
ARTICLE

The different places occupied by the sociocultural practices of Quilombola people in mathematics education research studies

Os diferentes lugares ocupados pelas práticas socioculturais de pessoas quilombolas em pesquisas em educação matemática

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Abstract

We analyzed research studies associated with Quilombola peoples, racism, and anti-racism, addressing mathematics education, published in master dissertations, doctoral theses, and articles from journals. We reflect on the role played by research that focuses on the articulation between mathematics education and the knowledge and practices of the Quilombola peoples. The theoretical discussions for this problematization are based on anthropoemic, *major* and *minor* science. An integrative literature review allowed us to summarize the findings of several studies without conflicting with the epistemological orientations of the material analyzed. We identified at least two analytical densities: sociocultural practices in the service of school mathematics, and mathematics education in the service of fighting structural racism. The first density refers to the cultural practices supporting school mathematics, with several studies describing the existence and importance of Quilombola education. However, using the sociocultural context only as an element to facilitate the teaching of school mathematics. The second density refers to studies that use mathematics education to combat structural racism since, despite referring to mathematical aspects present in the investigations, the meanings attributed to cultural practices, especially those developed in Quilombola communities, emphasize the *mathematical* aspect of the situation and include elements

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for thinking about structural racism. The studies that compose this density are closer to a mathematics education that can strengthen Quilombola peoples and build anti-racist practices, as researchers seem to understand their political role as contributing to reducing inequalities.

Keywords: Sociocultural practices. Quilombola education. Mathematics education. Racism. Anti-racism.

Resumo

Analizamos pesquisas associadas aos povos quilombolas, ao racismo e ao antirracismo, abordando a educação matemática, publicadas em dissertações de mestrado, teses de doutorado e artigos de periódicos. Refletimos sobre o papel desempenhado pelas pesquisas que focam na articulação entre a educação matemática e os saberes e práticas dos povos quilombolas. As discussões teóricas para essa problematização baseiam-se na antropológica, ciência *maior e menor*. Uma revisão integrativa da literatura nos permitiu resumir os achados de diversos estudos, sem entrar em conflito com as orientações epistemológicas do material analisado. Identificamos pelo menos duas densidades analíticas: as práticas socioculturais a serviço da matemática escolar e a educação matemática a serviço do combate ao racismo estrutural. A primeira densidade refere-se às práticas culturais que apoiam a matemática escolar, com diversos estudos descrevendo a existência e a importância da educação quilombola. Porém, utilizando o contexto sociocultural apenas como elemento facilitador do ensino da matemática escolar. A segunda densidade refere-se a estudos que utilizam a educação matemática para combater o racismo estrutural, pois, apesar de se referirem a aspectos matemáticos presentes nas investigações, os significados atribuídos às práticas culturais, especialmente aquelas desenvolvidas em comunidades quilombolas, enfatizam o aspecto *matemático* da situação, e incluem elementos sobre o racismo estrutural. Os estudos que compõem essa densidade estão mais próximos de uma educação matemática que possa fortalecer os povos quilombolas e construir práticas antirracistas, pois os pesquisadores parecem entender o seu papel político, no sentido de contribuir para a redução das desigualdades.

Palavras-chave: Práticas socioculturais. Educação quilombola. Educação matemática. Racismo. Antirracismo.

1 Introduction

This article aims to reflect on the role played by research that focuses on the articulation between mathematics education and the knowledge and practices of Quilombola peoples. We intend to problematize and scrutinize Brazilian research that, while giving visibility to sociocultural practices and mathematical rationalities of Afro-descendant¹ cultures, ends up subjecting them to school mathematics, which we understand as a type of mathematics developed under the guidance of specialists and curriculum makers based on epistemological and pedagogical dimensions (Valente, 2013) similar to the rationality developed by academic mathematics. Thus, in our study, we seek to minimize the extermination of epistemologies that diverge from those creating and regulating a *single* way of knowing the world, referred to as “epistemicide” (Santos, 2007, p. 21). Thus, as educators, we are concerned with the analysis of subtle processes of discrimination in Brazilian research that may hierarchize and suppress different mathematical rationalities. We consider that the mathematical knowledge of Quilombola communities plays a crucial role in combating racism by promoting the appreciation and recognition of the cultural contributions of these communities, deconstructing

¹ In this article we use the terms *Afro-descendant*, *Afro-Brazilian* and *Black people* synonymously.

racial myths and legitimizing mathematical knowledge and practices that are frequently marginalized and erased. In addition, we question the place sociocultural Afro-descendant practices occupy in the works investigated.

The discussion presented here seeks to deepen understandings of the relations between mathematics education and Quilombola school education (Almeida; Monteiro, 2016; Diniz; Monteiro, 2020; Monteiro *et al.*, 2019; Teixeira *et al.*, 2021) and those that maintain important interfaces with aspects of the education and health of the Brazilian Black population in different sociocultural contexts (Carvalho; Picornell-Lucas, 2020; Lima *et al.*, 2022; Sartori; Duarte, 2022). We are also interested in reflecting more generally on the education of Black students, because we teach at federal public universities, which, in 2013, began to reserve a percentage of admissions for Blacks in compliance with Law 12.711 (Brasil, 2012a).

The latest census revealed that 20.6 million Brazilians label themselves as Black, equivalent to 10,2% of the population (IBGE, 2022). In addition, the census shows that 92,1 million Brazilians identify as mixed-race, equivalent to 45,3% of the population. Brazil has been recognized as the country outside Africa with the largest population of Afro-descendants, although Brazilians themselves do not identify it as a Black nation (McCoy; Trajano, 2020).

