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Experience Reports

Critical mathematics education and gender violence: an experience report in elementary school

Educação matemática crítica e violência de gênero: um relato de experiência no ensino fundamental

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Abstract

This article reports on a pedagogical experiment conducted with seventh-grade elementary school students, linking Critical Mathematics Education and Mathematical Modeling to the discussion of gender violence. The aim of the project was to promote critical thinking and develop statistical skills through the analysis and production of graphs based on real data. This is a qualitative, exploratory, and descriptive study that sought to understand the pedagogical potential of the proposal in the school context. The intervention was organized in three stages: introduction of mathematical content, investigation of topics related to gender inequality, and socialization of results. The students showed high engagement and broadened their understanding of social inequalities, in addition to recognizing Mathematics as a language capable of interpreting reality, as a condition for the process of its transformation. The experience highlighted the potential of the interdisciplinary approach for civic, ethical, and critical education, as well as reaffirming the importance of integrating school content with relevant social issues.

Keywords: Critical Mathematics Education; Mathematical Modeling; gender violence; interdisciplinarity.

Resumo

Este artigo relata uma experiência pedagógica desenvolvida com estudantes do 7º ano do Ensino Fundamental, em que se articula a Educação Matemática Crítica e a Modelagem Matemática à discussão sobre a violência de gênero. A proposta teve como objetivo promover reflexões críticas e desenvolver competências estatísticas por meio da análise e produção de gráficos, com base em dados reais. Trata-se de uma pesquisa de abordagem qualitativa, de natureza exploratória e descritiva, que buscou compreender as potencialidades pedagógicas da proposta no contexto escolar. A intervenção foi organizada em três etapas: introdução aos conteúdos matemáticos, investigação de temas relacionados à desigualdade de gênero e socialização dos resultados. Os estudantes demonstraram alto engajamento e ampliaram sua compreensão sobre as desigualdades sociais, além de reconhecerem a Matemática como uma linguagem capaz de interpretar a realidade, como uma condição para o processo de sua transformação. A experiência evidenciou o potencial da abordagem interdisciplinar para a formação cidadã, ética e crítica, bem como reafirma a importância de integrar conteúdos escolares a problemáticas sociais relevantes.

Palavras-chave: Educação Matemática Crítica; Modelagem Matemática; violência de gênero; interdisciplinaridade.

INTRODUCTION

Contemporary society faces complex social challenges, such as economic inequalities, unemployment, climate change, and gender violence, which require innovative and interdisciplinary educational approaches. Among these challenges, gender violence stands out for directly affecting women's lives, often in ways that are invisible or normalized (Guimarães; Pedroza, 2015).

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In this context, there is a need to reflect on how education can contribute to social awareness and transformation (Gomes, 2023). Critically analyzing gender and education is essential to combat sexism, homophobia, machismo, and gender inequalities. This allows us to broaden our understanding of equality and inequality (Darsie; Saraiva, 2016).

Mathematics, often perceived as a neutral subject distant from everyday life, is frequently produced, taught, and learned in a way that is dissociated from the social issues that impact students' lives (Araújo; Martins, 2020). In this sense, it is assumed that perspectives such as Critical Mathematics Education (CME) and Mathematical Modeling offer ways to integrate mathematical and social knowledge, expanding the possibilities for reflection and action on real problems. Skovsmose (2014) understands that education needs to be directed towards everyday problems, that is, focusing on situations that transcend the classroom environment and promote meaningful connections between school learning and reality.

Based on this purpose, the present research seeks to answer the question: How can a pedagogical experience based on Critical Mathematics Education and Mathematical Modeling contribute to students' reflection on gender violence and promote the development of critical thinking? In this perspective, Viana and Santos (2022) highlight that Mathematical Modeling allows students to investigate real phenomena, such as gender violence, as it transcends technical content and transforms the school into a space for critical analysis and social transformation.

In this context, the present study aims to report on a pedagogical experience that used CME and Mathematical Modeling to explore issues related to gender violence in order to promote critical reflection and the development of statistical skills in elementary school students. Thus, we seek to investigate how mathematics can provide conditions for social debate and promote awareness about gender violence.

METHODOLOGY

This study is based on a qualitative approach, focusing on understanding behaviors, motivations, and attitudes based on detailed descriptions and in-depth interpretations (Minayo, 2010). It is an exploratory and descriptive study, whose objective is to analyze and reflect on a pedagogical experience in the school context, using the CME perspective as a reference (Skovsmose, 2001, 2020). In this approach, learning is not conceived as a neutral process or restricted to internal cognitive connections, but as a socially and politically situated practice that involves understanding, questioning, and transforming relationships of power, domination, and exclusion present in society. Learning, in this perspective, means critically participating in social practices mediated by mathematics, recognizing its uses as an instrument for maintaining or confronting inequalities. Thus, learning is considered meaningful when it promotes conditions for students to critically understand the world and act to transform it (Hackman, 2005; Skovsmose, 2020).

The educational experience described here took place in the city of Lages, located in the mountainous region of Santa Catarina, which had a population of approximately 171,000 in 2024. The Basic Education Development Index (IDEB) for the public school system in the municipality was 5.3 in the early years and 4.3 in the final years of elementary school, indicating low to medium performance (Instituto Brasileiro de Geografia e Estatistica, 2024). The school participating in this experiment is located in a peripheral neighborhood and serves approximately 860 elementary and high school students, distributed across three shifts (personal observation).

In this context, between February 19 and March 8, 2024, a pedagogical intervention was carried out with a 7th-grade elementary school class, composed of 32 students aged between 12 and 13, developed in reference to International Women's Day. The proposal aimed to articulate the teaching of mathematical content with the problematization of gender violence, in light of the assumptions of CME. The research was approved by the Human Research Ethics Committee of the institution of two of the authors, in accordance with Resolution 510/2016 of the National Health Council (Opinion 6.262.443/2023), which ensures compliance with ethical principles and the protection of participants.

