

Reflections for an Afrocentric Education: Mathematics Teaching and Teacher Training

Reflexões para uma Educação Afrocentrada: Ensino de Matemática e a Formação de Professores

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Abstract

This text reflects on the challenges and possibilities of approaching mathematical knowledge from the perspective of the africanities and Afrocentric education studies. We chose to present and discuss two studies developed within the scope of the research project “Afrocentric and decolonial perspectives in mathematics teaching and learning: investigations of the epistemologies of knowledge in teacher education” linked to a postgraduate program at a higher public institution in the rural region of Pernambuco. In this sense, we include in this section a research that discusses the mapping of scientific productions aimed at anti-racist teaching practices in mathematics classes in the annals of the National Meeting of Mathematics Education and a study with teachers and future teachers who teach mathematics through training workshops with focus on the African mathematical legacy and on the approach of law 10.639, which talks about the mandatory Education of Ethnic-racial Relations, including in the mathematics classroom. With the results of these studies and the respective discussion, we point to the need to expand research and training actions with teachers, promoting reflections for the hegemonic and Eurocentric deconstruction of mathematics and its teaching. The teaching and learning of mathematics from an Afrocentric perspective certainly enables processes that are adequate to our Brazilian reality, with repercussions on the constitution of democratic spaces and more aware citizens in relation to issues of black identity and racism.

Keywords: Afrocentric Education. Afrocentricity. Mathematics Education. Teacher Education.

Resumo

Este texto reflete sobre os desafios e possibilidades de abordagem do conhecimento matemático sob a perspectiva das africanidades e dos estudos da educação afrocêntrica. Optamos por apresentar e discutir dois estudos desenvolvidos no âmbito do projeto de pesquisa “Perspectivas afrocentradas e decoloniais no ensino e aprendizagem da matemática: investigações desde as epistemologias dos saberes à formação de professores” vinculado a um programa de pós-graduação de uma instituição pública superior no agreste pernambucano. Neste sentido, incluímos neste apartado uma pesquisa que versa sobre o mapeamento das produções científicas voltadas às práticas didáticas antirracistas em aulas de matemática nos anais do Encontro Nacional de Educação Matemática e um estudo com professores em exercício e futuros professores que ensinam matemática por meio de oficinas formativas com foco no legado matemático africano e na abordagem da lei 10.639, que versa sobre a obrigatoriedade da Educação das Relações Étnico-raciais, inclusive no chão da sala de aula de matemática. Com os resultados dos referidos estudos e a respectiva discussão apontamos para a necessidade de ampliar pesquisas e ações formativas com professores, instigando reflexões para a desconstrução hegemônica e eurocêntrica da matemática e seu ensino. O ensino e a aprendizagem de matemática numa perspectiva afrocêntrica certamente possibilitam processos adequados à nossa realidade brasileira, repercutindo na constituição de espaços democráticos e de cidadãos mais conscientes em relação às questões da identidade negra e do racismo.

Palavras-chave: Educação Afrocentrada. Afrocentricidade. Educação Matemática. Formação de Professores.

1 Introduction

This text aims to present a reflection on the challenges and possibilities of approaching mathematical knowledge from the perspective of Afrocentric education (Madhubuti, 1990), which, in turn, is anchored in the Afrocentricity theory (Mazama, 2009), (Nascimento, 2009), (Asante, 1988, 2015). For this, we present the discussion of two phases of an ongoing research project approved under the Federal University of Pernambuco called *Perspectivas afrocentradas e decoloniais no Ensino e Aprendizagem da Matemática: investigações desde as epistemologias dos saberes à formação de professores/Afro-cultural and decolonial perspectives*

in mathematics teaching and learning: investigations from the epistemologies of the knowledges to teacher education.

The studies and actions that the project encompasses are articulated and implemented with the Aya-Sankofa Group of Decolonial and Afrocentric Studies in Mathematics Education of the Agreste Academic Center of the Federal University of Pernambuco, linked to the mathematics teaching degree course and the postgraduate programme in education in science and mathematics.

In this excerpt, we present the results of a mapping of a study on African and Afro-diasporic knowledges in the proceedings of the National Meeting of Mathematics Education - ENEM oriented to an anti-racist approach and/or application of law

10.639/03, and discussions of formative experiences with mathematics teachers in initial and continuing education in the state of Pernambuco – Brazil, considering the teachers' knowledges and perceptions on African and Afro-diasporic mathematical knowledge.

In 2003, Law No. 10639 was enacted in Brazil and changed the Law of Guidelines and Bases for Education, a regulatory document for Brazilian education, making teaching and the presence of the theme Afro-Brazilian and African History and Culture mandatory. The signing of this law is the result of many years of struggle by Brazilian social movements, in particular, the Black Movement.