Although statistics are important tools for analysing populations and support for public policies (Jannuzzi, 2018), they are not sufficient to understand the identity and specificities of the black Brazilian population. It is necessary to consider several complex issues related to culture, politics, and ideology, especially in the construction and use of the concepts of race and racism. Munanga (2004) argues that the category of race has evolved since the 18th century and was initially based on biological aspects such as physical characteristics and skin colour. This view was consolidated in the 19th century with other supposedly scientific criteria to justify a hierarchy of races and the attribution of the *White race* as morally and psychologically superior to the other *races* and thus able to dominate them (Munanga, 2019). This racist ideology spread widely, culminating in tragic events such as those that occurred under fascist regimes in various parts of the world. From the 1970s onwards, with advances in human genetics and molecular biology, the concept of race as a biological category was scientifically invalidated (Munanga, 2004). The contemporary consensus among anthropologists and geneticists that human races do not exist (Santos *et al.*, 2010) led to the use of the concept of ethnicity as a new axis of differentiation and hierarchy (Munanga, 2004). Thus, cultural and identity differences began to be used to justify exclusion and discrimination.

In Brazil, the discussion about racism and ethnicity is complex. This fact stems from the nineteenth century elitist discourse of a supposed *racial democracy* (Munanga, 2019), when the

idea of miscegenation was disseminated, forging in the cultural imagination a supposed *national identity* by which there would no longer be Blacks, Indigenous peoples or Whites in Brazil, but only one people, whose cultural differences coexisted in harmony. Gonzales (1984) argues that Brazilian culture is marked by the indelible presence of black people, despite the ideology of racial democracy, which emphasizes a dominant discourse that naturalizes racism. This ideology also perpetuates stereotypes about the irresponsibility, intellectual incapacity and childishness of Black people, justifying their marginalization and exploitation.

This thinking about miscegenation was supported by the scientific racism of the time and by eugenicist theories that saw Whites as a superior race, at the top of racial hierarchy, and the Blacks as inferior, situated at the base. In this way, through sexual relations between Whites and Blacks, phenotypic gradations create a third element, neither white nor black, so that over time, as desired by the elites, the population would become “white”, like in European nations (Munanga, 2019).

The process of miscegenation was a resource used by Brazilian racial ideology to mix Whites and Blacks so that the Black population would gradually disappear, in a true ethnocide. The supposed national unity was the result of an elite fearful of an ethnic-racial plurality. This project failed, but its prints are almost indelible (Munanga, 2019).

Statistics indicate that racial inequalities in Brazil are evident in several areas, such as violence, education, health, and the job market (Gomes, 2023). The Brazilian Black population still occupies the poorest social strata and are excluded from various social rights, while also constituting the majority in prisons and psychiatric hospitals. They have the highest suicide and death rates in the country, and are underrepresented in literature, media, and the cinema. Racial discrimination impacts on the Black population’s living conditions and health and the way they die (Damasceno; Zanello, 2018). After the abolition of slavery there was no public policy of reparation for this population, nor were they allowed any political participation, so that Brazilian Black people were kept in poverty, with inadequate housing, and poor health and education. As Ciconello (2008, p. 2) points out, “The outcome is a society where racism and the resulting social inequalities are not revealed or discussed, and seem not to exist. The problem, they say, is not racism, but poverty; inequalities are not racial, they are social.”

Almeida (2018) argues that to comprehend racism in Brazil, it is necessary to reflect on the *structural* conception, which defines racism as result from the social structure itself, especially from the structuring elements of ideological, political, legal, and economic relations. Therefore, structural racism is a system of oppression that is not only related to aesthetic perception, but permeates spaces in public and private spheres (Bersani, 2018). Racism

permeates all institutions, including schools, which is expressed by the lack of Black representation in curricula, pedagogical resources and teachers, in addition to the prevalence of negative stereotypes about black students (Gomes, 2019).

The fight against racism in Brazil gained an important contribution in the 1970s and 1980s with groups of academics and social movements that reformulated the concept of Quilombo. Beatriz Nascimento (1985) argues that the origins of the concept of Quilombo can be traced back to the resistance against Portuguese colonial domination. She emphasizes the importance of the Quilombo as a space of resistance and preservation of Black culture in Brazil, highlighting the influence of the Quilombo in the formation of Brazilian identity. Thus, Quilombos are powerful symbols of Black cultural resistance in Brazil, inspiring generations of Afro-Brazilians to fight for equality and social justice.

Abdias do Nascimento (1980) discusses the concept of *Quilombismo* as a tool to understand the experience and struggle of Afro-Brazilians. Thus, *Quilombismo* is more than just the escape of enslaved people, but represents a system of life, resistance, and self-determination that is based on solidarity, social justice, and the search for a society free from exploitation and racism. *Quilombismo*, symbolized by the resistance of the Quilombos of the past, represents a historical struggle against racism, which continues to be alive in contemporary social movements that seek reparations and social justice for the Black population (Ioruba; Moraes; Gomes, 2016).

Arruti (1997) problematizes the complexity of using the term remnants of Quilombola communities. The author argues that the use of this term arose from the need to name and make visible Quilombola groups that did not fit perfectly into the traditional categories of Black people. This nomenclature reflects the historical process of spoliation and marginalization that these groups suffered, while at the same time recognizing the presence of an ancestral legacy, albeit fragmented, in their current reality. The category remnants of Quilombo, therefore, is not limited to describing a social group, but reveals a complex historical and political process, marked by disputes, resistance and the search for recognition of Quilombola communities.