During the 12 lessons that made up the intervention, students were introduced to the concepts of graphs, percentages, and data interpretation through the analysis of real information related to the topic, which enabled the adoption of mathematics as a language for critically reading reality. Considering the time available, the class's level of learning, and the pedagogical objectives of the proposal, it was decided to address exclusively the concepts and procedures of bar and/or column graphs, as these are visual resources that facilitate the understanding and analysis of data in a more accessible and effective way. In this way, this contributes to the development of critical thinking and to the reinterpretation of mathematics as a tool for social intervention.

The theme of gender violence was addressed through an interdisciplinary proposal that linked mathematical concepts to the reading of social data, with the aim of fostering a critical attitude among students and expanding their ability to interpret quantitative information in contexts of social relevance.

Thus, the pedagogical intervention was organized into three interdependent stages, designed based on an investigative and critical perspective of mathematics education, in which statistical knowledge was linked to contemporary social issues. These stages, which constitute the methodological core of the proposal, will be analyzed in the Results and Discussion section in order to highlight how each of them contributed to the construction of contextualized mathematical knowledge and to the development of students' critical thinking about gender inequalities.

The experience report was prepared based on observations made throughout the process, grounded in the understanding of Souza, Fassbinder, and Baldan Junior (2023), who characterize it as a textual modality that analytically describes concrete experiences in specific educational contexts, in addition to promoting reflection on the pedagogical practices adopted and their ramifications. This type of record is essential for the dissemination of innovative experiences and for the strengthening critical reflection in the field of education.

THEORETICAL FRAMEWORK

The theoretical basis of this research establishes the conceptual contributions that underpin the analysis of the relationships between gender, violence, and education. It starts from the understanding that social categories are historical and cultural constructs shaped by different forms of power, which require questioning the norms that define identities, behaviors, and social positions. Thus, this section presents the theoretical foundations that guide the discussion: initially, it addresses the concept of gender and its articulation with gender violence; then it discusses the presence of these issues in the field of education; subsequently, it analyzes statistical data that highlight gender inequalities; and, finally, it relates Critical Mathematics Education and Mathematical Modeling as instruments of reflection and pedagogical intervention.

Gender and gender-based violence

> The sex of a body is simply too complex. There is no such thing as this or that. Rather, there are nuances of difference, [...] labeling someone male or female is a social decision. We can use scientific knowledge to help us make that decision, but only our beliefs about gender—not science—can define our sex. Furthermore, our beliefs about gender also affect the type of knowledge that scientists produce about sex (Fausto-Sterling, 2002, p. 15).

The category of gender emerged in the scientific field with the contributions of the feminist movement, especially as a way of de-naturalizing the relationship between biological sex and social roles. Scott (1989) was one of the authors who highlighted this distinction, defining gender as a social construct, based on perceived differences between the sexes, but also as a structuring element of power relations. Thus, gender not only organizes subjects into normative categories, but also establishes hierarchies between them, constituting social inequalities.

Judith Butler (2018) expands on this discussion by pointing out that shifting the understanding of gender as a cultural construct, as opposed to sex as biological, still keeps certain normative structures intact. For the author, gender is not a fixed identity, but a performative practice, that is, constituted through repetitions of acts, norms, and discourses that consolidate certain ways of being and exclude others. Performativity, in this sense, reveals that gender is always produced, reiterated, and, for this very reason, subject to subversion.

Such understandings dismantle the idea of a natural and linear correspondence between sex, gender, and desire. As Butler (2016) points out, heteronormativity is based on the expectation that biological sex automatically determines a gender identity and a sexual orientation consistent with it. This logic regulates bodies and establishes standards of normality that marginalize experiences that escape the cisheteronormative binary.

In the social context, the effects of these constructs are concrete. Gender violence, for example, is not only an expression of inequality between the sexes, but a product of a system that imposes rigid norms on how bodies should be understood, experienced, and controlled. Foucault (2015) points out how, since the 18th century, sex has become an object of political management and social control, inserted into systems of utility, regulation, and morality—a process he terms biopolitics. In this context, sex and sexuality become devices for controlling life, in addition to regulating individual and collective behavior.

Preciado (2018), in revisiting and radicalizing Foucault's notion, introduces the concept of sexopolitics to name the way in which discourses on sex, gender, and identity are mobilized as central instruments of government. For the author, sex is not only a biological fact or a field of knowledge, but a device of power that produces subjectivities and regulates social life. Techniques used to normalize sexual identities—through medicine, law, religion, and education—become agents of standardization and control.

It is in this context that gender violence occurs. More than a series of isolated acts, it should be understood as an expression of the normative control mechanisms that discipline bodies and desires. This violence manifests itself physically, sexually, psychologically, and economically, as evidenced by Guimarães and Pedroza (2015), but it is also present in discourses, institutional practices, and subtle forms of exclusion and silencing.

Thus, when addressing gender violence, it is necessary to understand its structural roots. The social construction of genders—with their imposed dichotomies, hierarchies, and coherences—produces intelligible and unintelligible subjects, as discussed by Butler (2016). Those who do not align with the norm—women, LGBTQIA+ people, especially trans people—are often targets of violence for challenging established standards of identity, desire, and corporeality.

This dominant social norm, although not always named, is embodied in the figure of the white, heterosexual, Christian, urban middle-class man. All other subjects become "others" based on this hegemonic reference, as Louro (2001) observes. It is in the context of this matrix that markers of difference and gender inequalities are produced, materialized in rates of violence, social exclusion, wage inequality, low political representation, and restrictions on access to education and the labor market.

Therefore, when talking about gender and gender violence in the educational space, it is essential to recognize that these are not "accessory" or "complementary" themes, but central to understanding the power relations that permeate the school, the curriculum, and the learning processes. Schools, as social institutions, actively participate in the production and reproduction of these norms and, therefore, can (and should) also be spaces for resistance, deconstruction, and reconstruction of meanings about bodies, identities, and rights.