In this text, we use the expression “African Mathematical Knowledge” and similar statements to refer to the mathematical legacy originated and developed by the black African people in Africa and later in the African diaspora.

Based on notions posed by an Afrocentric pedagogy (Madhubuti, 1990; Asante, 2009), we inquired about the teaching and learning assumptions of mathematics and, thus, we chose to didactically denominate such reflections and experiences as Afrocentric mathematics education. In this sense, we turn our gaze to the deconstruction of a paradigm that validates scientific knowledge solely as a Eurocentric construct – scientific and academic Eurocentrism.

Regarding undergraduate mathematics teaching degree courses in Brazil, discussions on an Afrocentric approach to knowledges is still very beginner; positively, in recent years, there has been undergraduate teaching courses that bring this theme in their curriculum structure, however, this fact is not a reality in most of the courses that qualify teachers for teaching mathematics in basic education.

In the current Brazilian educational scenario, discussions in the context of initial and continuing teacher education on ethnic-racial relations and consequent disclosures for the constitution of a democracy-based education are an emerging need. Particularly, in the teaching and learning processes of mathematics and in the education of teachers who teach mathematics, studies and research on the African mathematical legacy of Africa and the diaspora are extremely necessary.

Discussions on topics such as Africanities, decoloniality, Eurocentricity and scientific epistemicide are scarce. Several researches work Cunha (2015) show that mathematics teachers are unaware of the history of mathematical knowledge, do not reflect on the subalternities of those knowledges, and do not feel to be included in this discussion. It is as if they believed that the math teacher has nothing to do with such themes and situations.

Hence, a project that expands and strengthens ethnic-racial issues within the university Munanga (2007), committed to fighting the dangers of a purely Eurocentric view of science - well solidified within the very mathematics-, becomes crucial. We must urgently deconstruct the idea that few Europeans created mathematics and that in Africa and the diaspora

countries, there is no valid scientific knowledge. Corroborating Giraldo, Fernandes, Matos and Quintaneiro (2019), it is worth challenging ourselves to unlearn to think from hegemonic references as unique and naturalised possibilities.

We chose as a theoretical framework the Afrocentricity paradigm, in which marginality and otherness imposed by Eurocentrism are rejected to demonstrate Africa's centrality in world history. (Asante, 2015). The core of this paradigm states that Africans must “operate as self-aware agents” of their history, taking as a starting point the “African culture” (Mazama, 2009, p.111). Mazama (2009, p.111) argues that “any idea, concept or theory, however ‘neutral’ it claims to be, constitutes the product of a particular cultural and historical matrix”. Therefore, as stated by Alves, Jesus and Scholz (2015), the Black-African civilising paradigm is believed to be constituted by the set of elements of the African cultural complex that will inscribe a civilising dynamic in Brazilian territory, even in the face of the dominant paradigm. In the following chapter, the reader can check out a brief discussion on Afrocentricity and education.

As Silva, Farias and Silva (2017) point out, Brazilian black social movements have struggled hard and systematically since 1950 to include the history of the African continent and the black people's struggle in Brazil. In 2003, Brazilian law 10.639, complemented by law 11.645, in 2008, established that Afro-Brazilian and Indigenous history and culture studies had to be included in public and private schools curriculum. In 2023, the law turns 20 years old and even after two decades of implementation, it is still not satisfactorily applied in the context of Brazilian schools. We feel it disturbing to find exact sciences teachers exempting themselves from applying a regulation that should be followed by all components of the school curriculum. All!

Once again, we draw attention to the fact that the mathematics teachers, with exceptions, seem not to have been formed and sensitised to implement proposals that strengthen the applicability of law 10.639/03 in mathematics classes. There is a shortage in the mathematics teachers' education that makes them, in many situations, believe that Africa has nothing to do with mathematics (Forde, 2017), uninformed of the history of mathematics that they should have been taught since their initial formation. At most, they come across Egypt as located in the African continent, but not with approaches that are consistent with their operation as self-aware agents of the ancestry of such knowledges. Valença (2018) points out that one of the roots of the lack of contextualisation and dialogue of the school curriculum is teachers' refusal to follow the guidelines of Law 10.639/03 on the school floor of the basic education.

In this theoretical essay, we emphasize that we will present two studies - in chapters four and five - within scope of the Aya-Sankofa Group and the project in reference, oriented towards understanding our challenges and possibilities for

an effective process of didactic implementations that can strengthen the practice of Afrocentric mathematics education in teacher education that reverberate with basic education.

2 The Aya-Sankofa Mathematics Education Group

The Aya-Sankofa Group began with actions triggered within the scope of the mathematics teaching degree course of the Agreste Academic Center– UFPE located in the municipality of Caruaru in the state of Pernambuco – Brazil. Alongside his academic activities, a professor of that course – and today one of the coordinators of the Aya-Sankofa Group – articulated a series of mini-courses, workshops, and lectures, both at the Agreste Academic Center - UFPE and several initial and continuing education actions with teachers who teach mathematics.

