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GENDER INCLUSION IN MATHEMATICS EDUCATION: CHALLENGES AND IMPACTS OF EDUCATIONAL POLICIES IN THE STATE OF CEARÁ IN THE TWENTY-FIRST CENTURY

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ABSTRACT

This paper investigates the implementation of educational policies in schools in Ceará and its effects on the promotion of gender equity in mathematics teaching, focusing on contemporary impacts and challenges. The research, of a qualitative nature, used documentary and content analysis, when scrutinizing Pedagogical Political Projects (PPP) of mathematics classes in public schools. The objective was to evaluate the presence and approach of gender issues in school curricula. The theoretical foundation included studies on Gender and Education and research on the training of Mathematics teachers. The results show that, despite some inclusive initiatives, the treatment of gender issues is superficial, without deep discussions about reducing the disparities between men and women. It is concluded that greater integration of gender policies in teacher training curricula is needed, highlighting the challenges of awareness and training to deal with these inequities in the educational environment.

Keywords: Diversity. Mathematics Education. Equity. Gender. Inclusion.

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INTRODUCTION

Gender inclusion policies in education have gained prominence in recent decades, emerging as a response to the need to promote equity and diversity in educational environments. According to this, the origin of this movement dates back to the 1970s, with the growing awareness of gender inequities, which were reflected in various social spheres, including education (COUY; GAZIRE, 2024). In this way, these policies seek to ensure that all existences are properly recognized, as provided for in the constitution, without gender or any other sphere, thus being able to promote an education that not only recognizes, but also values diversity.

In the Brazilian context, Couy and Gazire (2024) address that mathematics education is an area that still faces significant challenges related to gender inclusion. Thus, despite advances in educational guidelines, pedagogical practices often do not reflect the urgency of the theme. For example, teacher training curricula often lack a critical approach that dialogues with gender inequities, resulting in training that can perpetuate stereotypes and discrimination.

In view of the above, the problem of this research lies in the superficiality with which intersectional issues to gender are treated in mathematics curricula in schools in Ceará. Thus, despite the existence of educational policies that promote inclusion, the lack of discussions on reducing gender disparities indicates a significant gap in pedagogical practices.

In this sense, the rationale for this research is clear: understanding how gender inclusion policies are being implemented is crucial for strengthening teaching that is truly inclusive. In this way, this understanding will allow not only a critical reflection on current practices, but also the proposition of improvements that can effectively promote gender equality in mathematics teaching.

Still, the relevance of this study is due to the urgency of transforming mathematics education into a space of inclusion, in which all existential narratives are considered. In addition, the research seeks to contribute to the strengthening of educational policies, proposing a critical look at teacher training and pedagogical practice. In view of this, the research aims to evaluate the implementation of gender inclusion policies in mathematics education in schools in Ceará, analyzing its impacts and challenges.

Thus, the methodological path adopted is qualitative, using documentary and content analysis to examine the PPPs of mathematics classes in public schools. From this

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perspective, the theoretical foundation is based on studies on Gender and Education, as well as on research focused on the training of Mathematics teachers.

Thus, the structure of the work is organized into chapters that include: a review of the literature on gender and mathematics education, the research methodology, the analysis and discussion of the collected data and the final considerations, which summarize the findings and propose recommendations for future educational practices.

GENDER AND MATHEMATICS EDUCATION: HISTORICAL AND THEORETICAL PERSPECTIVES

The historical evolution of mathematics education with a gender focus refers to the process by which mathematics, as a school subject, has been accessed differently between genders over time (SOUZA; MARIA DA CONCEIÇÃO, 2024). This focus implies analyzing how opportunities and expectations regarding mathematics learning have varied for boys and girls, influencing their academic and professional trajectories. That said, it is appropriate to understand that the ramifications of gender inequities can be identified in the establishment of a social gender filter, responsible for a kind of pedagogy of violence, which defines which areas of education should be accessed — or not — by boys or girls.

Thus, the present production aims to stimulate the discussion about the teaching-learning process of mathematical knowledge and, above all, to rethink the strategies that have been used, as they can be identified as real or fictitious facilitators. Thus, the origin of this discussion dates back to the nineteenth century, when educational institutions began to expand and mathematics was formally introduced into the school curriculum (SOUZA; MARIA DA CONCEIÇÃO, 2024). Initially, access to education, including mathematics, was restricted, and girls were often excluded from areas considered "masculine", such as mathematics and science. In view of this, again, identify the presence of a gender filter that has acted as a construct for the maintenance of timeless gender violence present in different social relations.

Historically, changes in educational and social policies throughout the twentieth century, especially with feminist movements, boosted the inclusion of girls in mathematics education (SOUZA; MARIA DA CONCEIÇÃO, 2024). In the 1970s and 1980s, studies began to highlight gender disparities in education, leading to a greater focus on policies that promote gender equity in schools. In Ceará, educational policies in the twenty-first century have sought to promote gender equality in mathematics education (CONCEIÇÃO,

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2024). This occurs in a scenario where, despite the initiatives, stereotypes and prejudices still persist that affect the perception and performance of girls and boys in mathematics, influencing their future choices.