Gender and education

School is one of the privileged spaces for the constitution of social, cultural, and subjective identities, playing a central role in both the reproduction and contestation of gender norms.

The school curriculum, often marked by silences and stereotypes, acts as a mechanism for structuring inequalities, often reinforcing binary and normative patterns. Including gender and sexual diversity in the educational context, as stated by Darsie and Saraiva (2016), represents not only the recognition of the necessary cultural change, but also the urgency of constructing theoretical and methodological references that challenge prejudices and promote an ethical, aesthetic, and humanizing education in diversity.

An analysis of the presence (or absence) of the category of gender in school content reveals that the theme is rarely considered as a focus for critical reflection. In the specific case of mathematics, there is a tendency to treat the subject as neutral and objective, dissociated from the social and cultural dynamics that permeate it. Skovsmose (2022) warns about the didactic examples that inhabit textbooks and classrooms: "João buys apples" and "Maria buys eggs," simplified and binary representations that obscure the complexity of gender experiences and their articulations with race, class, sexuality, and territory. This perspective limits the development of critical and emancipatory education, as it disregards the social determinants that shape bodies, knowledge, and ways of being and learning.

Based on a post-structuralist approach, Louro (1997) understands that educational discourses are permeated by power relations that produce and regulate gender identities. The author points out that educational institutions not only reflect social norms, but are also spaces for their active production, through pedagogical practices, languages, symbols, and everyday interactions. By understanding gender as a relational, situated, and unstable construct—rather than a fixed role to be played—Louro invites us to shift our gaze from essentialist explanations to the social practices that produce masculinities and femininities.

This understanding is in line with the studies of Crociari and Perez (2019), which demonstrate how gender constructs are present from early childhood education onwards, influencing pedagogical practices, play choices, and expectations directed toward boys and girls. The authors highlight that even in the early stages of schooling, it is common to reproduce social norms that associate behaviors, skills, and interests with one gender or another, perpetuating stereotypes and inequalities in school relationships. However, the authors also point to possibilities for resistance and subversion of these patterns, especially when there is pedagogical intentionality and critical training for teachers.

In this sense, working with gender in education is not limited to including content on diversity, but rather implies transforming the ways of teaching, evaluating, and relating to subjects in their plurality. It means breaking with the false neutrality of the curriculum and recognizing that all disciplines, including mathematics, are influenced by political, cultural, and social dimensions. By taking a critical stance, teachers contribute to destabilizing the norms that produce exclusion and violence, in order to build a more just, pluralistic, and welcoming school for all identities.

GENDER-BASED VIOLENCE IN STATISTICAL DATA

Gender-based violence can be observed and analyzed through statistical data, as they allow for the identification of patterns and structural inequalities. In the context of this study, six themes were selected for the pedagogical approach with students: wage differences between men and women, female participation in technological careers, access to education for girls, violence against women, female representation in politics, and female entrepreneurship.

Gender discrimination is evident in the labor market. Studies indicate that women often receive lower wages than men, even when they have similar or superior professional characteristics (Martins, 2015). The gender pay gap is more pronounced in informal jobs (13%) than in formal jobs (5%) (Yahmed, 2018). The choice of university courses also influences this inequality, since the fields of Science, Technology, Engineering, and Mathematics (STEM) are predominantly male, which contributes to the maintenance of the wage gap (Bustelo et al., 2021).

Violence against women in Brazil remains an alarming problem. In the first five months of 2024 alone, more than 380,000 cases were reported, including physical, psychological, and sexual assaults. Despite a slight reduction of 5.1% in cases of femicide compared to 2023, the phenomenon persists due to factors such as underreporting, fear of reprisals, and the inefficiency of the judicial system (Brasil, 2024).

CRITICAL MATHEMATICAL EDUCATION AND MATHEMATICAL MODELING

Critical Mathematics Education (CME) challenges the idea that mathematics is a neutral and technical discipline, arguing that its teaching can both reinforce inequalities and act as a tool for social emancipation (Skovsmose, 2014; Roux; Swanson, 2021). Instead of treating mathematics as a set of abstract rules, CME proposes an approach that connects mathematical content to social issues, encouraging contextualized and critical learning.

One of the most effective strategies within CME is Mathematical Modeling, as it enables students to analyze real phenomena using mathematical tools, in a process of investigation and critical reflection. Mathematical Modeling can be conceived as a scenario for investigation, in which students are invited to problematize everyday situations, formulate questions, and seek solutions, understanding mathematics not as a neutral language, but as a constituent part of social practices (Araújo; Martins, 2020; Skovsmose, 2001, 2022). In the context of the research reported here, this approach was used to enable students to explore data on gender violence, which involved statistics and graphical representations.

By relating mathematical concepts to social inequalities, CME breaks with the traditional view of mathematics as an isolated discipline. For Scheffer (1999), Mathematical Modeling allows students to analyze the reality in which they live, in order to concretely problematize and promote active participation in the learning process. In the case of this project on gender violence, classroom debates encouraged students to reflect on women's rights and the importance of gender equality.

In addition, CME contributes to the development of critical thinking by teaching students to question the way data is presented and interpreted. According to Skovsmose (2022), overcoming the uncritical reading of numbers is essential for educating citizens who are able to understand the power relations that permeate society and act in a more conscious and engaged manner.

RESULTS AND DISCUSSION

The pedagogical experiment was developed in a 7th-grade elementary school class, with the aim of integrating the teaching of graphs and tables with a reflection on gender violence. The proposal sought to break with the traditional view of mathematics as a technical and neutral discipline and instead promote connections between mathematical content and the social issues experienced by students. As Skovsmose (2022) points out, mathematics education should focus on concrete problems that allow students to construct meaning based on the analysis of situations that transcend the classroom and establish links between school content and reality.