The Brazilian Constitution (Brasil, 1988) recognized the term *Quilombo*, guaranteeing land tenure rights to Afro-descendants living in remnant Quilombo communities. The article 68 of the Act of Transitional Constitutional Provisions (ADCT) states: “The remnants of quilombo communities that are occupying their lands are recognized as having definitive ownership, and the State must issue them the respective titles” (Brazil, 1988, p. 167). However, it was only with Decree 4.887 (Brazil, 2003a), that the procedure for identifying, recognizing, delimiting, demarcating and titling the lands occupied by remnants of Quilombola communities was

regulated. It is worth mentioning article 2 of the aforementioned decree when it states that

[...] for the purposes of this Decree, remnants of quilombo communities are considered to be ethnic-racial groups, according to criteria of self-attribution, with their own historical trajectory, endowed with specific territorial relations, with a presumption of black ancestry related to resistance to the historical oppression suffered (Brazil, 2003a, p. 4).

The identity of a quilombo remnant is related to two aspects: identification and belonging to an ethnic-racial group and land. Despite the relative and slow regulatory progress, the slowness of recognition and titling of lands of Quilombola communities stands out, which reveals the commitment of the Brazilian State to agribusiness and large landowners, and that self-declared Quilombola communities feel neglected.

The 2022 Census investigated the Quilombola population in Brazil for the first time, registering 1,327,802 people, or 0.65% of the total population. 473,970 households where at least one Quilombola person lived were identified, spread across 1,696 Brazilian municipalities (Gomes, 2023). Only 167,202 people, which is 12.59% of the Quilombola population, reside in Quilombola territory and of these, 89,350, corresponding to 53.44%, are in the Northeast region.

Law 10.639 (Brazil, 2003b) changed the guidelines for national education to include Afro-Brazilian history and culture in the curriculum at primary and secondary school levels. After major struggles by social movements, Brazil also formulated the National Curriculum Guidelines for Quilombola Basic School Education (Brasil, 2012b), thus officially recognizing that a specific education for Quilombolas was needed.

Despite the specificities, Monteiro and Reis (2019) state that the National Curriculum Guidelines for Quilombola School Basic Education follow the General National Curriculum Guidelines for Basic Education:

Quilombola School Education is developed in educational units registered in their lands and culture, requiring their own pedagogy with respect to the ethnic-cultural specificity of each community and specific teacher education, observing the constitutional principles, the common national basis and the principles that guide Brazilian Basic Education. In the structuring and operation of Quilombola schools, their cultural diversity must be recognized and valued (Brasil, 2012b, p. 42).

If guaranteed by the national state, such principles should constitute a policy of affirmative and equalizing actions for thousands of Quilombola communities in the country and, consequently, guaranteeing achieved rights, with the inclusion and active participation of people involved in the educational processes. However, the realities of Quilombola schools seem far different from what the guidelines establish (Monteiro; Reis, 2019). Although the Brazilian state guarantees Quilombola education, we can infer that social agents consciously or

unconsciously undervalue it. Thus, while formally Quilombola culture is highlighted, in daily practice engendered by the structures of racism, it is devalued by teachers and school managers, thus subordinating Quilombola mathematical knowledge to school mathematics.

Several theoretical and methodological approaches that take into account various forms of mathematics developed in specific sociocultural contexts, have been devised for mathematics education (e.g. D'Ambrosio, 2005; Gerdes, 2007; Cunha Junior, 2017). However, issues related to racism present complexities and specificities that demand approaches beyond those proposed by critical mathematics education and ethnomathematics, requiring more specific studies and conceptualizations (Valoyes-Chávez, 2017). The mandatory nature of this law has increased the number of studies that focus on Afro-Brazilian culture, and this is also reflected in research in mathematics education (Monteiro *et al.*, 2019). However, we believe that it is still necessary to expand pedagogical practices that make Quilombola cultures and mathematics visible and that can contribute to the construction of anti-racist practices. There is a need to develop a democratic and anti-racist mathematics education in the context of Quilombola School Education, which highlights other knowledge holders and valid ways of knowing (Teixeira *et al.*, 2023).

In the next section, we present basic concepts used for the analysis of the empirical material, followed by the methodology employed to select the material analyzed and the analysis of how the studies approach the mathematical knowledge derived from the Afro-descendants' sociocultural practices, while the following section presents our final considerations.

2 Theoretical tools

By analyzing studies published in Brazil addressing mathematics education associated with Quilombola peoples, we reflect on how these studies have contributed to overcoming racist practices in mathematics education. The theoretical tools for supporting this problematization make use of the concepts of *anthropoemia* from Lévi-Strauss's anthropology (1961) and the those of *major science* (also called sedentary or royal science) and *minor science* (or nomadic science) developed by Deleuze and Guattari (1997). Such tools allow us to reflect on the place cultural practices occupy in research investigating Afro-descendant communities/practices/knowledge. Those theoretical aspects can contribute to think about the processes in operation in encounters with the *other*, and this leads to different forms of reaction to the other. Thus, every

[...] stranger shatters the rock on which the security of daily life rests. He comes from afar; does not share local assumptions – and thus ‘essentially becomes the man who must call into question almost everything that seems to be unquestionable to the members of the approached group’ (Bauman, 1998, p. 19).

However, questioning certainties can lead to insecurities. The *rock* that supports our security, as Bauman states, trembles! Thus, in order to return to a state of safety, to solid ground, it will often be necessary to annihilate the strange to return to the comfort zone of our own truths. Even if unintentionally, such annihilation sometimes occurs through anthropoemic movements in which the consumed strange violates the body that intends to consume it, causing regurgitation. Therefore, we expel the strange, “isolating them for a time, or for ever, denying them all contact with humanity, in establishments devised for that express purpose” (Lévi-Strauss. 1961, p. 386).