Examples of historical evolution can be seen in the introduction of programs to encourage girls' participation in mathematics competitions and in curriculum reforms that include a more inclusive approach, aiming to reduce gender disparity (CONCEIÇÃO, 2024). In addition, teacher training initiatives have sought to sensitize them about the importance of promoting gender equality in their classrooms. In this way, feminist theories in the context of mathematics education examine how gender relations affect mathematical learning and practice (CONCEIÇÃO, 2024; SOUZA; MARIA DA CONCEIÇÃO, 2024). These theories address issues of power, identity, and the social construction of genders, seeking to understand how these factors influence girls' participation and performance in mathematics.

In this vein, the origin of feminist theories dates back to the feminist movement of the twentieth century, which began to question and challenge the social norms and power structures that marginalized women. Feminist theories in the field of education emerged from these reflections, focusing on the need to review educational practices to make them more just and equitable (CONCEIÇÃO, 2024; SOUZA & MARIA DA CONCEIÇÃO, 2024). The historical and theoretical path of feminist theories in mathematics education includes criticism of the traditional curriculum that often excludes or disregards the contributions of women in mathematics and science (CONCEIÇÃO, 2024; SOUZA & MARIA DA CONCEIÇÃO, 2024). This movement has gained strength in recent decades, promoting a reevaluation of teaching methodologies and didactic material.

Currently, the theme of gender inclusion in mathematics education is especially relevant in the context of Ceará, where educational policies seek not only equity of access, but also the transformation of pedagogical practices (CONCEIÇÃO, 2024; SOUZA; MARIA DA CONCEIÇÃO, 2024). This involves critical reflection on how feminist theories can be applied to improve girls' learning experience in mathematics. Examples include the implementation of pedagogical approaches that incorporate a gender perspective, such as the use of materials that highlight the contributions of female mathematicians, as well as initiatives that encourage the active participation of girls in math classes, such as math clubs aimed at the female audience.

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Gender stereotypes in mathematical disciplines refer to prejudiced beliefs that associate mathematical competence with the male gender, leading to the assumption that boys are naturally better at mathematics than girls (BATISTA; SAINTS; MELO, 2024). These stereotypes can influence both educators' expectations and students' self-confidence. Thus, the origin of these stereotypes can be traced back to cultural and social traditions that have historically relegated women to secondary roles in the areas of science and mathematics (BATISTA; SAINTS; MELO, 2024). These stereotypes have been perpetuated by media representations and family structure that often does not encourage girls to pursue careers in technical fields.

From this perspective, the historical course demonstrates that, over the centuries, women have often been excluded from educational opportunities in mathematics, which has contributed to the perpetuation of negative stereotypes (BATISTA; SAINTS; MELO, 2024). In summary, it is also possible to understand the existence of a hierarchy between the areas of knowledge, while the more masculinized ones occupy greater social recognition, especially when they are not committed to the diversity of the public that accesses them. In recent years, however, studies have highlighted the importance of deconstructing these stereotypes to improve girls' participation in mathematical subjects.

In Ceará, the presence of these stereotypes in schools is still a significant challenge, with many students feeling that they are not good enough at mathematics, which affects their performance and interest in the subject (BATISTA; SAINTS; MELO, 2024). This requires educators and policymakers to work together to create a learning environment that minimizes these stereotypes and that allows self-efficacy or school failure to result from actual pedagogical difficulties.

For example, the implementation of awareness programs for teachers that address the deconstruction of gender stereotypes and the creation of more inclusive learning environments (BATISTA; SAINTS; MELO, 2024). In addition, extracurricular activities that challenge these stereotypes, such as mixed math competitions, can help foster a culture of inclusion and equity. Also, initiatives such as those mentioned configure the implementation of an emancipatory education that is organized in such a way that it has resources to meet socially rooted violence.

Also, the representation of gender in mathematics teaching materials refers to how genres are portrayed and included in books, exercises and educational resources (BATISTA; SAINTS; MELO, 2024). The way boys and girls are represented can influence

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their identities and their perceptions of their mathematical abilities. The origin of this problem can be traced back to the historical development of teaching materials that often marginalize or stereotype women, presenting them in roles that reinforce traditional gender norms (BATISTA; SAINTS; MELO, 2024). This results in a lack of positive female role models in mathematics, which can impact female students' interest and motivation.