The activity was organized into three main stages. Initially, a theoretical presentation was given on reading, interpreting, and constructing graphs and tables, addressing technical aspects such as identifying axes, analyzing legends, scales, titles, and the organization of numerical data. Understanding these elements was essential to ensure that students grasped the statistical fundamentals necessary for critical data analysis. In addition, a discussion was held on the importance of mathematics as a tool for reading the world in order to highlight that numerical data are not neutral or devoid of ideology, but bear marks of social, political, and economic structures that produce inequalities. This approach is in line with the assumptions of CME, which proposes situated and contextualized learning capable of fostering reflective thinking and transformative action (Skovsmose, 2022).

According to Roux and Swanson (2021), mathematics can either reinforce forms of exclusion or open paths to social justice, depending on how it is mobilized in the school environment. In this sense, the proposal to integrate statistical content with the discussion of gender violence is aligned with a sociopolitical perspective of teaching, in which mathematical concepts are linked to emerging themes from the students' reality. This strategy allows students to develop cognitive and ethical skills, such as argumentation, interpretation, empathy, and critical thinking, strengthening citizenship education and broadens the meaning of schooling.

The students were then organized into six groups, each responsible for investigating one of the following topics: the gender pay gap, female participation in technology careers, access to education for girls, violence against women, female representation in politics, and female entrepreneurship. These topics were selected based on their social relevance and their potential to engage students in critical reflections on gender inequalities present in various contexts. The proposal also considered the importance of addressing topics that, although fundamental to social reality, are often overlooked in school curricula (Darsie; Saraiva, 2016; Louro, 1997).

During this stage, the groups conducted research using reliable sources, such as scientific articles, institutional reports, government platforms, and data from international organizations, such as the IBGE, UN Women, the Brazilian Forum on Public Safety, and the Social Indicators Panel. The teacher acted as a facilitator in the process, providing guidance for critical analysis of the information, as well as offering methodological support and encouraging the formulation of hypotheses and questions about the inequalities identified. This teacher participation was essential to stimulate student autonomy, while ensuring the seriousness and relevance of the sources used.

The methodology adopted was Mathematical Modeling, understood as a pedagogical approach that allows mathematical concepts to be linked to real situations, so as to encourage students to engage in investigative processes into social phenomena. As Skovsmose (2001) points out, modeling, when critically guided, constitutes an investigative learning environment in which students are invited to question reality and reflect on the role of mathematics in society. In this regard, Araújo and Martins (2020) emphasize that modeling can favor the construction of mathematical meanings and the development of critical thinking, promoting learning that goes beyond technical mastery, contributing to the civic and democratic education of individuals.

The third stage consisted of organizing and visually representing the data through the construction of graphs and tables. This representation was fundamental to visualize the patterns and contrasts revealed by the research, making the analysis and critical interpretation of the data more accessible. The production of educational materials with narrative and visual elements, such as graphs and stories discussed in this activity refers to pedagogical experiences that integrate the teaching of mathematics with storytelling, so as to contribute to student engagement and meaning construction (Moura, 2024).

The culmination of the proposal took place through classroom presentations, when each group shared their results, contextualized the data, and discussed their social implications with their classmates and teacher. During these presentations, students were encouraged to answer previously prepared questions that linked mathematical aspects to sociocultural reflections, which promoted the development of argumentation, active listening, and the exchange of ideas among peers.

The group responsible for the theme on the wage gap between men and women focused on comparing the average incomes of four professions: doctors, engineers, teachers, and lawyers. The analysis revealed significant discrepancies between genders, even in occupations with similar qualifications and technical requirements. The students identified this scenario as a reflection of structural inequalities in the world of work and proposed measures such as equal pay for equivalent jobs, greater incentives for women in leadership positions, and the creation of legislation that holds companies accountable for gender pay discrimination.

During the presentation, the group emphasized the importance of deconstructing stereotypes in the professional environment, highlighting that "everyone can do everything," a phrase that summarized the students' perception of the urgency of equity. The graphic representation produced by the group, shown in Figure 1, highlighted the income disparity between men and women in the professions analyzed and, thus, contributing to the class's critical reading and engagement in the debate.