Such concepts are productive for analyzing how certain research studies, whether intentionally or not, reproduce such actions. Quilombola mathematical knowledge refers to knowledge used by community members, constructed from daily and professional practices: related to agriculture, fishing, crafts and the collection of natural products, which require specific mathematical skills (Santos; Silva, 2016). For example, measuring land (Oliveira, 2011), counting harvested products (Oliveira *et al.*, 2023), dividing resources and negotiating prices are activities that involve fundamental mathematical concepts. Thus, we ask ourselves: what reactions are in operation when we encounter other mathematics, which might be linked to Quilombola practices? Will those mathematics be ingested by academic mathematics? Or regurgitated for being too strange? Would they be placed in the field of the exotic? Would they be treated as *proto-mathematics*?

This problematization invites us to think about the relationship that is established between *major science* and *minor science*. *Major science* refers to scientific methods based on the concept that to produce knowledge it is necessary to isolate the object of study (Duarte; Taschetto, 2013). On the other hand, *minor science* is an unconventional scientific approach which is difficult to be classified because it has had an eccentric development (Deleuze; Guattari, 1997). *Major science* is totalitarian because it denies other forms of knowledge, which are not consistent with its epistemological principles and methodological rules. Therefore, to maintain its totalitarian position, *major science* establishes a certain order, as well as rituals, to purify waste, the *dirt* that does not belong to the established order and that must be eliminated. *Minor* or *nomadic science*, on the other hand, has characteristics that prevent its capture by *major science*. Capture is made difficult because it establishes lines of flight, that is, the attempt

to fix it, to show it as unique, vanishes because it presupposes the possibility of variation². Due to its singularities, it does not attribute authorship of knowledge to itself, as is required in the major sciences. They are marginal, not intended to be universal, belong to a “borderless, unfenced space” (Deleuze; Guattari, 1997, p. 51), and move through escape lines. In other words, it is often eliminated from the body that intends to capture it. Such conceptualizations become relevant for us to think about the relationship we establish with the *minor sciences*, other kinds of mathematics; as Lizcano (2004) tells us:

By training and habit, we tend to place ourselves in academic mathematics, take it for granted (that is, place it beneath us, as a fixed ground) and, from there, look at school practices, in particular, at the popular ways of counting, measuring, calculating... Thus placed, we assess their features using our own as a reference. We measure the distance that separates those practices from ours, i.e. from the one mathematics (in the singular). And, as a result, we consider that certain kinds of mathematics are more or less advanced, or we believe that in a certain place we can find “traces”, “embryos” or “intuitions” of certain mathematical operations or concepts. The mathematical practices of others are thus legitimized – or delegitimized – depending on their greater or lesser resemblance to the mathematics we learn in academic institutions (Lizcano, 2004, p. 125).

Considering this *formation and habit* imposed by the power that emanates from *major science*, we often look at those *other mathematics* as if they were imperfect, with *factory defects* that would require a scientific process of purification. In the same vein, Joseph (1996, p. 23-24) states that:

For the last four hundred years, Europe and the nations culturally dependent on it have played a dominant role in world affairs. This is all too often reflected in the character of some of the historical works written by Europeans. When another people appears, it always appears transiently, as if Europe had ventured to address them. Thus, the history of Africans or the indigenous peoples of America often seems to begin only after their encounter with Europe.

In this sense, the history of American indigenous people, including its mathematization processes, only began when European colonization process took place, with their ways of experiencing the world, for example, through religious systems, economic and political structures, and architectural and urban models. Events and lifestyles prior to this *encounter* are now perceived, if at all, as exotic and folkloric. In the wake of these premises, we propose to examine and problematize research that has *other kinds of mathematics* as its object of analysis. In this article, specifically, we analyze research on Quilombola mathematics.

² An example of these characteristics is visible in a unit of measurement used by farmers in Rio Grande do Sul. This unit of measurement is called Tamina. Farmers in the interior of Santo Antônio da Patrulha-RS use it to make linear and surface measurements. This unit of measurement is equivalent to the measurement of an area of 10 *braças* by 20 *braças*. Each *braça* corresponds to 2.20 cm. In the metropolitan region of Gravataí, the Tamina used by farmers is equivalent to an area of 8 by 20 *braças* (Oliveira, 2011). As the author states, “[...] the Tamina unit of measurement is established and perfectly used with different measurements, but they are true in their use within each form of life” (Oliveira, 2011, p. 70).

3 Methodology

We conducted an integrative literature review, which allows the researcher to synthesize the findings of several studies in search of answers to general or specific questions without conflicting with the epistemological affiliation of the material analyzed. This type of review can be used to meet various purposes such as the definition of concepts, analysis of evidence, methodological aspects, theories and specific issues (Soares *et al.*, 2014; Souza; Silva; Carvalho, 2010). It differs from other systematic literature review approaches in that it seeks to outline a particular topic, or understand its development over a period of time, without validating the methodological approaches or the results of the analyzed studies. The review follows well-defined steps such as the delimitation of the research problem, descriptors, choice of databases, inclusion and exclusion criteria, reading and synthesis techniques of the material collected, categorization, interpretation, and critical analysis of the material (Botelho; Cunha; Macedo, 2011). In our reading of the studies, we highlight two aspects that constitute our research focus: to see if 1) the publications analyzed subject mathematical rationalities and Afro-descendant cultural practices to school mathematics, and 2) they support the struggle against structural racism. We chose these two foci of investigation because we understand that truth is centered on the form of scientific discourse and the institutions that produce it (Foucault, 2007).