Such actions aroused in students the interest in researching games and didactic resources that enable, on the one hand, the strengthening of afrodiasporic thinking and, on the other hand, the constitution and experiences of valuable activities to approach mathematics in basic education. In September 2019, the research group was formally registered and approved in the Directory of Research Groups of Capes – Ministry of Education called Aya-Sankofa Group of Decolonial and Afrocentric Studies in Mathematics Education. Currently, the group is formed by higher education professors, basic education teachers, undergraduate, and postgraduate students.

The two studies we discuss and bring here to weave reflections are forged in the wake of the research and actions articulated by the group.

The general objective of the group is to develop research involving theoretical studies and didactic practices for mathematics teaching and learning in basic education and higher education guided by the perspectives of Afrocentric and decolonial studies for the construction of scientific knowledge, encouraging the association of master's/doctoral projects to increase the education of researchers and initial and continuing teacher education processes.

The results of those isolated and/or articulated studies will contribute to the advancement of theoretical and methodological knowledge on mathematics teaching and learning and may support teacher and student formation processes, contributing to a deconstruction of the Eurocentrist paradigm of mathematical knowledge.

The group's name was chosen in a democratic discussion among the participants, when two words that represent two different Adinkras symbols¹, Sankofa and Aya, were selected. Sankofa means the importance of returning to the roots and learning from the past, “return and learn from the past.” With

the energy carried by Sankofa, we will develop readings, studies, and discussions on the African mathematical legacy from Africa and the diaspora, and on the scientific epistemicide with a focus on scientific mathematical knowledges.

Another Adinkra symbol, Aya is a symbol of resistance, challenge against difficulties, perseverance, independence, and resourcefulness. Also known as a symbol of resources. In the shadow of Aya, we will discuss teacher education assuming the decolonial and afrodiasporic perspective. We will study and develop activities, games, African-based mathematical situations for formative experiences with teachers who teach mathematics and with students of basic education and higher education. We will also study the development of didactic resources for the floor of the mathematics classroom, oriented to the strengthening of ethnic-racial relations, and the experiences with prospective and in-service teachers with the resources studied and developed.

We want to highlight here some ongoing studies developed by members of the group, namely: Construction of a didactic proposal for understanding the mathematics involved in Capoeira Angola; Contribution of African games of the mancala family in the exploration of mathematical knowledges related to the final years of elementary school; Igba-ita game: African mathematical knowledge and ethnic-racial relations; Adinkras symbols to approach the concept of symmetry; Investigations with teachers in quilombola schools in Pernambuco; and the research *Enegegendo a matemática* (Darkening the mathematics) – the study of African games for mathematics teaching in partnership with students of the mathematics teaching degree course of the Federal Rural University of Pernambuco - UFRPE.

3 Afrocentricity, Afrocentric Education, and the Struggle for Recognition of the African Legacy

One of the main characteristics of Afrocentricity is the critique of European cultural and economic domination, the correction in repositioning the African as subjects of their own history, and the movement to found that concept in the cultural thought of classical Africa. (Asante, 2015). In the essay “Afrocentricidade como Crítica do Paradigma Hegemônico Ocidental: Introdução a uma Ideia”/Afrocentricity as a Critique of the Western Hegemonic Paradigm: Introduction to an Idea, the author gives essential references for the development and application of the Afrocentricity paradigm in several areas, such as education, political science, psychology, and Egyptology.

The researcher Molefi Kete Asante² (2015) offers us some reflections, focusing on the fact that the African influence on ancient Greece, the oldest European civilisation, was profound

¹ **Adinkras** are African symbols, developed by the Akan (a cultural group present in Ghana, Côte d'Ivoire, and Togo, West African countries), which stand out for the use of symbols to convey ideas.

² Molefi Kete Asante is a full professor in the department of African American Studies at Temple University in Philadelphia (USA), where he founded and implemented the first doctoral programme in African American Studies in the United States. He founded and curated the Museum of African Arts and Antiquity in Buffalo, NY.

and significant in art, architecture, astronomy, medicine, geometry, mathematics, law, politics and religion. However, several factors contribute to this influence not being revealed, which does not come to light.

Among these factors, we highlight the need to perpetuate domination over peoples and countries that some hegemonic groups consider inferior, disseminating that these peoples' cultures are inferior and underdeveloped. In school, since early childhood education, we are bombarded by a multitude of situations that make us believe in European supremacy and that nothing that exists before or outside the Western world can be taken into account. Focusing on mathematical knowledge, we bring as example research by Silva et al. (2017), which discusses that mental calculations have always been a tradition in Brazilians' daily lives. Notwithstanding, the school ignores that Africans have strongly influenced us in this aspect.