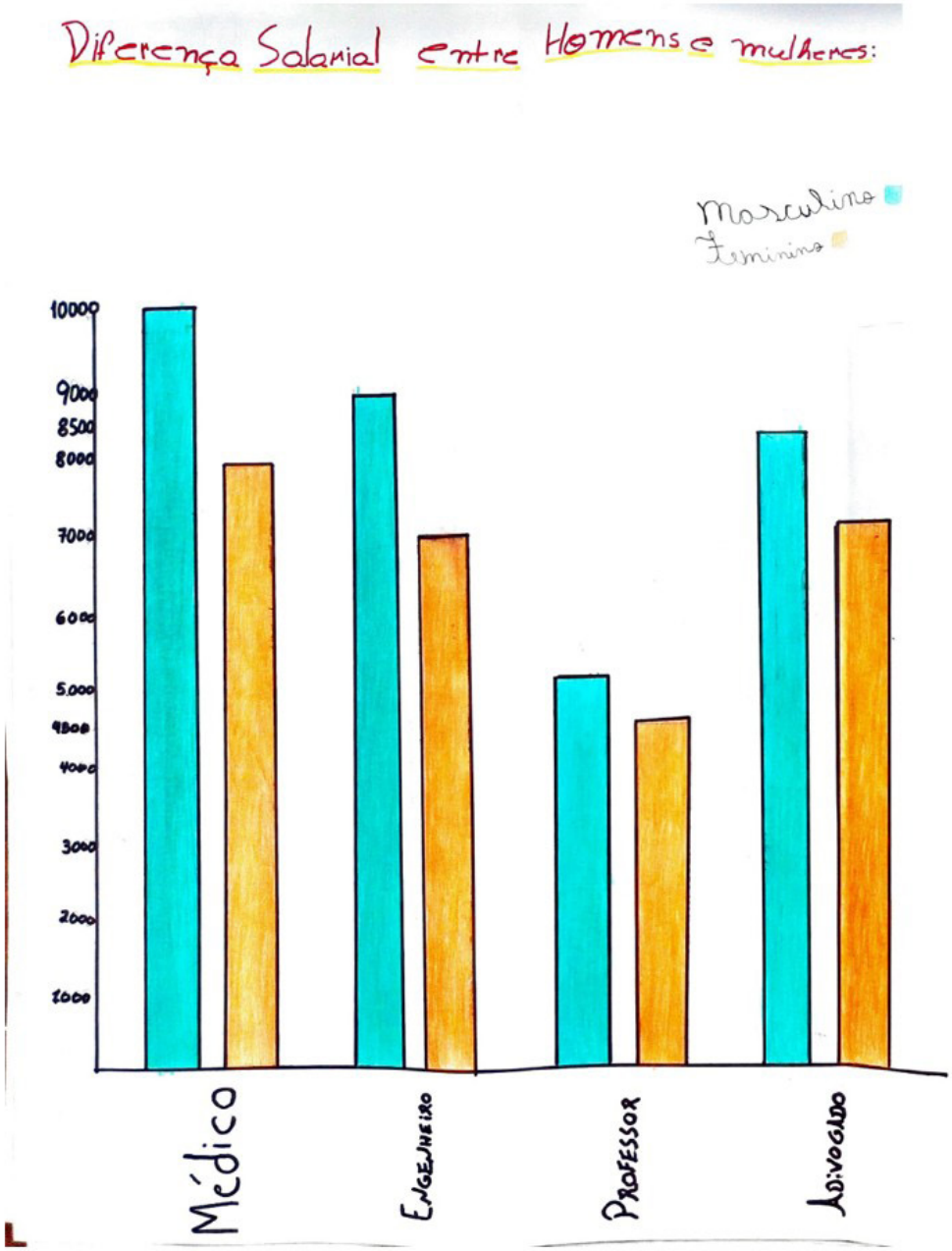

Figure 1. Study on the wage gap between men and women.
Source: Prepared by students (2024).

When observing wage discrepancies, students recognized that gender inequality in the world of work is not limited to the presence or absence of women in certain professions, but is expressed concretely in the economic devaluation of their work, even in jobs with the same qualification requirements. This perception is corroborated by studies such as those of Martins (2015) and Yahmed (2018), which identify discrimination as the main factor in wage

inequality in Brazil, especially in formal and informal occupations. In this sense, the activity enabled students not only to describe statistical data but also to question the structures that produce them, aligning with the proposal of Critical Mathematics Education, which promotes a reflective reading of reality (Skovsmose, 2014; Roux; Swanson, 2021).

Female participation in technology careers was another topic addressed by the students, who proposed actions to encourage girls to take an interest in mathematics, science, and technology from an early age. Among the strategies proposed, they highlighted the importance of showing examples of successful women in these areas, as well as the creation of specific programs, such as scholarships and hiring policies that promote female representation. These proposals are in line with the findings of Oliveira, Gava, and Unbehaum (2019), who emphasize that early encouragement of girls' participation in STEM areas is essential for overcoming gender inequalities in these fields. According to the authors, the presence of female role models and the combate against stereotypes starting in elementary school are decisive elements for increasing gender equality in science and technology. Figure 2 graphically illustrates the group's analysis, which demonstrates the underrepresentation of women in technological fields and reinforces the urgency of educational policies that promote equal access to these careers.

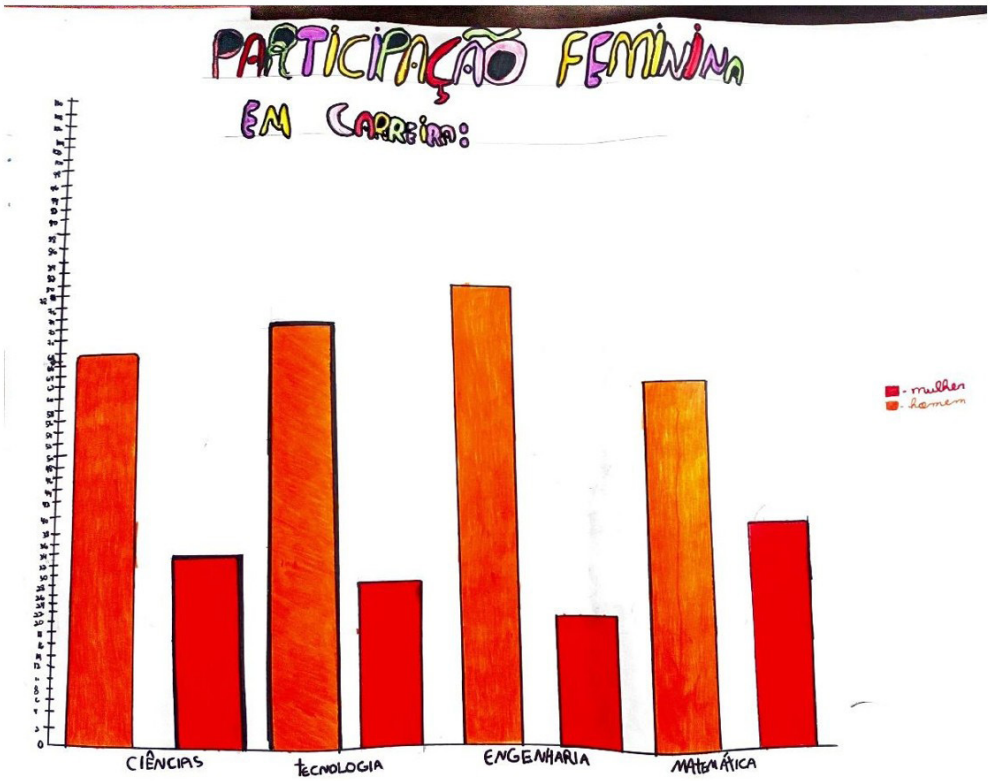

Figure 2. Work on participation in STEM careers.
Source: Prepared by students (2024).