Likewise, the historical course shows that, until the second half of the twentieth century, most teaching materials were prepared without considering gender issues. With the advancement of gender studies, there has been a growing movement to review and update these materials, but many still remain contaminated by stereotypes (BATISTA; SAINTS; MELO, 2024). In Ceará, the need for a critical review of mathematics teaching materials is evident. Educational policies have encouraged the inclusion of more equitable representations, but practice often fails to reflect these changes, resulting in materials that still perpetuate gender inequities (BATISTA; SAINTS; MELO, 2024).

Examples include the analysis of textbooks that depict boys in challenging mathematical activities, while girls are presented in less active contexts (BATISTA; SAINTS; MELO, 2024). Revising these materials to include female figures in prominent roles in mathematics and science is an important step in promoting gender equality. The influence of culture on mathematics and gender education refers to the role that cultural norms and values play in shaping attitudes and expectations regarding mathematics learning among different genders (ZANON; INÁCIO, 2024). This includes how culture shapes the perception of boys' and girls' mathematical abilities.

Furthermore, the origin of this cultural influence can be seen in societies that traditionally attribute different roles to men and women, influencing educational opportunities and self-confidence in mathematical skills since childhood (ZANON; INÁCIO, 2024). These cultural norms often manifest themselves in attitudes that discourage girls from excelling in math. The historical path indicates that, in many cultures, mathematics has been seen as a male activity, which has led to an underrepresentation of women in fields related to mathematics and science (ZANON; INÁCIO, 2024). However, growing awareness of gender equity has challenged these norms and encouraged cultural shifts.

In Ceará, local culture can influence mathematics education in a significant way, with gender stereotypes rooted in traditions that affect girls' participation (ZANON; INÁCIO, 2024). Cultural initiatives that promote gender equity in education are key to combating these negative influences. For example, the implementation of programs that address

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gender culture in schools, encouraging discussions on the role of women in mathematics and promoting events that highlight the contribution of women in the sciences (ZANON; INÁCIO, 2024). These initiatives help to challenge harmful cultural norms and encourage girls' participation in mathematics.

GENDER INCLUSION POLICIES IN MATHEMATICS TEACHING

National legislation and guidelines on gender inclusion are legal norms and educational guidelines that seek to ensure gender equality at all levels of education, with a special focus on combating gender discrimination (FREIRES *et al*., 2024). They aim to promote an inclusive educational environment where everyone, regardless of their gender, can have equal access to learning opportunities and academic development. Thus, these legislations have their origins in international movements for human rights and gender equality, such as the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), adopted by the UN in 1979, and Sustainable Development Goal (SDG) No. 5, which deals with gender equality. In Brazil, the 1988 Constitution and the Law of Guidelines and Bases of National Education (LDB, 1996) incorporate principles of gender equality in the educational context (FREIRES *et al*., 2024).

Historically, the feminist movement and gender studies began to influence public policies in education from the 1960s and 1970s. In Brazil, legislation on gender inclusion gained strength with the World Conference on Education for All (1990) and the Beijing Conference (1995). These academic and theoretical discussions have underpinned the creation of inclusive policies in education, including mathematics, a discipline historically marked by gender disparities (FREIRES *et al*., 2024). In the Brazilian educational context, gender inclusion guidelines seek to combat stereotypes that associate mathematical skills exclusively with men, encouraging the presence and success of girls and women in this area (NASCIMENTO, 2024; FOSTER; BOILER; SOUZA, 2024). Policies such as the National Education Plan (PNE) establish goals to reduce inequalities and ensure that the school environment is a space for equal development for all genders.

In this way, the National Common Curriculum Base (BNCC), approved in 2017, is an example of how Brazilian legislation seeks gender inclusion by providing for equity in the development of mathematical skills (NASCIMENTO, 2024; FOSTER; BOILER; SOUZA, 2024). Programs such as "*Girls in the Exact Sciences*", from the Ministry of Education, also exemplify initiatives that encourage the participation of women in mathematics and exact

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sciences, promoting a more inclusive environment. Therefore, government programs and initiatives for gender inclusion are strategic actions promoted by public agencies with the objective of reducing gender disparities in the educational field (NASCIMENTO, 2024; FOSTER; BOILER; SOUZA, 2024). These programs aim to encourage the participation of women in subjects such as mathematics, where female representation is traditionally lower.

Consequently, the origin of these programs is linked to public policies for social and educational inclusion, influenced by international treaties and commitments, such as the Millennium Development Goals (MDGs) and, later, the UN SDGs (NASCIMENTO, 2024; FOSTER; BOILER; SOUZA, 2024). In Brazil, these initiatives began to gain strength after 1990, with the implementation of policies aimed at educational equity and the inclusion of minorities in school spaces.