In a brief explanation, in the theory of Afrocentricity, Asante (2009) defines "Afrocentricity as a type of thought, practice, and perspective that perceives Africans as subjects and agents of phenomena acting on their own cultural image and according to their own human interests." (Asante, 2009, p.93). It should be noted that the texts on Afrocentricity encompass Africans from Africa and the African diaspora. (Santos Júnior, 2010) points out that Afrocentricity consists of a paradigm, an epistemic proposal, and a method that seeks to face any phenomena through a key concept, the concept of location, which will promote the agency of African peoples in favour of human freedom. Lima, Reis and Silva (2018) reaffirm that Afrocentricity should not necessarily be considered synonymous with the assumption of some African customs. The Afrocentric approach recognises black people as epistemic subjects (Lima et al., 2018).

In Lima (2020), the author highlights the emergence of the theory of Afrocentricity as a fruitful epistemological field for black and non-black researchers and intellectuals who are interested in deconstructing hegemonic approaches and establishing a dialogue through other epistemologies, without assuming for themselves impositions of a unique, absolute, and universal epistemology.

Another fundamental feature that I want to highlight in this text is that Afrocentricity is not a black version of Eurocentrism Asante (1988) so we do not use the term Afrocentricism. Eurocentrism imposes its reality as a universal truth and induces a belief that all non-whites are seen as a specific group, therefore, as non-human (Santos Júnior, 2010). On the contrary, Afrocentricity establishes a perspective that the existence of pluralism of cultures without hierarchy is possible, but this requires cultural equality and respect. The following passage further clarifies this issue,

No one can take away Europe's gifts, nor should this ever be an objective of study, but Greece cannot impose itself as a universal culture that has developed entirely out of thin air without the foundations it has received from Africa. (Asante,

2015, p.107).

As Asante (2015) points out, starting a discussion about the ancient world only in 800 BC is certainly poor knowledge. The ruling classes always seek to promote and maintain the mythologies that justify their domination. In most cases, knowledge is built on knowledge and through African-American studies and research, it is possible to articulate that the Greeks learned from the Egyptians. This is exactly what Cunha (2015) describes in the following excerpt.

the denial of the scientific and technological past of African peoples and the exacerbation of their "playful character" was one of the main achievements of Eurocentrism and that still today strongly undermines the self-esteem of the African population and the diaspora, because the "methods," "concepts," and many European scientists gave the impression to the rest of the world that African populations did not have a relevant contribution to the construction of universal knowledge. (Cunha, 2015, p.7).

As we see, a historical and epistemic review is urgently needed, including on mathematical knowledge, to crack the "assumed official history of humanity." (D'Ambrósio, 2008) and (Nascimento, 2009) indicate the misappropriation of African cultural heritage by Greco-Roman civilisation. This movement of scientific contestation is strengthened by scientists and historians dedicated to bringing forward crucial issues regarding the evils caused by the Eurocentric vision of knowledge, as, for example, Cheikh Anta Diop and Kabengele Munanga.

The Eurocentric hegemony so pervaded in our society contributes to racist attitudes and practices, and consequently, ends up impacting educational practices, with significant social damage. Lima et al. (2018) advocate that Eurocentric hegemony is present in educational studies, making other theoretical perspectives invisible.

Madhubuti (1990) adds that an Afrocentric education is necessary to support the line of resistance to these conditions. Still corroborating Madhubuti (1990) with an African-American education, it is possible to produce an education that contributes to achieving pride, equity, power, wealth, and cultural continuity for Africans in America and other countries. In the logic of Afrocentric education, Nascimento (2020) discusses collectivity as an undoubted characteristic in the construction of knowledge. The author points out that Afrocentric education highlights as important the need for African and Afro-diasporic logics to be resumed as the centre of an educational experience and, thus, "relationships are developed in horizontal contexts, and exchanges are a constant stimulus to the collective construction of knowledge" (Nascimento, 2020, p.35).

In one of his studies with African-American children, Madhubuti (1990) asks us what characteristics would be necessary for informal experiences with mathematics to share sufficient attributes of formal school mathematics that can serve as a basis for learning in school. Thus, we ask:

How to expand the knowledge for the teachers' mathematics teaching and enable the work with mathematics based on the principles of an Afrocentric education? We do not want to have all the answers here, but to encourage this displacement, an epistemic and political displacement, because it also proposes confronting the consequences of Eurocentrism and the perverse processes of coloniality.

4 African Mathematical Knowledge in the Articles of the Proceedings of the National Meeting of Mathematics Education

The mapping and discussion presented here sought to answer two specific questions “What has been discussed in the productions published in the proceeding of ENEM about mathematics teaching and learning, based on the discussion of African history and culture over the past events?” and “How have these productions debated mathematical knowledge with Afrocentric and anti-racist contours?” From these questions, we decided to analyse the scientific communications published in the proceedings of the six most recent editions of ENEM.