We researched master dissertations, doctoral theses and peer-reviewed scientific journals published between 2016 and 2020, that is, from the time of the emergence of the first studies that considered the possible repercussions of the implementation of Quilombola education advocated by the National Curriculum Guidelines for Quilombola Education (Brasil, 2012b) until the time in which this review was carried out. The descriptors chosen for the search were *Quilombola*, *matemática* and *racismo*, *Quilombola and matemática*, and *racismo and matemática*. The search was carried out in three databases: in Capes Catalogue of Theses and Dissertations (on January 9, 2021), Biblioteca Digital Brasileira de Teses e Dissertações/ Brazilian Digital Library of Theses and Dissertations (BDTD, January 11, 2021), and Capes Portal de Periódicos/ Journal Portal (January 9, 2021). The first two databases are the most important portals for the depositing and dissemination of academic work produced by Brazilian graduate programmes. The last data base was used to identify scientific articles; the Capes Portal accesses important national and international research databases with more than 38,000 titles. We included theses and dissertations to expand the scope of the investigation, given that

master's and doctoral graduate programs represent a significant part of Brazilian scientific production; our search also revealed that it is difficult for young researchers to publish articles in journals.

The criteria of choice for the databases were related to their qualification, as they are sponsored by public policies to promote the dissemination of scientific knowledge produced in the country and providing access to internationally qualified journals. On the other hand, it is recognized that the search in the Capes Journal Portal may not have included several non-indexed Brazilian publications.

Studies were selected on the basis of their answering our two analytical questions. After the search for, selection and exploratory reading, fifteen publications were included: two doctoral theses, nine master dissertations and four articles. Eleven were derived from the search performed with the combined descriptors *Quilombola and matemática* and four from *racismo and matemática* (Frame 1).

Title (descriptor)
Doctoral thesis
<i>Práticas socioculturais Quilombolas para o ensino de matemática: mobilizações de saberes entre Comunidade e Escola</i> (Khidir, 2018). (Quilombola AND Matemática)
<i>Tensões nas aulas de matemática e contribuições para um currículo para a educação das relações étnico-raciais</i> (Oliveira, 2019). (Racismo AND Matemática)
Master dissertations
<i>A construção de “caixas” de marabaixo na comunidade Quilombola do curiáu: uma abordagem etnomatemática</i> (Rodrigues, 2016). (Quilombola AND Matemática)
<i>A etnomatemática como princípio de valorização sociocultural em uma comunidade Quilombola na região amazônica: elo entre o conhecimento empírico e o escolarizado</i> (Silva, 2019). (Quilombola AND Matemática)
<i>Ribeiras de vales: ...e experimentações e grafias e espaços e Quilombolas</i> (Gondim, 2018). (Quilombola AND Matemática)
<i>O uso do jogo oware para promover o ensino de matemática em uma escola Quilombola</i> (Almeida, 2017). (Quilombola AND Matemática)
<i>Reflexões sobre o currículo sob a perspectiva da Etnomatemática: possibilidades em uma escola “Quilombola</i> (Libório, 2018). (Quilombola AND Matemática)
<i>Etnomodelagem: uma abordagem de conceitos geométricos no cemitério de Arraias</i> (Pimentel, 2019). (Quilombola AND Matemática)
<i>Matemática, africanidade e formação de professores na escola Quilombola</i> (Valença, 2018). (Quilombola AND Matemática)
<i>Os foregrounds de estudantes Quilombolas e suas intenções em aprender matemática</i> (Diniz, 2019). (Quilombola AND Matemática)
<i>Denúncias e anúncios sobre camadas de vulnerabilidade social e educação matemática junto a um grupo de mulheres pretxs que assumiram empoderar-se por meio da tecnologia</i> (Suárez, 2020). (Racismo AND Matemática)
Articles
<i>A alfabetização matemática e as práticas de numeramento na comunidade Quilombola de São Félix: a pedagogia crítica e o currículo em ação</i> (Santos; Zanardi, 2020). (Quilombola AND Matemática)
<i>A influência da cultura local no processo de ensino e aprendizagem de matemática numa comunidade Quilombola</i> (Santos; Silva, 2016) (Quilombola AND Matemática)

<i>Microagressões no ensino superior nas vias da educação matemática</i> (Silva; Powell, 2016). (Racismo AND Matemática)
(Re)claiming an activist identity as criticalmathematics educators: addressing anti-Black racism because #BlackLivesMatter (Price; Moore, 2016). (Racismo AND Matemática)

Frame 1 – List of studies included
Source: elaborated by the authors (2021)

The studies met our research criteria because they include discussions about Quilombola communities and their mathematics as expressed in cultural phenomena, games and social practices as examples or as sociocultural practices. These studies either oppose or analyze academic or formal school contexts, providing evidence of structural racism present in teaching and learning practices and processes. Based on these initial aspects, we proceeded with an interpretative reading of the publications, and extract content from the material that would allow us to construct a critical interpretation that considers the debate on structural racism and mathematics education as well as our theoretical basis. The most complex phase of the review process is associated with critical interpretation, as it requires an analysis of the whole publications based on our theoretical tools. We inquired into the empirical materials implemented and, from our analysis, constructed what we call *analytical densities*; density is the degree of mass concentration in a given volume, that is the selected publications. At specific moments *masses of statements* raise the degree of concentration and thus of our attention directed towards the themes. These were based on our reading of the publications included here, the references that support our analysis and discussions we held with researchers from different fields of knowledge and public Brazilian higher education institutions.

We defined two densities to be analyzed: *sociocultural practices in the service of school mathematics*, and *mathematics education in the service of fighting structural racism*. The definition of these densities stemmed from the analysis of excerpts that indicated how the researcher or teacher used this knowledge in their research or classrooms. The choice of excerpts used was based on a critical and detailed reading of the selected publications. We prioritized those excerpts that would contribute most to illustrating the defined analysis categories.