Furthermore, the development of programs for gender inclusion is rooted in feminist theories of education, which point to gender inequality as a historical factor that limits women's access to areas such as the exact sciences (NASCIMENTO, 2024; FOSTER; BOILER; SOUZA, 2024). Since the 2000s, Brazil has adopted programs such as ProUni and quota policies, which, although focused on social inclusion, also influence gender equality in universities. In Ceará, gender inclusion programs seek to overcome cultural and social barriers that still limit the presence of women in fields such as mathematics (LUSTOSA, 2009; SOUZA, 2023). Thus, initiatives such as "*Ceará Científico*" and support for robotics and technology projects have been fundamental to encourage the participation of girls in these areas, promoting the development of a more equitable education.

For example, the "*Olympic Girls*" program, which encourages female participation in math and science Olympiads, and the creation of specific study groups for women in technology areas, such as the "*Women in Exact Sciences*" project at the Federal University of Ceará (UFC), which aims to integrate more women into the field of mathematics (LUSTOSA, 2009; SOUZA, 2023). Furthermore, the role of schools and educators in the implementation of gender inclusion policies is to ensure that the guidelines established by the government are put into practice in daily school life (FREIRES *et al*., 2023). This includes promoting an educational environment free of bias, developing inclusive pedagogical practices, and combating gender stereotypes within the classroom.

The emphasis on the responsibility of educators comes from critical pedagogy, initiated by Paulo Freire, who argues that education should be a means of social transformation (PONTES, 2021). The school, as a space for integral education, is seen as

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essential for the deconstruction of gender prejudices and the promotion of equity. Throughout history, critical pedagogy and gender studies have come to influence educational practices. Since the 1980s, there has been a growing effort for schools to be places to combat gender discrimination. Contemporary theories of inclusive education argue that educators play a crucial role in the implementation of these policies, being mediators of changes in social mentalities and practices (PONTES, 2021).

In Ceará, the role of educators is even more significant, as it is often up to them to adapt government guidelines to the local context. Therefore, the state, which has been promoting gender inclusion in its educational system, depends on the training of teachers and the commitment of schools so that these policies are implemented in practice (LUSTOSA, 2009; SOUZA, 2023). And also, schools that adopt gender inclusion projects, such as activities aimed at inclusive mathematics, have shown positive results. An example of this is the "Mathematics for All" project, which encourages the participation of girls and boys equally, using methodologies that break gender stereotypes related to academic performance (LUSTOSA, 2009; SOUZA, 2023).

Furthermore, the evaluation of gender inclusion policies is the process of critical and systematic analysis that aims to measure the effectiveness of these policies in the educational environment (GALVÃO *et al., 2021). This includes monitoring results, identifying points for improvement, and ensuring that the actions implemented are truly promoting gender equality in schools. That said, the practice of public policy evaluation has its roots in the field of public administration and educational management theory. In recent decades, it has become common to evaluate policies from a gender perspective, especially after advances in international and national legislation aimed at women's rights and the inclusion of minorities (GALVÃO et al., 2021).*

In the 1980s and 1990s, the evaluation of these actions became crucial to ensure that the established goals were met. Several theoretical studies defend continuous evaluation as a way to adapt policies to local realities, ensuring that the planned actions do not remain only on paper (GALVÃO *et al., 2021). In Ceará, the evaluation of gender inclusion policies in mathematics education is essential to ensure that federal guidelines are effectively implemented and that there are no gaps in the equitable access of boys and girls to this subject. For example, evaluation in practice can be observed in the periodic review of programs such as "Girls in the Exact Sciences*", which uses data on female participation in mathematical Olympiads to adjust its strategies. Thus, evaluations such as

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this allow for continuous adjustments and ensure that inclusion goals are achieved effectively (GUSE; WAISE; ESQUINCALHA, 2020).

So, teacher training in gender and mathematics refers to the continuous training of teachers so that they can deal with gender issues within the classroom, especially in the teaching of mathematics (RABELO, 2023). This type of training seeks to sensitize educators to gender disparities and empower them to promote a more inclusive and equitable approach to mathematics education. Thus, gender-focused teacher training emerged as part of the educational reforms driven by the feminist and human rights movements, which, from the 1970s onwards, began to criticize gender disparities in the school environment (RABELO, 2023). In Brazil, the 1996 Law of Guidelines and Bases of National Education (LDB) was an important milestone in integrating teacher training as a priority for inclusive education.

Therefore, the theoretical debate on the need for teacher training in gender began with the recognition that the school is a space for the reproduction of social stereotypes (TORRES; CARRIL, 2021; PEAR TREE; TITO, 2024). Authors such as Paulo Freire and Bell Hooks argue that education needs to be critical and transformative, and teacher training in gender is part of this perspective. Historically, public policies have begun to require teacher training to include topics such as gender equity, in order to combat discriminatory practices (RABELO, 2023).

In Ceará, teacher training in gender has proven to be essential to ensure that inclusion policies in mathematics teaching are successful. Teachers need to be prepared to identify and combat stereotypes that may hinder girls' performance, as well as to create a learning environment that favors gender equity (RABELO, 2023). In this way, programs such as "*Continuing Education of Teachers for Gender Equality*" are examples of how the state government has invested in the qualification of educators (RABELO, 2023). In addition, initiatives such as workshops and seminars focused on gender inequality in science and mathematics teaching have shown a positive impact on reducing disparities within schools.

