gaps that affect women's entry and persistence in STEM fields, as found in various research studies (Noonan, 2017; Iglesias et al., 2018; Ribeiro, 2020; Sígolo et al., 2021) . Additionally, it draws upon the current educational policy for the restructuring of high school curriculum, Law No. 13,415, dated February 16, 2017 (Brasil 2017a), preceded by Provisional Measure (MP) No. 746/2016. The study investigates the high school reform with the aim of examining the policy's measures, which announce the replacement of a single curriculum model with a diversified and flexible model through the implementation of the National Common Curricular Base (BNCC) and Educational Pathways (Itinerários Formativos), organized by areas of knowledge.

The Educational Pathways (IFs) constitute the diversified part of the curriculum and propose a deepening of one or more academic curriculum areas that are part of the BNCC, namely: Languages and their Technologies; Natural Sciences and their Technologies; Mathematics and its Technologies; and Human and Social Applied Sciences, in addition to Professional Technical Education. To facilitate the implementation of this structure, known as the New High School (NEM), Brazil has signed an agreement with the International Bank for Reconstruction and Development (IBRD), a part of the World Bank Group, and established the Results Program (PforR). The program's goal is to strengthen the capacity of educational networks to carry out the reform. The program's evaluation includes technical analysis to achieve the objective of increasing school completion rates and the quality of education, with measures such as the adoption of a flexible curriculum and the gradual expansion of the school day. It also includes fiduciary analysis related to financial management and socio-environmental impact analysis, concerning the ability to ensure environmental and social benefits with the program's implementation, while safeguarding against potential risks such as inequalities (Brasil 2017b).

Thus, the socio-environmental impact includes gender equity as one of the analysis indicators, as a way to mitigate the risk of selecting a training path dictated by gender bias, with strategies aimed at inspiring, engaging, and empowering girls in STEM fields. It is worth noting that boys predominantly choose pathways in Natural Sciences (CN) and Mathematics (Mat), while girls tend to focus on language and social sciences pathways. This pattern can be explained by the persisting false perception in society regarding the relationship between women and professions that require attention, care, and affection (Brasil 2017b; Frigo and Araújo 2023).

The possibility for young people to choose their educational path through IFs is one of the most criticized aspects of the reform. Despite promoting the idea of flexibility

and personalization, in practice, it raises doubts about its effectiveness and the risk of exacerbating educational disparities. There are several studies that highlight the challenges in the ongoing implementation, as seen in the National Movement in Defense of Secondary Education. Since the issuance of the MP, this movement has expressed concerns about the widening educational inequalities. In a recent letter to the Transition Working Group of the government, they cited evidence from research conducted in nine Brazilian states, identifying two main weaknesses in IFs. The first is the lack of understanding among teachers regarding the possibilities of implementing this curriculum, and the second is related to the actual freedom of choice for young people, as there are barriers imposed by the structure of each educational network, influenced by their different realities (ANPED, 2022).

In light of these weaknesses, we sought to understand the dynamics of the assessment that links disbursements to educational outcomes, in alignment with the objectives of the Secondary Education reform, as the agreement aims to strengthen the capacity of state secretariats in managing the program's social and environmental impacts (Brazil, 2017). Therefore, the documentary analysis in this exploratory, qualitative research (Gil, 2019) considered the following documents:

I) Socio-environmental research report of the New Secondary Education Support Program - ProNEM (Brasil, 2021);

II) Safeguard Socio-environmental Research Report (Brasil, 2022);

III) Socio-environmental research report of the Itinerary Training Program (ProIF) (Brasil, 2022a);

IV) Verification report of the ProIF socio-environmental research (Brasil, 2022b);

V) Socio-environmental Management Guide (Brasil, 2022c).

The reports, which constitute records of part of the implementation of public policy directed towards the New Secondary Education, present data collected in surveys applied to schools that have adopted the ProNEM program and to the education networks in the country. The results supported the development of the Socio-environmental Management Guide, a pedagogical support tool that presents themes aligned with the 17 Sustainable Development Goals (SDGs). Table 1 provides a compilation of each analyzed document, highlighting the main data collected about gender in STEM fields.

Table 1
Documentary analysis based on socio-environmental research reports and Socio-Environmental Management Guide

Documents	Document objective	Main collected data
I) Report on the socio-environmental research of the New High School Support Program - ProNEM	Present the systematization of data regarding the socio-environmental aspects of the New High School Support Program, established by MEC Ordinance No. 649/2018, in a survey applied to 4,020 schools from June 22 to July 21, 2021.	74.1% of the schools eligible for ProNEM participated in the survey. 49.4% of the schools stated that no actions were planned to encourage the enrollment of girls in the CN IF, followed by 44.7% who said "Yes." For the Mat IF, 49% said "No," and 45% said "Yes."
II) Safeguards Socioenvironmental Research Report	VeCheck socioenvironmental aspects at the level of state and district education secretariats. Monitoring report. Survey conducted from 12/02 to 12/16/2021	All 27 federal units participated in the survey. 70% of the education networks stated that they had "No" strategies to increase enrollment of girls in IF CN and Mat from 2018 to 2021.
III) Environmental and Social Safeguard Research Report of the Professional Training Itinerary Program (ProIF)	Collect information about the implementation of the Professional Training Itineraries (IFs) in the schools of the ProIF, established by MEC Ordinance No. 733/21. This report details the structure, application, and results of the research conducted from June 15th to June 30th, 2022.	All 27 federal units participated in the survey. 93% of the networks answered "No" to having carried out any actions in 2022 to encourage the enrollment of girls in the Natural Sciences Itinerary (IF de CN), and 89% responded "No" for the Mathematics Itinerary (IF de Mat).
IV) Verification report of the socio-environmental research on the ProIF	Presents the results of the research on the implementation of the IFs in ProIF schools and adds an analysis of the responses with classifications of: satisfactory, moderate, and unsatisfactory.	Classified as unsatisfactory the execution of specific action to encourage enrollment of girls in CN and Mat. Concludes that the action needs to be better presented, explained, and guided for the purpose of developing and implementing strategies.
V) Guide to Socio-Environmental Management	A pedagogical support tool with social and environmental themes necessary for school sustainability. It presents best practices for each theme. Published after the research results in the year 2022.	It addresses gender data in Basic Education, Higher Education, and the job market. It suggests as a best practice: encouraging girls to enter STEM careers through pedagogical projects. Conducting campaigns that empower girls in Science and Mathematics.