4 Findings

We observed that most of publications articulate mathematics education with Quilombola social practices based on the theoretical perspective of ethnomathematics. However, despite this common feature in terms of the theoretical tools used by researchers, we

observed some displacements with regard to the role played by social and cultural practices described by the studies and articles we analyzed.

4.1 Sociocultural practices in the service of school mathematics

This first analytical density was evidenced in some studies by the way in which some Quilombola sociocultural practices are related to scientific mathematics practices, in a mining process to give meaning, contextualize and, in effect, facilitate the learning of school mathematical knowledge. The following quotes indicate this process:

The study of plane and spatial geometry is identified in the construction of the “boxes” when measuring the height of this solid, or calculating the lateral area of this cylinder, elements that are perceptible when following this process. [...] We could verify that there are other concepts that can be addressed, concepts studied in school mathematics, as well as other knowledge, as part of the process of building the “box” (Rodrigues, 2016, p. 66-67).

The excerpt from Rodrigues (2016) exemplifies how school mathematics is imposed onto Quilombola sociocultural practices. Consequently, the effort to enrich traditional crafts with formal mathematical knowledge implies an approach that regards Quilombola practices as inferior, adaptable, and responsive to school concepts.

Furthermore, in Rodrigues, (2016, p. 90) we read:

When dealing with the mathematics present in the making of [Marabaixo] “boxes”, we notice that the respondents do not point out the use of this knowledge when describing the construction process. However, when relating the mathematical ideas used by artisans to school mathematics, it is possible to cite, for example, the study of areas of plane figures, and each area of the rulers used for the construction of the lateral area of the cylinder can be calculated, taking into account only its height and width, and can be expressed mathematically by the formula $A_L = 2 \times \pi \times R \times h$.

The above quote, from Rodrigues (2016) illustrates that the artisans' knowledge is acknowledged and articulated within the realm of mathematical concepts. This emphasis on connecting Quilombola craftsmanship to concepts taught in classrooms underscores the integration of sociocultural practices to enrich school mathematics education. However, the utilization of school mathematics terminology and formulas to describe the artisans' techniques also implies an attempt to diminish sociocultural knowledge by translating it into standardized mathematical concepts.

Regarding Khidir's thesis (2018, p. 35), the author points out that the research “aimed to understand how teachers can mobilize Quilombola sociocultural knowledge in the reorientation of their teaching activities in school mathematics teaching, in the search for senses and meanings attributed to school knowledge”.

Related to Khidir's text, our analysis suggests an emphasis on integrating Quilombola cultural practices within the context of school mathematics. This indicates an intention to enhance the teaching of mathematical concepts by incorporating cultural practices, often perceived as exotic or interesting elements, to facilitate mathematics instruction.

The students' activities were to survey the sociocultural practices of the Kalunga do Mimoso as a tool to study reality. These practices were presented and discussed in the second and third modules. In the latter, activities for the teaching of mathematics in the multigrade classes of Quilombola schools within the territory of Mimoso were developed (Khidir, 2018, p. 137).

The fragment inserted above emphasizes the examination of sociocultural practices to enhance the understanding of school mathematics by connecting it with Quilombola communities. Therefore, Quilombola knowledge would require validation through the formal teaching of mathematics.

The quotes examined indicate the protagonism assumed by school mathematics when applied to sociocultural practices. They seek to *give sense and meaning* to school mathematics. A *sociocultural practices survey* is carried out for the elaboration of mathematics teaching activities. For example, the studies intend to approach areas of plane and spatial figures and mathematical formulas. Thus, aspects of Quilombola and Afro-descendant cultures are converted into mere exotic gadgets to pretend that they are being valued. The logic that prevails in the excerpts highlighted assumes that "other mathematical knowledge only makes sense if a relationship is established with scientific Mathematics, whether this relationship is a comparison or a hierarchical relationship" (Junior, 2014, p. 1155).

The analyses of studies emphasize the school mathematical ideas used by artisans and the need to address mathematics concepts based on participants' practices. Structural racism only grants this knowledge a secondary place in school practices and hegemonic scientific production. Silva (2021) argues that the anti-racist struggle reflects the historical tension in educational policies, pointing out that there are policies that both perpetuate structural racism in its various manifestations and obliterate the racial issue and at the same time want to break with this logic of racism. Therefore, despite the supposed intention to valorize cultural knowledge and practices as a way to combat racism, in reality, these knowledge systems are given secondary space. In other words, structural racism tries to erase the racial issue in education through the supposed appreciation of these knowledges. A true anti-racist education is one that combats any and every expression of racism, even the most imperceptible, acknowledges and genuinely values the cultural knowledge, past and present, of Afro-descendants and other peoples. Being anti-racist places the fight against racism as an ethical

principle in educational practices.

Although almost all studies cite Brazilian legislation, specifically Law 10.639 (Brasil, 2003b), which establishes the obligation to teach Afro-Brazilian and African history and culture in basic education nationwide, we question whether mathematical rationalities, sociocultural practices developed by Afro-descendants should be put into effect solely and exclusively in Quilombola schools. Does this mean operating only with the premise that mathematical knowledge must be articulated with the local reality? We believe that the answer to this question is no. On the other hand, the interlacing between mathematics education and Quilombola sociocultural aspects carried out in some studies, however unintentional, seems to us to be covered by the greater need to contextualize school mathematical knowledge. Sociocultural practices are taken as a starting point, an appetizer (Pais, 2012), for searching for sense and meaning in school knowledge. This is evidenced by this example:

The need to think about new methodologies for teaching Mathematics, especially from subjects related to students' daily life, motivated the accomplishment of this work, through the Ethnomodelling, which aims to identify mathematical ethnomodels present in the construction of the wall of the Cemetery and its square of the city of Arraias-TO providing the knowledge of part of the local reality (Pimentel, 2019, p. 10).