We chose the documents published in ENEM, assuming primarily their relevance to mathematics education. We also took into account that ENEM has had an increasing amount of research published each edition. Therefore, wishing for the feasibility of analysis and consistency with the year of publication of Law 10.639/03, we decided to explore the last six published proceedings. From those proceedings, to have better uniformity, we chose to analyse only scientific communications, thus disregarding mini-courses, workshops, posters, lectures, and round-tables.

Searching for keywords, we found 199 scientific communications. We observed that those found through the words “Afro,” “Africano,” “Africana,” and “África” refer to studies focused on African knowledge or law 10639/03. Those obtained through “História”, “Histórico”, “Histórica,” and “Legado” (legacy) are related to publications with the theme of History of Mathematics. Articles with more than one of those keywords were also collected, thus comprising all texts that fit the assumptions established.

Searching for elements that denounced the theme worked in each communication, we read the abstracts or introduction of the 199 articles. We searched again for the keywords, this time throughout the text. The terms searched were: África, Africano, Africana, Afro and Egito. Thus, 36 articles were mapped with words referring to African knowledge or Africa and its diaspora.

Through this reading, we identified 18 articles that contained the keywords we needed but had another type of discussion and perspective. For example, several communications use the Egyptian pyramids as a scenario to problematise activities to work with spatial geometry. Others use Africa as the place where history and mathematical knowledge are

addressed; however, there are no indications of an anti-racist education perspective or work with law 10.639/03. Thirteen articles refer to the African continent, citing it as a place of passage for mathematicians³, or treating it as an environment of mathematical curiosities. Those works cite Africa only as a textual curiosity, unrelated to the theme addressed in that article, or Africa is presented only as a place where a given fact occurred, unrelated to any specific knowledge. Some of them, for example, discussed mathematics teaching through the history of mathematics in class, with citations of concepts developed in Egypt – but disconnected from the relationships we were looking for.

We do not want to interfere in the objectives of the studies of those articles, but only indicate the screening criterion we used according to the object intended with the mapping. We emphasise that all communications have their singularities and objectives, and we do not seek to disqualify them. With their partial or complete research results, such articles support and embody other fields involving mathematics education in all its plurality.

Finally, we verified the congruence of five articles published with our mapping focus about a debate as strengthening the anti-racist struggle through mathematics in the classroom, which can contribute to the paradigm of an Afrocentric education.

In the editions of IX ENEM – year 2007, VIII ENEM – year 2004, XII ENEM – year 2016, and XI ENEM – year 2013, there were no scientific communications with the criteria defined in this mapping. Table 1 shows the list of articles selected.

Table 1 - Articles related to African mathematical knowledge as a discussion of African history and culture in mathematics teaching and learning as a proposition of an anti-racist and Afrocentric education

Titles	Authors	Year
A abordagem da história e da cultura afro-brasileira pelos professores de matemática: o papel dos livros didáticos. / Mathematics teachers' approach to Afro-Brazilian history and culture: the role of textbooks.	Fares Frades Coêlho; Wanderleya Nara Gonçalves Costa.	2010
O ensino e aprendizagem de matemática em afroperspectiva: os anos iniciais do ensino fundamental pensado para além dos rituais instituídos. / The teaching and learning of mathematics from an Afroperspective: the initial years of elementary school thought beyond the established rituals.	Erivelton Thomaz; Barbara Thees.	2019

3 In this case, we use “mathematicians” for both genders, because the communications also refer to female characters.

Titles	Authors	Year
O jogo africano mancala como semeador de uma educação antirracista, decolonial e intercultural na escola pluricultural odé kayoed. / The African game mancala as seeder of an anti-racist, decolonial, and intercultural education in the multicultural school odé kayoed.	Adriana Ferreira Rebouças Campelo; Devaneide Souza Barbosa; José Pedro Machado Ribeiro.	2019
Abordagens geométricas em estamparias afro-brasileira: um estudo etnomatemático. / Geometric approaches in Afro-Brazilian prints: an ethnomathematical study.	Élida de Sousa Peres; Erasmo Borges de Souza Filho.	2019
O movimento social negro e a promulgação da lei 10.639/03: possibilidades para o ensino da matemática de forma a valorizar a história e cultura afro-brasileira e Africana. / The black social movement and law 10.639/03: possibilities for mathematics teaching to value Afro-Brazilian and African history and culture	Devaneide Barbosa de Sousa; Adriana Ferreira Rebouças Campelo ;Cleibiane Rodrigues dos Santos; Kêite Ferreira de Almeida; Roberto Barcelos Souza.	2019

Source: research data.