CURRICULUM, EDUCATIONAL PRACTICES AND PSYCHOSOCIAL FACTORS

The analysis of the mathematics curriculum from a gender perspective refers to the critical evaluation of educational contents, approaches, and practices that may, intentionally or not, perpetuate gender disparities in the discipline (FREIRES *et al*., 2024., FONSECA;

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BOILER; SOUZA, 2022). This analysis aims to identify possible barriers that influence the performance and participation of students of different genders in mathematics.

Thus, the idea of analyzing curricula from a gender perspective arises from the feminist movement and critical education in the twentieth century, which highlighted the importance of reviewing educational materials to combat the perpetuation of stereotypes and promote gender equality. From this perspective, the analysis of gender in the curriculum has its roots in feminist studies in the 1970s and 1980s, when scholars began to observe how science and mathematics curricula reinforced gender stereotypes (FONSECA; BOILER; SOUZA, 2022). Over the decades, this approach has broadened, also considering intersectionalities such as race and class.

In Ceará, from the twenty-first century onwards, educational policies began to include guidelines for gender equality. However, there are still challenges in revising the mathematics curriculum so that it becomes truly inclusive and sensitive to gender differences, as the evaluation of how textbooks represent women mathematicians or how certain topics are addressed in a way that discourages girls from pursuing careers in exact fields. (FONSECA; BOILER; SOUZA, 2022).

In this sense, inclusive teaching methodologies for all genders are pedagogical approaches that ensure the equitable participation of students of all genders in the learning process, promoting an environment of respect and recognition of differences (FONSECA; BOILER; SOUZA, 2022). Thus, the concept of inclusive teaching is based on multicultural and critical education, which emerged as a response to exclusions and discrepancies in traditional classrooms, with an initial focus on racial issues and which later included gender and other forms of diversity.

Since 1990, the inclusion of gender in teaching methodologies has been strongly influenced by feminist and pedagogical theories that argue the importance of adapting teaching practices to be sensitive to gender experiences and expectations (FONSECA; BOILER; SOUZA, 2022). In the context of Ceará, inclusive methodologies still face challenges to be fully consolidated. Specific initiatives have promoted workshops and continuing education for teachers with the aim of creating more inclusive environments in mathematics subjects. For example, the adoption of methodologies such as collaborative learning, which encourages both boys and girls to actively participate in activities, avoiding the segregation of tasks based on gender stereotypes.

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Furthermore, psychosocial factors are elements of the social and psychological environment that influence how individuals perceive and engage with mathematics. They include social expectations, beliefs about skills, and gender stereotypes (FONSECA; BOILER; SOUZA, 2022). The study of psychosocial factors in education has its roots in educational and social psychology, with theorists such as Albert Bandura and Lev Vygotsky looking at how the social environment and interactions shape learning and behavior.

From the 1980s and 1990s, studies began to focus specifically on how gender stereotypes affect girls' self-esteem and performance in mathematics, showing that limiting beliefs and social expectations can discourage female participation in the areas of exact sciences (FONSECA; BOILER; SOUZA, 2022). In Ceará, differences in participation according to gender are observed in several disciplines, especially in mathematics, where girls are often discouraged due to stereotypes that associate mathematical success with masculine characteristics. For example, the so-called "*stereotype threat effect*", in which girls who are exposed to messages that suggest that "girls are not good at math" tend to perform lower than boys.

Furthermore, the influence of the school environment on mathematical learning refers to the impact that culture, pedagogical practices and social relations within the school have on students' performance and motivation in mathematics (FONSECA; BOILER; SOUZA, 2022). Therefore, the notion that the school environment influences learning goes back to theorists such as John Dewey, who argued that education is profoundly affected by the social and cultural experiences lived within the school. Since the twentieth century, studies on the sociology of education and educational psychology have shown that the school environment, including the support of teachers and the quality of interactions with colleagues, is a determining factor in student success.

In Ceará, public schools face challenges in creating environments favorable to mathematical learning, with a lack of resources and, sometimes, inadequate pedagogical practices. This context can reinforce gender disparities and hinder inclusion (FONSECA; BOILER; SOUZA, 2022). Thus, a school environment that promotes excessive competition can discourage girls from participating in mathematics classes, while schools that promote cooperation and mutual support can improve the performance of all students, regardless of gender.

Thus, interpersonal relationships in the school environment, especially between teachers and students, as well as between colleagues, play a central role in academic

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performance, affecting confidence, motivation and emotional support during mathematics learning (FONSECA; BOILER; SOUZA, 2022). In this way, the importance of interpersonal relationships in learning was initially studied by psychologists such as Carl Rogers and Lev Vygotsky, who highlighted how social interaction and emotional support are fundamental for cognitive development and academic success.