With regard to girls' access to education, it is important to ensure that schools are located close to communities, that free public transportation is available, and that adequate school supplies are provided. Added to this is the importance of community campaigns that raise awareness among families about girls' educational rights, an issue that gained momentum with the students' assertion that "boys and girls have the same rights." This statement highlights the intertwining of gender, class, and territorial inequalities, a dimension widely discussed in the formulation of educational policies committed to equity and the recognition of differences. In this context, Bortolini and Vianna (2022) analyze the disputes surrounding educational proposals aimed at overcoming structural inequalities and valuing diversity.

When analyzing the educational scenario from a broader perspective, it is clear that the challenges faced by gender and sexual diversity policies are not unique to Brazil. The imposition of cis-heteronormative systems, sustained by colonial and patriarchal structures, is a reality present in various social and cultural contexts. This observation reinforces the understanding that the struggle for an education that promotes the rights of girls and the LGBTQIA+ population is a global issue that requires confronting deeply rooted historical and cultural barriers (Bortolini; Vianna, 2022).

Figure 3 presents a summary of this group's work, highlighting how structural barriers hinder girls' access to basic education.

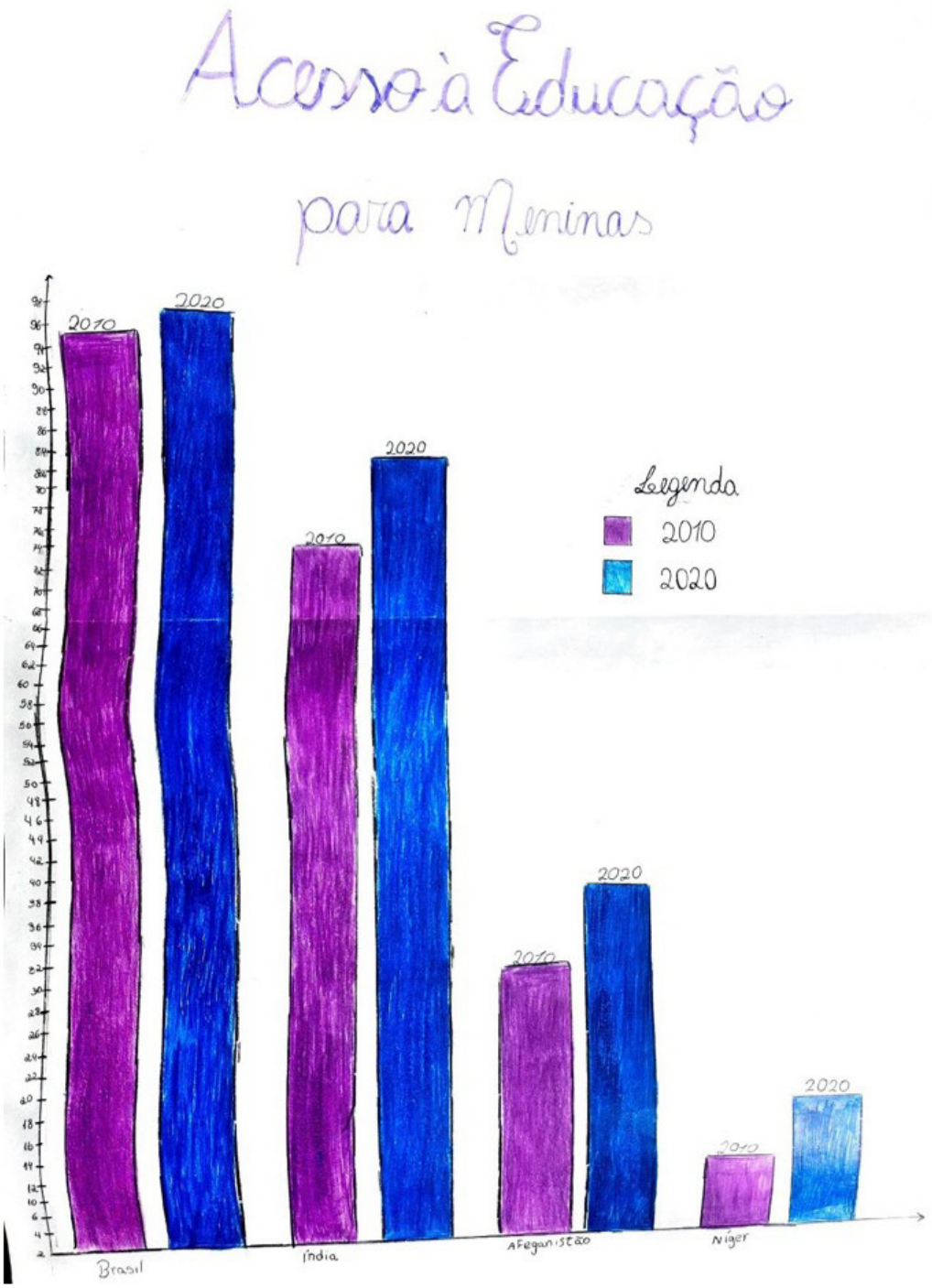

Figure 3. Work on access to education for girls.
Source: Prepared by students (2024).

Violence against women was also widely discussed by the students, who highlighted the importance of teaching respect in schools, creating stricter laws, and strengthening the support network for victims, including shelters and emergency services. In addition, they pointed out that social media can be a powerful tool for combating gender-based violence, with awareness campaigns and social mobilization. During the explanation of their graph, the students stated that it is essential to "show that violence is a serious crime," which reflects their critical understanding of the problem and the need to engage in the fight against this reality.

This perception is in line with Alves (2021), who emphasizes the need for coordinated public policies and educational actions to combat gender violence, as well as with Guimarães and Pedroza (2015), who advocate for broadening the debate on the multiple expressions of this violence. The Figure 4 below, based on official data, allowed students to visualize the frequency, forms, and most common locations of violence against women in Brazil, highlighting the urgency of preventive and educational actions starting in school.