The article “A abordagem da história e da cultura afro-brasileira pelos professores de matemática: o papel dos livros didáticos”/Mathematics teachers’ approach to the Afro-Brazilian history and culture: the role of the textbooks by Coêlho and Costa (2010) - X ENEM presents a reflection on the fact that curricular guidelines or laws do not imply a direct change in school practices and routines. They can even bring discomfort among mathematics teachers as the lack of support represented in textbooks is evident. The authors conducted a study with teachers of public and private school institutions in the city of Barra do Garças - MT, through which they sought to detect whether the textbooks used by them could support them in complying with the guidelines given by law 10.639/03 and 11.645/08. Coêlho and Costa (2010) conclude that, given the lack of textbooks that can support the mathematics teacher, it is necessary, at least for the time being, to think of alternative actions, even if necessary, the didactic-pedagogical support that the textbooks, in part, represent.

In the XIII ENEM, in 2019, the text “O Ensino e aprendizagem de matemática em afroperspectiva: os anos iniciais do ensino fundamental para além dos rituais instituídos”/The teaching and learning of mathematics from an Afroperspective: the initial years of elementary school thought beyond the established rituals, by Thomaz and Thees (2019), discusses the approach of Afroperspective in the initial years of elementary school. The authors aimed to present to the teachers participating in the research the possibilities of the Afroperspectivity as a methodology for the mathematics classes so that learning becomes an event. As the most relevant

teachers’ knowledge, the authors highlight the possibility of a didactic cultural reordering that can lead us to a paradigm that has been little discussed in academia and schools, the African paradigm of childhoods (ethnosemantics). Thomaz and Thees (2019) conclude by discussing that games and plays must cease being appendages in school, assuming their protagonism in the construction of an Afroperspectivist place for teaching and learning mathematics with children, which requires a path consisting of multiple and interpenetrated paths, involving a pluriversal, poly-rational, and anti-dogmatic methodology for the development of proposals that comprise cosmosenses experienced at school, having childhood as a possible horizon.

The article “O jogo africano mancala como semeador de uma educação antirracista, decolonial e intercultural na Escola Pluricultural Odé Kayodê”/The African game mancala as seeder of an anti-racist, decolonial, and intercultural education at Escola Pluricultural Odé Kayodê, by Campelo, Barbosa and Ribeiro (2019), aimed to understand how the game mancala contributes to an anti-racist, decolonial, and intercultural education at Escola Pluricultural Odé Kayodê, located in the city of Goiás/GO, Brazil. In this study, the authors, in the light of law 11.645/08 - which complements Law 10.639/03 - reflect on children’s practice with that game. According to the authors, in the teaching and learning process at Escola Pluricultural Odé Kayodê, the game mancala is useful as an important didactic resource that, because it is dynamic, enables working mathematics in a more attractive and challenging way. Campelo et al. (2019) state that the game is directly linked to logical reasoning and is able to contribute to the evolution of abstract thinking for effective knowledge, and, at the same time, it is notorious that recognising the presence of mathematics in an African game contributes to the construction of our identity, valuing those who have been marginalised from the process of knowledge construction.

The fourth study is entitled “Abordagens geométricas em estamparias afro-brasileira: um estudo etnomatemático”/ Geometric approaches in Afro-Brazilian prints: an ethnomathematical study, by Peres and Souza Filho (2019). The authors propose to establish the transversality in the teaching of mathematics to revitalise the relevant contributions of African peoples to the formation of our society. The study aimed to show the mathematical knowledge in Afro-Brazilian prints, in the mathematics teaching and learning process, in a contextualised way. According to the authors, we sought to give visibility to Afro-Brazilian history and culture from an ethnomathematical point of view, assuring us that it is possible to tread different paths for mathematics teaching, relating it to effective social practices and, why not say, directed to social transformation. Peres and Souza Filho (2019) approached the teaching of geometry from Afro-Brazilian prints, allowing us to know the culture and history of a people that for many years was made invisible by a Western society that has always sought to devalue the culture of blacks and indigenous people. They discussed the history that has not been told and that we

need to recognise as part of our formation, reestablishing ties with our past for the recognition of the diversity that makes up this country, especially the respect for the history left by our ancestors.