In the twentieth century, interpersonal relationships gained prominence in the theories of cooperative learning and social constructivism, which argue that learning occurs in social contexts and depends on the quality of interpersonal interactions. In Ceará, the role of interpersonal relationships in mathematics teaching is recognized, but often neglected in everyday practices. Teachers with greater sensitivity and preparation to deal with students in an inclusive way tend to get better results from their students. Thus, a teacher who establishes a relationship of trust with his students can help reduce the anxiety incited by the mathematical content and increase their interest in continuing their studies in the area.

IMPACTS AND FUTURE CHALLENGES IN PROMOTING GENDER EQUALITY IN MATHEMATICS

Gender equity in mathematics refers to the fair treatment of students of different genders in the teaching and learning of this discipline (BATISTA; SAINTS; MELO, 2024). In this way, equity implies that all people, regardless of gender, have access to quality mathematics education, without prejudice or structural barriers. In this way, the search for gender equality in education began to intensify from the 1970s and 1980s, influenced by feminist movements that questioned structural discrimination in educational institutions (BATISTA; SAINTS; MELO, 2024). In Brazil, public policies for gender inclusion gained more attention with the enactment of the 1988 Constitution, which established equal rights between men and women, including access to education.

Historically, mathematics education has been associated with a gender view, where men were seen as more apt for exact areas. With the development of feminist and educational theories, a critique of this gender segregation emerged, in which researchers began to investigate how pedagogical practices, curricula, and social expectations contributed to gender disparities in mathematics (BATISTA; SAINTS; MELO, 2024). In Ceará, gender equality in mathematics is an emerging issue that challenges schools and public policies. Despite the advances, girls still face barriers such as gender stereotypes,

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which negatively influence their performance and interest in mathematics, especially in areas of high complexity.

In this sense, recent studies show that, in math olympiads and in assessments such as the SAEB, boys tend to obtain better results in mathematics. However, these results are more related to social and cultural factors than to cognitive differences, evidencing the importance of promoting gender equality in the teaching of the discipline (BATISTA; SAINTS; MELO, 2024). The challenges in promoting gender equity in mathematics involve obstacles that hinder the full access and participation of all genders in mathematical activities, such as prejudices, stereotypes and lack of effective educational policies.

Moreover, these challenges have deep roots in historical and social constructions that, for a long time, relegated girls and women to areas considered "less technical". Gender segregation in certain professions and the low representation of women in the exact sciences are reflections of a historical heritage that persists to this day (BATISTA; SAINTS; MELO, 2024). Over the past few decades, educational theories based on feminism and gender studies have addressed these challenges. Researcher Jo Boaler, for example, argues that traditional mathematics teaching practices contribute to marginalizing girls and minorities, suggesting new pedagogical approaches that value collaboration and creative problem-solving (BATISTA; SAINTS; MELO, 2024).

In Ceará, these challenges are evident in schools in urban and rural areas. Public policies have advanced, but stereotypes and the lack of encouragement for girls in areas such as mathematics still need to be faced in a more systematic way (BATISTA; SAINTS; MELO, 2024). For example, teacher training is focused on inclusive practices. Programs such as "*Girls in Science*," which aim to encourage young people to pursue scientific careers, face cultural and institutional resistance.

Therefore, the influence of digital technologies in mathematics education refers to the use of technological tools to facilitate the learning of mathematics, providing new teaching methods that can be more inclusive and equitable for different groups of students (BATISTA; SAINTS; MELO, 2024). The use of digital technologies in mathematics teaching gained strength with the development of computers and educational software, especially from the 1990s onwards, when schools began to incorporate these tools into the curriculum. In Brazil, programs such as *PROINFO*, aimed at digital inclusion in public schools, have expanded access to these technologies. Based on the constructivist learning theories of Piaget and Vygotsky, digital technologies began to be seen as ways to mediate

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knowledge and provide more active and participatory learning. For gender equality, the use of these technologies can help break down barriers, offering more autonomy and personalization in learning (BATISTA; SAINTS; MELO, 2024).

In Ceará, digital technologies are being progressively implemented in public schools, but with challenges in terms of infrastructure and teacher training (Batista., Santos & Melo, 2024). The COVID-19 pandemic has accelerated the use of educational technologies, but it has also highlighted gender disparities, where girls often have less access to digital resources in their homes. Tools such as educational games, online learning platforms, and math simulators allow girls to explore mathematics in a more interactive way. However, the lack of access to *the internet* and equipment in poorer areas of Ceará is still a significant obstacle to digital inclusion (BATISTA; SAINTS; MELO, 2024). Educational paradigm shifting refers to the transformation of traditional conceptions of teaching and learning, adapting the education system to be more inclusive, equitable, and responsive to the needs of all learners, regardless of gender.