In the wake of this premise, we thought that, if the overriding objective is centered on curriculum content and its contextualization, or on *the need to think about new methodologies for teaching mathematics*, we could replace such practices by any others, since they merely help to facilitate and legitimize the importance of mathematics as developed in school.

Studies have used sociocultural practices from different cultures to give meaning to school mathematics (Lerman, 2006). However, some authors have problematized the success of such an endeavor, claiming that “The meaning of a practice and the knowledge involved in it are deeply rooted in the community of practice where they are exercised and developed” (Lave; Wenger, 1991, p. 37). Thus “there is nothing that guarantees a transfer of knowledge from one practice to another without a certain degree of ‘misunderstanding’” (Pais, 2012, p. 37).

Beyond discussing the efficacy or not of such practices, we ask ourselves about their very execution, since school mathematics seems to want to absorb “the symbolic proteins” (Agnolin, 2002, p. 136) of sociocultural practices to oxygenate school mathematics. It is a selective absorption, because it examines them in terms of what is powerful for teaching school mathematics. It is a process similar to extraction, purification, annulment of differences, which eliminates everything that could not be used for the purpose of teaching school mathematics.

We believe that the movement to visualize the sociocultural practices of discriminated peoples, as in the case of African culture, should go beyond the condition of serving the purposes of school mathematics education, because the fact that the rationality in operation in cultural practices has been amalgamated with broader cultural aspects is disregarded.

When discussing the incorporation of different rationalities in school environments based on the Deleuzian concepts of *major science* and *minor science*, (Authors) emphasize that researchers involved with ethnomathematics should consider the extent to which cultural practices are hierarchized and subordinated, when incorporated into the school curriculum. Thus, we infer that investigations that underscore the practices of culturally different peoples cannot be reduced to didactics. When it is, “it loses all the emancipatory potential of criticism that made it emerge and becomes blind to its role in the world” (Pais, 2012, p. 45).

Finally, we point out that the research studies classified under Density 1 represent an advance by disseminating the existence and importance of Quilombola education. This is particularly significant especially in a society in which research into mathematics education focuses on approaches that exclude sociocultural contexts, resulting in the narrowing down of both research and mathematics education.

4.2 Mathematics education in the service of fighting structural racism

In this analytical density, an appreciation of African contributions, the protagonism of Black social movements and the construction of an image free of stereotypes about Afro-descendant peoples also contributes to mathematics education. In this density there is an appreciation of the contribution that African knowledge can make to the construction of mathematical thinking; some mathematical concepts are reproduced, but there is also an apparent attempt to problematize racism and to discover how education can contribute to combating it.

This type of research and reflection involves ethnomathematics merely going beyond the possible rescue of *other* mathematics. The approach aims at minimizing inequalities, especially those of an epistemological nature. Thus, in one study that we came across African games go beyond the mathematical content. It would be useful to explore and understand them in mathematics classes as elements of African culture (Almeida, 2017). In this respect, it becomes crucial to investigate the cultural dimension of Quilombola education, the authors referring to studies on Black social movements and the origin of the term Quilombo. The authors realized that

[...] the inclusion of African and Afro-Brazilian knowledge in school curricula could enable the construction of an image of Afro-descendant peoples free of stereotypes, by bringing this knowledge closer to classrooms. In this way, African contributions to the various areas of knowledge, including mathematics, could be properly valued (Almeida, 2017, p. 19-20).

Similarly, in another study, these questions were raised:

I) How do [...] teachers understand the importance or not of the application of Law 10.639/03? II) How do/would [...] teachers plan to approach the theme of Afro-Brazilian culture in mathematics classes? III) To what extent do/would the respondent teachers relate contents necessary for mathematics learning to the reading or recognition of the Quilombola identity that students should have as part of the process of cultural self-valorization and recognition as subjects who demand the realization of their historical social rights, such as the right to title land tenure for Quilombolas, among others? (Valença, 2018, p.19-20).

In another example, the researcher emphasizes the protagonism of Blacks:

to encompass historical reports, placing Blacks in the scenario of constructing and strengthening the State of Amapá, and thus seeking to break with preconceived ideas about the participation of Blacks in the construction of knowledge, so that the racial issue becomes real and transformative knowledge (Silva, 2019, p. 3).

What distinguishes studies in this density is the fact that, although they do not neglect the educational field of mathematics, they place it in the service of broader discussions. We therefore understand that it is possible to have educational approaches not only for mathematics but also through mathematics. We reaffirm here that we reject the absence of sociocultural practices and diverse forms of rationality in school. We understand that this space protects *major science*, hegemonic knowledge, or so-called scientific knowledge. And for this reason, placing knowledge and practices that challenge it as a unique form of knowledge becomes productive. It is a question of entering the arena so as not to hinder the power of resistance of other science. In other words, placing it in the school environment would be to enhance its power of struggle.

With respect to this intention, some studies shed light on the disregard of Quilombola education by schools and other educational institutions and silence and microaggression in the face of their racism:

From the analysis of the data produced in the research done by the first author, it is possible to say that another type of microaggression can also manifest itself in the university context, which does not cling to race, gender, ethnicity, or social class. This type of microaggression is linked to the students' mathematical knowledge. For example, some mathematics teachers' specific attitudes often reveal [a sense of] superiority, manifested through microaggression. Several students highlighted having felt uncomfortable and intimidated when they seemed unable to master some mathematical content, considered "basic" in the view of university mathematics (Silva; Powell, 2016, p. 66).