The last article is entitled “O movimento social negro e a promulgação da lei 10.639/03: possibilidades para o ensino da matemática de forma a valorizar a história e cultura afro-brasileira e Africana”/The black social movement and law 10.639/03: possibilities for mathematics teaching to value Afro-Brazilian and African history and culture, written by Sousa, Campelo, Santos, Almeida and Souza (2019). This research deals with a bibliographic investigation that sought answers to the following questions: How are black social movements seen in the enactment of Law 10.639/03? Is it possible to teach mathematics, valuing the teaching of Afro-Brazilian and African history and culture, and how can the teacher contribute to the inclusion of this theme? In the research findings, five articles related to the problematisation proposed were found. We can see that there are many possibilities to teach mathematics, valuing Afro-Brazilian history and culture, and reinforcing black identity through the law in question. However, as the authors state, there is a need to articulate the black movement as a driver of this advance, to intensify the role of social movements in building a more equitable and just society. In the analysis of the teachers’ practices in the material under study, Sousa et al. (2019) state that the educators’ concern with inserting content about the inclusion of the history and culture of the African and Afro-Brazilian population in pedagogical practices was explicit. However, they evidenced that this insertion was by the “obligation” of the law in the curriculum, which confirms the delegitimisation of African culture during a long historical process, and how much the black movement has been helping to reconstruct black identity in our country. Although Law 10.639/03 is a reflection of the claims of the black movement, the articles presented were little grounded on the struggle of this movement for the promulgation of the law, making evident the lack of teachers’ formation and/or awareness in relation to social movements as sources and agencies of knowledge production and, even more, the importance of qualifying citizens who fight for rights and for a more just and egalitarian society.

With the studies seen, we point out that, according to the results and discussions presented by the authors, it is possible to raise such discussions in mathematics teaching and learning, from the classroom to teacher education. In the articles above, we find a more systematised discussion, in which there is clearly an engagement of the authors in strengthening a mathematics teaching and learning to form teachers who teach this curricular component, to promote an anti-racist education, and against the devaluation of the knowledge of the black people in science, through African and Afro-Brazilian culture and history.

We emphasise that, at this moment, what we present here is

an excerpt with the limitations of the methodological proposal, in which we focus only on the scientific communications of the last six editions of ENEM, which does not mean the potential of all the productions and research carried out by the mathematics education community. Considering this, we believe that, in an event aimed at teachers who teach mathematics, the more works in the various modalities we have on legacy, history, and African and Afro-Brazilian culture, the more we will contribute so that the wall of the West does not prevent us from seeking, knowing, and making various connections to reframe our mathematical and didactic practices.

5 Teachers’ Perceptions of Mathematics and Africanity in Formative Experiences with In-Service and Prospective Mathematics Teachers

In this section, we discuss the perceptions of a group of teachers when participating in continuing education workshops on mathematics and Africanities. The purpose of this work emerged as the need to cope with formative processes that do not yet encompass an Afrocentric approach. As a method, we developed formative workshops with four different groups consisting of in-service and prospective teachers who teach mathematics in the state of Pernambuco in 2019. In total, the workshops involved 55 participants distributed among teachers in initial education (20 participants), that is, undergraduate mathematics students and graduated in-service teachers (35 participants).

The workshops were built to initially collect data concerning teachers’ conceptions about the constitution of African mathematical knowledge and legacy and subsequently experience a game of African origin – the Igba-Ita of the Igbo people of Nigeria, which was adapted as a didactic resource to strengthen African identity bonds. In both moments, the interaction in the workshops took place in a dialogic way with space for speeches and debates. We used theoretical excerpts and research results to permeate the discussions and contribute to re-signifying theoretical and practical perspectives concerning mathematics teaching and learning.

At first, participants were asked about who they considered the great heroes of mathematics in the classroom and their conception of the purpose of mathematics teaching in basic education. The teachers’ reflection during the meetings helped us to understand the perceptions and ideas that circulated during the formative meetings. In light of the principles defended by Zeichner (1998), the speeches, thoughts, and individual positions can be interpreted as a manifestation of the growth of each teacher in the formative group.

In this sense, the data, constituted by the register of discussions, pointed out that teachers still have a gap with regard to knowledge about the African mathematical legacy. In most of the teachers’ discourses, we identified examples that strengthen the erroneous notion that, for example, mathematical knowledge was constituted by a few Europeans

such as Pythagoras and Tales de Mileto, the most cited mathematicians by the teachers in initial education or in-service teachers.

Another finding is that the participating teachers do not refer to mathematics originated and developed in Africa. However, some cite the pyramids of Egypt unrelated to the black people who contributed to the systematisation of such knowledge. This result was similar to some of the articles found in the mapping of the previous study, in which facts or places in Africa are cited only as a geographical context.

In the collective debate on the contributions of African knowledge to the development of mathematical concepts, one of the teachers⁴ points out:

On the historical question of rational numbers, I did not know, but by researching, I discovered that it came about because the Nile River rose, and people could not figure out the limits of their lands. So, the scribes spent time studying to be able to divide the parts, but there was always some part lacking, that is the question of the fraction. The influence occurs when you bring the student the historical concept, show him why you studied mathematics, and that people studied to solve everyday problems. (Teacher Vitalino).

Teacher Vitalino makes a citation about the Nile River and the relationship with the epistemology of the concept of rational numbers. He mentions that people there studied mathematics to solve everyday problems, however, there is no more specific guidance concerning African knowledges in mathematics. Of course, from the teacher's statements and the gaps in education that we have already pointed out, our proposal was to expand knowledge on this theme. Below we present two more of the participants' statements with other perceptions.