Still, the need to change educational paradigms began to gain strength in the twentieth century with the development of critical educational theories, such as Paulo Freire's pedagogy, which defends a liberating education, focused on equity and social justice. The traditional teaching paradigm, centered on the teacher and on the content, has been questioned by progressive approaches that defend an education focused on the development of critical thinking and inclusion (BATISTA; SAINTS; MELO, 2024). Gender equity is a central aspect in this transformation, as a more diverse and inclusive curriculum is sought. In Ceará, the change in educational paradigms is seen as essential to address gender disparities in disciplines such as mathematics (BATISTA; SAINTS; MELO, 2024). Continuing education programs for teachers are being reformulated to incorporate pedagogical practices that promote gender equality.

Projects such as the reformulation of the curriculum of the state public school system to include issues of gender, diversity and inclusion in mathematics classes are examples of paradigm shifts that are being implemented in Ceará. Communities and families play a crucial role in promoting gender equity in education, being responsible for supporting academic development and ensuring that girls and boys have the same opportunities for learning and success (BATISTA; SAINTS; MELO, 2024). The involvement of families in children's education has always been recognized as a key factor for school success, but the discussion about their role in promoting gender equality has gained

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strength with the broadening of the debate on the social and cultural influence on academic performance, especially from the studies of sociology of education.

Thus, research in education has shown that family expectations and attitudes towards girls and boys directly influence their academic and professional choices. Theories such as Bronfenbrenner's highlight the importance of macrosocial contexts, such as the family, in the formation of children and in the reproduction of gender inequities. In Ceará, families often reproduce gender stereotypes that limit girls' educational aspirations. The school, therefore, needs to work with the community to deconstruct these perceptions and encourage girls' participation in subjects such as mathematics. Community projects that involve families in promoting science and mathematics education for girls, such as science fairs and lectures, have shown success in challenging gender stereotypes and increasing girls' confidence in their mathematical abilities.

METHODOLOGY

To achieve the proposed objective, a qualitative research was conducted. Procedures related to the modalities of documentary and content analysis were employed, focusing on the study of the Political-Pedagogical Projects (PPP) of mathematics classes in public schools in the state of Ceará. According to Lüdke and André (2005),

> Although little explored not only in the area of education but also in other areas of social action, document analysis can be a valuable technique for approaching qualitative data, either complementing the information obtained by other techniques, or unveiling new aspects of a theme or problem (Lüdke; André, 2005, p. 38).

According to its general purposes, the research is also characterized as exploratory, since a study of documents and other references was carried out in order to deepen the knowledge about the object of study. Given that, in the analysis of the documents, it was necessary to identify, analyze, classify and interpret the data, the approach adopted is also characterized as descriptive. A total of 15 PPPs were analyzed in 15 public schools in the state of Ceará (CE), whose PPPs were made available by the Municipal Secretariats of Education (SME) of the state of Ceará that were (re)formulated in accordance with Resolution CNE/CEB 7/2010.

In the state, several educational institutions were proven, but the research took place in 15 mathematics classes in public schools, distributed among 11 institutions. In three of these institutions, two classes were evaluated, and in two of them different PPPs

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were identified for each class. In the third, only one of the PPPs was available. The PPP of one of the schools was not located either on the website of the Municipal Department of Education, or on the school's official page, which is why it was not included in the corpus of the research.

Content Analysis was used for the study of the PPC, conceptualized by Bardin (2016, p. 48) as

> a set of communication analysis techniques aimed at obtaining, through systematic and objective procedures for describing the content of messages, indicators (quantitative or not) that allow the inference of knowledge related to the conditions of production/reception (inferred variables) of these messages.

The phases of Content Analysis proposed by the author are: pre-analysis, exploration of the material and data treatment (inference and interpretation). The pre-analysis involves the organization of the study and is divided into four stages: floating reading, selection of documents, formulation of hypotheses and objectives, and, finally, the referencing of the indexes and elaboration of the indicators. In the second phase, the material is explored, with the categorization and identification of the registration units in the documents, aiming at categorization and counting of frequency and context, to better understand these units. The third stage, which covers the treatment of the results, inference and interpretation, represents the moment of critical and reflective analysis.

To carry out this work, in the pre-analysis phase, a reading of all the PPPs that made up the corpus of the research was made, available in digital copies, with the objective of highlighting discussions or actions related to the theme. After that, the next step consisted of checking the syllabi of the curricular components and the teachers' lesson plans, seeking to identify if there were discussions about equal rights and opportunities between men and women, which was not confirmed. Thus, a search for terms/expressions referring to gender relations was carried out, exploring the contents of the curricular components, especially those of a mandatory nature.