3. MAIN RESULTS OF THE MAPPING OF EDUCATIONAL POLICIES TO PROMOTE GENDER IN STEM AREAS IN THE NEW HIGH SCHOOL PROGRAM

The analysis reveals that, in the case of the CN and Mat areas, the increase in girls' enrollment through the IFs is proposed in all the documents analyzed. However, the research results show that the majority of responses, in general, indicate "No" for the action to

encourage an increase in girls' enrollment in the CN and Mat IFs during the initial pilot implementation period (2018 to 2021).

Report I provides data on planning, meaning it asks schools about their plans to encourage the enrollment of girls in the aforementioned courses. Despite the majority of responses being negative, around 49%, and 6% of schools responding "don't know," there is a significant portion of approximately 45% of schools that answered "Yes."

Regarding the school districts, Report II shows that 70% of the responses indicated that there were no working strategies with the districts when it comes to increasing enrollments of girls in STEM-related IFs. The districts were consulted again in 2022, according to Report III, and the percentage of "No" responses increased to 93% for CN and 89% for Mat, meaning not all districts that indicated having a strategy to increase girls' enrollments were able to implement it in practice.

In Report IV, which verifies the research with the IFs, the action of encouraging enrollments of girls in CN and Mat pathways is classified as unsatisfactory, needing to be understood first before strategies can be developed by the school districts. The result is concerning because it signals a lack of prioritization of the agenda by the education systems, as evidenced by the lack of targeted actions for schools, whether to encourage new actions or maintain the interest of schools that had already indicated in 2021, as per Report I, the need to encourage enrollments of girls in STEM-related IFs.

The technical study published by the Ministry of Education (MEC), with the compilation of results from socio-environmental research within the ProNEM scope, shows a relevant piece of information when it asks if schools promote discussions on diversity, where 84.7% answered "Yes" to actions related to Gender Diversity (Brasil, 2022d). It remains to be seen how this is happening in school settings and how ProNEM can actually contribute, considering its goal of providing support to the federal units for the implementation of the reform.

Despite the Guide being a step in this direction, it makes little progress in the proposed model of disseminating best practices. While plausible, the sharing of models needs to be accompanied by more robust actions that produce effects in line with the work already signaled by the schools. Therefore, it is expected that the results presented by the reports will inform new training actions for and with the networks.

4. FINAL CONSIDERATIONS

The results of this study are preliminary, as the PforR is still ongoing. However, they indicate that the policy for high school education requires that education networks consider strategies to increase girls' enrollment in STEM-related curricula, which is a perspective for the growth of women's careers in these areas.

Considering that Law 13,415/2017 established a period of 5 years for the implementation of extended school hours throughout the country (2018-2022), as well as the inclusion of IFs in the curricular matrices, the application of the socioenvironmental management survey provides the first official data on the flexibility of pilot schools. Regarding diversity, as already pointed out, there is little progress in practice in terms of the results of schools and education networks in implementing actions to promote gender equity in enrollments for STEM-related IFs.

It's worth noting that the ongoing reform of high school education originates from a politically turbulent context, established by Law No. 13,415/2017, which began with the issuance of a Provisional Measure (MP) by the president who took office after an impeachment process, reflecting a specific political agenda. This act has been controversial from the perspective of democratic governance and has been questioned by researchers in the field of education. The implementation process was interrupted during the current presidential administration in Brazil (2023-2026) – the current president, Luiz Inácio Lula da Silva, has previously governed the country in two other terms, from 2003 to 2006 and from 2007 to 2010. The current administration initiated an evaluation of the process, starting consultations and national seminars from March to July of this year, in response to the movement calling for the repeal of the reform, which has spread across the country. After the conclusion of the public consultation, the Ministry of Education (MEC) released a proposal for changes to incorporate the feedback received, as outlined in the executive report [Brazil 2023].

In this context, concerning the need for policies targeting Brazilian youth to promote the participation of women in STEM careers, we observe that the risk with the New High School (NEM) reform is that it may not only fail to contribute to this goal but also exacerbate vulnerabilities that widen differentiation and discrimination within the public education sector. This could happen by prematurely influencing potential choices through the educational pathways without the comprehensive implementation of interventions outlined in the program itself. These interventions could include raising awareness among education professionals about gender biases and implementing strategies aimed at building a “scientific identity” for girls.

The research presented here will continue to monitor the upcoming developments in the New High School (NEM) policy. The data collected through document analysis, organized in spreadsheets, will be made available for integration into the Connected Open Data platform being developed within the ELLAS project.

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