We teachers see those contributions in formation, but at school, we do not see nor work with them. In the formation we have the discipline of History of Mathematics, but what we take to the classroom in high school and elementary school in public schools, we cannot work those contributions, even if the teachers want to. There is a schedule to follow, we teach as the government requires us to. The government wants results from the large-scale assessments at the end of the year, so we work according to the descriptors, throughout high school, always focusing on the descriptors. (Teacher João)

In fact, prejudice is so great that some people think that Egypt is a country apart from the African continent, but it is located in northeast Africa. In a study I did on the Pharaohs' dynasties, I realised that the former were all black. So, the tale that the Egyptians were white is false, who did the mathematics was the Egyptian people, along with the black and African people. This mathematics that we are studying today was not done by whites, nor by Europe, African culture did it. (Teacher Dandara).

In the excerpt taken from teachers João's and Dandara's statements, we observed that the first teacher points out that there is a discipline of History of Mathematics, but unrelated to what they address in class, because the schedule is tight

and focused on institutional assessment. The second teacher discusses Egypt's cultural displacement and says that when the country is mentioned, they ignore that Egypt is an African country. Teacher Dandara hits harder on the positioning of the blackness of the Egyptian people and the scientific epistemicide (Santos, 1997) practised against the black people.

During the teachers' conversation, we encouraged reflection on their knowledge regarding didactic resources and/or didactic proposals of African and/or Afro-diasporic nature for teaching mathematics. The teachers highlighted games such as Mancala, as we can see in the following statement: *I have worked with my students and realised that Mancala has made teaching more interesting* (teacher Tião). However, the participating teachers do not bring a diversity of suggestions, which makes us reflect on the systematic denial of access to those resources in teacher education courses.

As previously mentioned in one of the teachers' statements, the gaps that in-service and prospective teachers show are directly related to the curricula of the initial education courses, in our case, the mathematics teaching degree course. When conducting a study with the syllabus of undergraduate courses in mathematics, Santos and Souza (2018) discuss that,

we can infer that the Pedagogical Project of the Mathematics Degree Course (re)produces pedagogical discourses that keep teachers in formation trapped in discursive and ideological formations of Eurocentric civilising frameworks, preventing them from accessing other reading gestures and interpretation of discourses that are also part of their history. (Santos & Souza, 2018, p.25).

Thus, we believe that a reliable and suitable approach to mathematical knowledge in class should consider the African mathematical legacy. Also, to confront Eurocentric approaches that do not contribute to the recognition of African and Afro-Brazilian identities. The students' and teachers' school trajectory is marked by the marginality of their own Afro-diasporic history and culture, being stopped from experiencing, as Lima states (2020, p.9), "the Afrocentric experience as individual, cultural, psychological, educational, and social self-appreciation."

6 Conclusions

Nowadays, particularly in the Brazilian context, it is important to value activities with in-service and prospective mathematics teachers to have them recognise their roots and strengthen their cultures, and, no less important, make them acquire a meaningful understanding of the origins of mathematical knowledge, acknowledging Africa as the golden cradle of mathematics.

We emphasise, for example, that the western way of counting is not the only one, and different peoples and civilisations have developed particular methods of solving mathematical problems, until today used by different peoples (Silva et al., 2017). As Cheikh Anta Diop underscores,

4 We used fictitious names to identify teachers; we opted for names that have a strong relationship with the state of Pernambuco.

Pythagorean mathematics, the theory of the four elements of Thales of Miletus, Epicurean materialism, Platonic idealism, Judaism, Islam, and modern science have their roots in the African cosmogony and science of Egypt (Nascimento, 2007).

The mapping of articles in the proceedings of the National Meeting of Mathematics Education - ENEM allowed us to understand the trajectory that some teachers and researchers have followed, particularly with the five articles chosen. By presenting the different methods and proposals of these studies, we want to highlight concrete possibilities of contours of an Afrocentric mathematics education, of anti-racist perspectives in the mathematics classroom, with students and teachers experiencing positive experiences of ancestry, identity, and appreciation of scientific and technological knowledge of the black people.

From the immersion in the formative workshops with in-service and prospective mathematics teachers and the experience of didactic approaches that locate African knowledges from Africa and the diaspora, we believe that there are ways to confront racism, including through historical and cultural recognition of the legacy of the black people in science. For Nascimento (2009), an Afro-Brazilian approach will collaborate to the transmission from generation to generation of Afro-Brazilian beliefs, habits, knowledges, and values without guilt, fear, and distancing.

We reaffirm that knowing, discussing, and reflecting in spaces of initial and continuing education can enable a rebalancing in our methodological proposals for the construction of mathematical knowledge on the classroom floor, resonating in the constitution of democratic spaces and more conscious citizens regarding issues of black identity and racism.

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