Likewise, the study by Price and Moore (2016, p. 84) highlights that "In schools, we fail to recognize that most curriculum and assessment is based on knowledges, values, and

Eurocentric ways of being, because the hidden and explicit curriculum is the way we educate children under colonialism”.

In these excerpts³, it is possible to see the commitment to break with preconceived ideas about the participation of Black people in the construction of knowledge, to identify that knowledges, values, and ways of being are based on Eurocentric models and to make visible the microaggressions in our universities. In particular, the fragment by Silva and Power (2016, p. 66) reveals through microaggression, structural racism operates when the supposed absence of basic mathematical knowledge, for example, is associated with Black and poor students. Thus, this academic mathematics becomes an instrument of oppression and is operationalized through microaggressions, that is, a silent and almost imperceptible form of oppression.

Gomes (2023) argues that to deepen discussions about racism in education, the knowledge of communities can be used as a tool to combat it. From this perspective, studies on Quilombola education could problematize situations of racism that permeate the daily practices of people in the communities, in research situations that contribute to deconstructing myths and stereotypes that perpetuate racism. These reflections should emphasize the importance of intersectionality in the analysis of racism, as issues of gender, class, and other forms of oppression are interconnected. For example, research should address experiences of racism experienced by individuals of different gender and age, especially those situations in which the knowledge and practices of communities linked to mathematics are discriminated against. These actions are anti-racist because they challenge racism in people's daily lives and involve the experiences of communities.

We believe that the research studies cited present the myopia caused by structural racism that often prevents us from recognizing the curriculum put into operation at school, as well as realizing that the arrogance of some mathematics teachers often reveals superiority, manifested through microaggression. It is in the microsphere that the processes of capture and maintenance of structural racism mostly occur. Relationships between knowledge and power occur, expand, and shrink in tiny, specific relationships. For this reason, because of the capillarity of power, there is a need

[...] to capture power at its ends, in its final ramifications (...) to capture power in its most regional and local forms and institutions, especially (...) going beyond the rules of law that organize and delimit it (...); in other words, to capture power at the increasingly less legal end of its practice (Foucault, 2007, p. 182).

³ These two publications were selected utilizing the descriptor *matemática* and *racismo* (mathematics and racism).

Our argument is based on the idea that there is a direct interconnection between racial issues and mathematics education. Thus, in this article, we recommend thinking about the forces that sustain this interconnection. We believe that the *minor sciences* should be part of the school curriculum, as it is here that the process of undermining the hegemony of *major science* can be instigated. From this perspective, it is our responsibility to identify structural racism in Brazil and this implies taking account of the *anthropophagic* and *anthropoemic* processes that we utilized in our research.

5 Final considerations

This article has suggested analytical paths for acknowledging how mathematics education research for Quilombola interacts with structural racism. This was revealed either in the microaggression evidenced by the studies or when the cultural contexts were used as mere decoration. By highlighting, problematizing, and denouncing racist practices, mathematics education research can become an active space for fighting them. Thus, we believe that this study is a step towards putting the anti-racist struggle on the agenda of mathematics education.

Within schools and curricula, particular narratives circulate and establish “which knowledge is legitimate, and which is illegitimate, which ways of knowing are valid and which are not, what is right and what is wrong, what is moral and what is immoral, what is good and what is bad [...]” (Silva, 2013, p. 195). There is a fine line between research and/or pedagogical practices incorporating Quilombola knowledge that leads to its empowerment and that which leads to its subjugation to academic mathematics.

Therefore, the issues problematized here indicate a way to approach discussions about mathematics education and racial issues. The discussions make visible sociocultural practices and the rationalities involved. In some studies, the capturing power of *major science* eventually provokes forms of *anthropoemia* at the point of encounter. Sociocultural practices and rationalities that are put into operation serve only as a starting point, as a context for school mathematical knowledge.

We need to be attentive because the strength of *major science* challenges us daily. There is no question of our defending a movement that impairs sociocultural practices in the school environment, specifically those linked to Brazilian Black population, because, acting in this way, we would be undermining the visibility of different cultures and, consequently, their power to question our way of life and existence in the world. On the contrary, it means

problematizing research whose central objective is only to appropriate them in order to contextualize school mathematical knowledge.

Ultimately, our intention was motivated by the attempt to escape from the force that twists research into exclusively favoring school mathematical knowledge. We expect that our reflections will contribute to an evaluation of the repercussions of studies in mathematics education which address issues in Quilombola school education and will provide evidence for changes that can promote the empowerment of Afro-descendant culture and its protagonists.

The findings from this investigation may prompt other researchers to consider working on these issues and to realize that it is possible to incorporate discussions on racism and anti-racism in mathematics education studies. We also indicate how important it is to make interdisciplinary articulations, interactions with other fields of knowledge, especially with the human and social sciences, to build new relationships that allow us to denaturalize these practices which maintain sociocultural inequities. Undoubtedly, the concepts of *major science* and *minor science*, as well as *anthropoemia*, which derive from the social sciences, allow us to reveal those processes and to place them in discussions about anti-racism. We believe that mathematics education has the social commitment to transform this situation, becoming anti-racist, problematizing these issues, and, in particular, stimulating once more debates about educational curricula and practices.

Author Contributions

All authors contributed substantially to the conception and planning of the study; to the acquisition, analysis, and interpretation of data; to the writing and critical revision; and approved the final version to be published.

Data Availability

The data generated or analyzed during this study are included in this published article.

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