In the next stage, which involved the exploration of the material, a spreadsheet was prepared to organize the main information about the PPPs that addressed, in some way, the theme of gender relations, ensuring that the meaning was aligned with the meaning discussed in this text. In the third and last phase, referring to the treatment of the results, inference and interpretation, from the initial survey, the information available in the PPPs (identification of the school, diagnosis of the school's reality, didactic-pedagogical

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principles, planning of the school's actions, teaching and evaluation methods, mission, values, philosophy and identity of the school and the school's pedagogical proposal) were verified. organizing boards based on these categories for easy analysis. This made it possible to make the inference and interpretation of the results.

RESULTS AND DISCUSSIONS

The information provided in this paper indicates that gender stereotypes are configured as tools that reinforce the continuity of discriminatory actions in the educational system, specifically with regard to the transmission of mathematical knowledge in an equitable way, such as a constitutional right that is – or should be.

It is noteworthy that it should be understood that the development of mathematical skills is not defined by cognitive differences between genders, since education, as a social instrument, is a phenomenon that aims at the exercise of citizenship and, therefore, should be understood as agender. Thus, it is perceived that the roles socially attributed to each gender have actively contributed to new modalities of gender violence, even though they are being interpreted and named – via attenuation – as school failure.

The results shared here are in line with the studies by Gomes et al. (2023), as they conceptualize violence at school and violence at school, respectively, as the development of violent acts within the school environment and also the occurrence of behaviors by school representatives that result in direct or indirect harm to the student. The discrepancies present in the transmission of mathematical knowledge to both genders should be understood as a kind of existential damage, which takes away from girls the opportunity to perform in areas read, in a prejudiced way, as masculine. In this sense, the difficulty imposed in the transmission of mathematical knowledge is incongruous with the objectives and principles of teaching itself. Thus, it is valuable to rescue, whenever possible, the scientific rigor behind this knowledge, which should not be entangled with social perceptions, especially those that are at odds with Human Rights.

Ahead, Gomes (2024) describes violence as a pedagogical movement that violates female people only because of the gender they belong to, thus defining it as a permanent condition, because they are violated by an aspect – gender – that they cannot change without it being their own desire. This is a result that dialogues with the problem accentuated in the current research, since it denounces the superficiality with which intersectional themes to gender are addressed in the mathematics curricula in schools in

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Ceará. Therefore, gender stereotypes function as strengtheners of a modality of gender violence that removes from a certain gender the opportunity to play a leading role in areas, such as, for example, technological, exact, applied social, agrarian and related sciences, without actual cognitive justifications.

Recently in Ceará, the results of the research point to gender inclusion programs such as "Ceará Científico" or projects focused on the areas of technology and robotics that encourage active female participation, as well as the PPPs of the 11 institutions analyzed show and strengthen the idea that even today there is a glaring lack - and that must be urgently resolved - about the discussion and importance of important names of women in Mathematics, such as Sofia Kovalevskaya, the first female mathematician, that is, not bringing the idea of female representation in this white and patriarchal educational scenario.

Furthermore, this view corroborates the statement that Law No. 14,986/2024 is not yet being applied in schools, as this law requires approaches based on women's experiences and perspectives in the curricular content of elementary and secondary education; and institutes the Week of Appreciation of Women Who Made History within the scope of basic education schools in the country

In fact, even if there is a law that supports this appreciation and importance, there is still much to be done for this to be actually conquered by the educational space, as plausible actions that provide opportunities for the achievement of an equitable education. To this end, it is suggested that such achievements be developed in the early years of contact with the school space, so that it can really enable female ascension in areas of knowledge seen as more analytical and thus forging the social misunderstanding that attributes rationality to men and emotional to women, even if they are made agender and inseparable, Therefore, they are not exactly innate of one gender or another, but above all socially stimulated by misogynistic and sexist perspectives of having feminine and masculine functions.

CONCLUSION

The research aimed to evaluate the implementation of gender inclusion policies in mathematics education in schools in Ceará, was achieved. This is due to the identification of both existing initiatives and gaps in pedagogical approaches to gender issues. Thus, the results show that, although there are initiatives aimed at gender inclusion, the approach to

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associated issues is predominantly superficial, lacking in-depth discussions. From the study, it should be noted that many schools do not address gender disparities in a systematic way, which limits the effectiveness of the policies implemented and challenges the frequency of self-efficacy in the school environment.

Therefore, the theoretical contributions of this study expand the understanding of the intersection between gender and mathematics education, highlighting the importance of including gender discussions in teacher education. Furthermore, the work also provides a basis for future investigations, proposing guidelines that can enrich both teacher training and pedagogical practice in educational institutions. Thus, it is recommended that future investigations explore a sample of more institutions and include the students' perspective on gender issues in mathematics teaching, as well as investigating studies in the continuing education of teachers on the subject, can provide clarifications for more efficient pedagogical practices. Therefore, the longitudinal analysis of gender policies can also offer a broader, more critical and diverse understanding of their evolution and impacts over time.

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