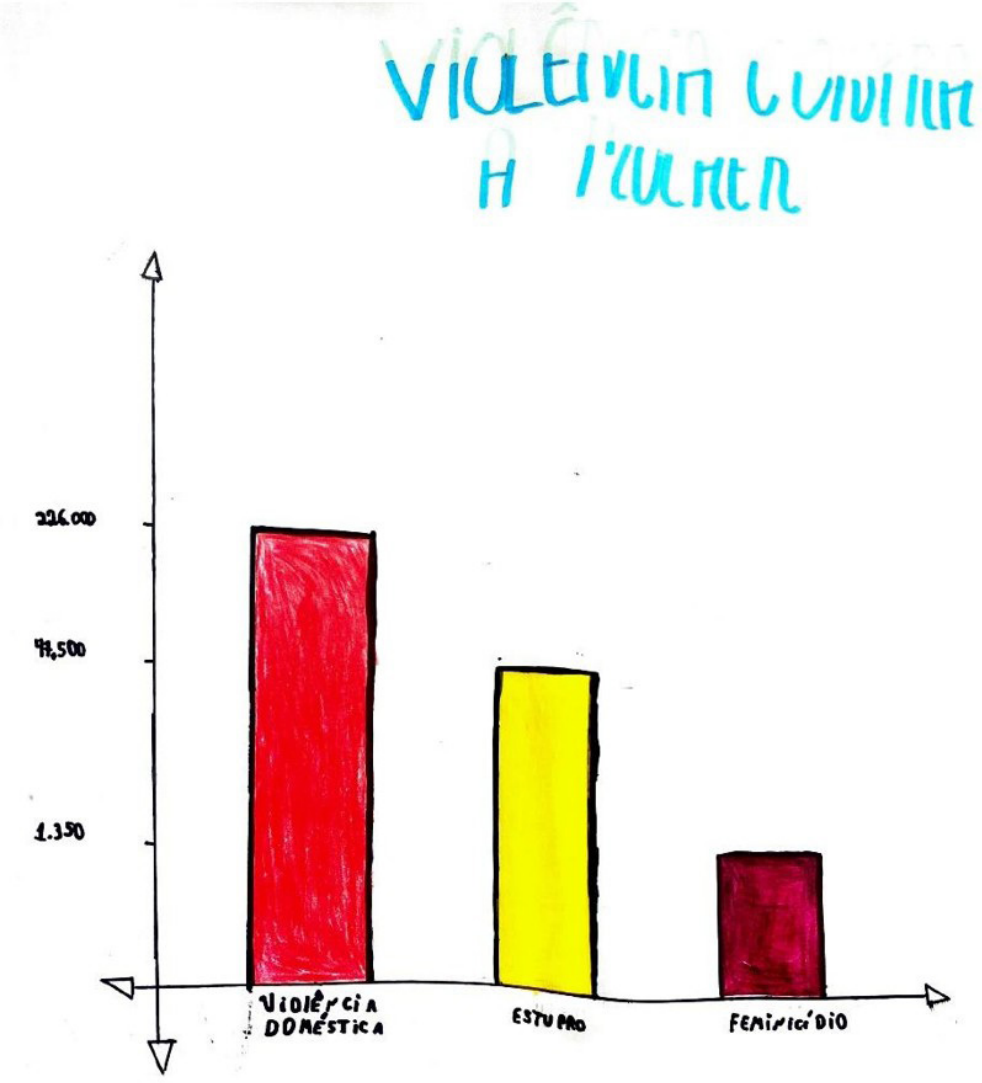

Figure 4. Work on violence against women.
Source: Prepared by students (2024).

In the discussion on female representation in politics, students proposed the implementation of quotas for women in public office, campaigns to encourage female participation, and continuous support for female candidates during elections. As they explained when discussing

the graph they produced, the students defended the importance of "making space for women to participate," which highlights the need to build a more inclusive and equitable political environment. This proposal is in line with the observations of Santos (2021), when discussing the impact of electoral rules and patriarchal political culture on the underrepresentation of women in the Brazilian Congress and analyzing the limits of gender quota laws in achieving equity in candidacies. In addition, the data organized by the students showed that, despite comprising more than half of the Brazilian population, women still occupy a very small portion of elected positions, highlighting the persistence of institutional and symbolic barriers to their participation. Figure 5 illustrates the data collected by the students on the presence of women in the Brazilian political scene.

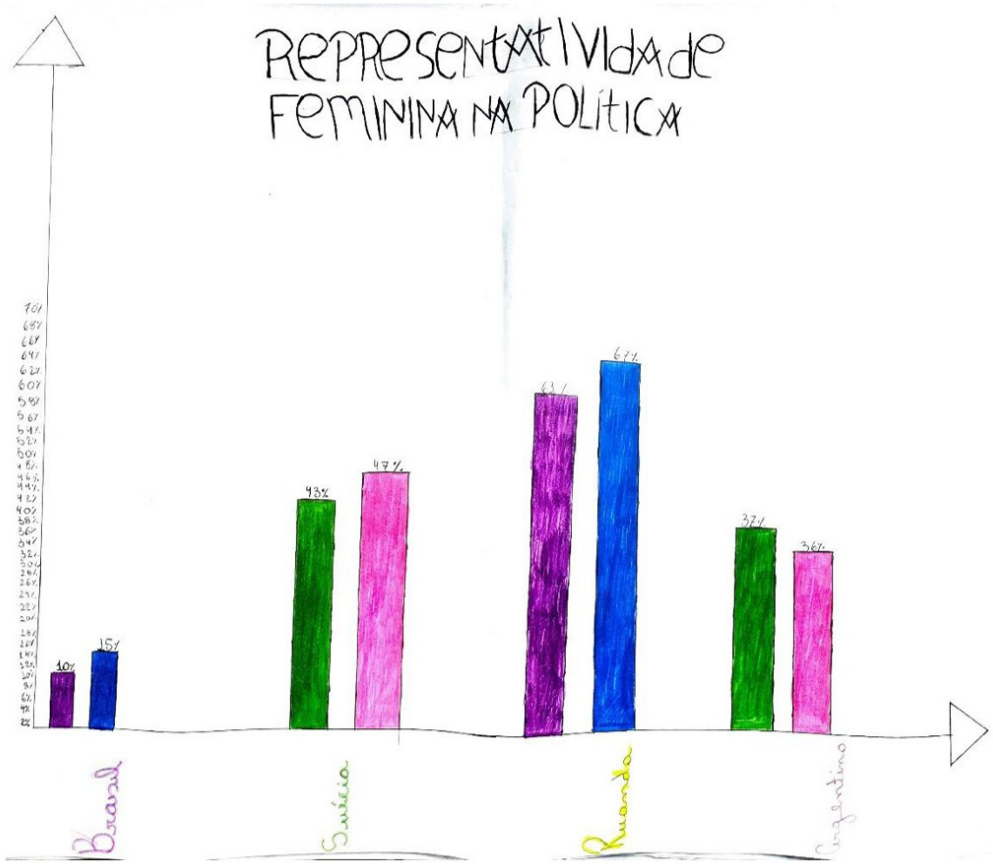

Figure 5. Work on female representation in politics.
Source: Prepared by students (2024).

Finally, the group that addressed female entrepreneurship suggested the creation of courses and workshops aimed at developing entrepreneurial skills for women. In addition, they proposed low-interest credit policies and government incentives to stimulate women-led businesses. They also highlighted the role of companies in establishing partnerships to support women's projects, in order to reduce the barriers faced by women entrepreneurs in the labor market. These contributions are in line with the studies by Brush et al. (2018), which highlight how women face structural barriers in entrepreneurial ecosystems, and by Rodrigues et al. (2021), which identify the critical factors in female entrepreneurship in Brazil, especially in the socio-anthropological and gender-psychological dimensions. The agency of women entrepreneurs, as pointed out by Murphy (2023), is also a form of resistance to gender racism and historical inequalities in economic and social spaces.

The results of the pedagogical experiment showed a high level of involvement and commitment from the students, who perceived mathematics as a powerful language for the critical analysis of social reality. The use of Critical Mathematics Education and Mathematical Modeling proved

to be effective in promoting critical thinking and encouraging active student participation, even in adverse contexts, such as emergency remote teaching. This approach reinforces the importance of rethinking pedagogical practices in mathematics education, incorporating interactive and contextualized methodologies that encourage reflection on inequality, rights, and social justice (Skovsmose, 2014; Roux; Swanson, 2021; Abreu; Macedo; Rossi, 2024).

This experience is linked to an interdisciplinary approach that connects mathematics to a critical reading of the world, supporting the understanding that mathematical content is not limited to rules, formulas, or algorithms, but can function as a tool for social analysis and the transformation of reality (Roux; Swanson, 2021; Skovsmose, 2014). This perspective broadens the scope of school mathematics, assigning it a political and ethical role in the formation of individuals.

FINAL CONSIDERATIONS

The pedagogical experiment demonstrated that integrating mathematics with relevant social issues, such as gender violence, is a powerful strategy for promoting meaningful learning and developing critical thinking skills. By relating the reading and production of graphs to concrete everyday problems, students were invited to think about the structural inequalities present in society, which created conditions for expanding students' sociocultural repertoire and developing argumentation and critical analysis skills, based on the monitoring carried out during classes.

The systematization of the activity carried out through graphs, encouraged moments in which students explored the data, developed new representations, and interpreted the phenomena in more detail. This practice contributed not only to the consolidation of mathematical content, but also to the strengthening of an investigative and ethical stance toward social injustices. Students came to understand that mathematics can be used to investigate and understand different existing social demands.

By analyzing data on wage inequality, political participation, access to education, and violence against women, students linked statistical concepts to social issues. This movement indicated potential for ethical and critical reflections on the phenomena investigated. In this context, the school plays a strategic role in building a more just and egalitarian society. By incorporating interdisciplinary approaches into the curriculum, such as the example discussed in this article, the school environment expands its commitment to social transformation. Mathematics, therefore, is no longer to be a neutral and abstract field and becomes a space for reading the world, capable of mobilizing students to confront inequalities and exercise citizenship.

The consolidation of pedagogical practices of this nature also requires the support of public policies committed to equity and inclusion. Promoting teaching through research, collaborative work, and dialogue between different areas of knowledge is essential for forming autonomous, critical, and participatory individuals, prepared to intervene ethically and in solidarity in the multiple realities in which they are inserted.

Although the reported experience led to advances in the articulation between mathematical content and social issues, it is important to recognize some limitations of the study. As this was a single intervention, carried out with a single class and over a short period of time, it was not possible to monitor long-term developments in the students' critical thinking skills. Furthermore, as this was a pedagogical experiment of limited duration and without the use of formal data collection tools (such as interviews or recordings), the evidence for the analysis is based on teachers' observations and students' work, without extensive transcripts of statements. This methodological choice was made to respect school schedules and the ethical nature of the activity. In addition, involvement with sensitive issues such as gender violence requires continuous preparation from teachers and institutional support, which are not always guaranteed in public schools.

Nevertheless, the experience opens up possibilities for new research and pedagogical practices that broaden the dialogue between mathematics and social issues, to reduce the gaps between the conceptual development of CME and mathematical modeling and their application in schools.

Future studies could explore the application of this approach at different educational levels, compare its effects in urban and rural contexts, or investigate how teacher training can be enhanced to address controversial social issues in the subject teaching. Such paths reinforce the importance of consolidating a mathematics education committed to social justice, gender equality, and citizenship education.

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Authors contribution

RG: Responsible for conceptualizing the study, applying the activity in the classroom (data collection), and constructing the research methodology. Actively participated in data analysis and interpretation, writing the original manuscript, and critically reviewing the text for approval of the final version.

JBOJ and VLGJ: Collaborated in the conceptualization and methodological design of the research, jointly contributed to the analysis and discussion of the results, the writing and critical review of the manuscript, and approved the final version to be submitted.

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