Geometric thinking, art and racial issues in early childhood education: decolonial pedagogical possibilities and practices

Pensamiento geométrico, arte y cuestiones raciales en la educación infantil: posibilidades y prácticas pedagógicas decoloniales

Pensée géométrique, art et enjeux raciaux dans l'éducation de la petite enfance: possibilités et pratiques pédagogiques décoloniales

Pensamento geométrico, arte e questões raciais na educação infantil: possibilidades e práticas pedagógicas decoloniais

Ariene Vitalino da Silva[1]
Municipal Department of Education of Rio de Janeiro (SME-RJ)
Master of Education
https://orcid.org/0000-0003-4656-2896

Bruno Gonçalo Penedo Souza[2]
Universidade do Estado do Rio de Janeiro (UERJ)
Bachelor of Science in Mathematics
https://orcid.org/0000-0003-4209-2321

Gabriela dos Santos Barbosa[3]
Universidade do Estado do Rio de Janeiro (UERJ)
Ph.D. in Mathematics
https://orcid.org/0000-0003-4442-6022

Abstract

In this article, we present and discuss data from a research that proposed to investigate the construction of geometric thinking by black children from favelas in Early Childhood Education, in the favela of Maré, municipality of Rio de Janeiro, in a decolonial perspective, from the point of view of art.. More specifically, we develop and analyze activities that favor the construction of geometric thinking, using Tarsila do Amaral's Self-Portrait as its main resource. The method used was action research. We conclude that children are extremely capable of analyzing, naming, relating and differentiating geometric shapes with the elements found on Tarsila do Amaral's canvas and on objects that are part of everyday life, including the

[1] vitalino1603@gmail.com
[2] bruno-penedo@hotmail.com
[3] gabrielasb80@hotmail.com

body itself. We also found that the teaching strategy based on pedagogical projects with an interdisciplinary bias makes it possible to validate a curriculum that permeates geometry and art, promoting enriching dialogues for the integral learning of children. These actions, in turn, provided didactic actions based on decoloniality and its consequences. The observation and analysis of the Self-Portrait led us to reflect on Afro culture and the construction of black identity in an affirmative way, favoring children's protagonism.

Keywords: Geometric thinking; Child education; Afro culture; Decoloniality**.**

Resumen

En este artículo, presentamos y discutimos los datos de una investigación que se propuso investigar la construcción del pensamiento geométrico de niños negros y de la favela en Educación Infantil, en la favela de Maré, municipio de Río de Janeiro, en una perspectiva decolonial, desde el arte Más específicamente, desarrollamos y analizamos actividades que favorecen la construcción del pensamiento geométrico, utilizando como recurso principal el Autorretrato de Tarsila do Amaral. El método utilizado fue la investigación acción. Concluimos que los niños son extremadamente capaces de analizar, nombrar, relacionar y diferenciar las formas geométricas con los elementos que se encuentran en el lienzo de Tarsila do Amaral y en los objetos que forman parte de la vida cotidiana, incluido el propio cuerpo. También encontramos que la estrategia didáctica basada en proyectos pedagógicos con sesgo interdisciplinario permite validar un currículo que permea la geometría y el arte, promoviendo diálogos enriquecedores para el aprendizaje integral de los niños. Estas acciones, a su vez, proporcionaron acciones didácticas basadas en la decolonialidad y sus consecuencias. La observación y análisis del Autorretrato nos llevó a reflexiones sobre la cultura afro y la construcción de una identidad negra de forma afirmativa, favoreciendo el protagonismo infantil.

Palabras clave: Pensamiento geométrico; Educación Infantil; Cultura afro; Decolonialidad.

Résumé

Dans cet article, nous présentons et discutons les données d'une recherche qui a proposé d'étudier la construction de la pensée géométrique par les enfants noirs et des favelas dans l'éducation préscolaire, dans la favela de Maré, municipalité de Rio de Janeiro, dans une perspective décoloniale, à partir de l'art. Plus précisément, nous développons et analysons des activités qui favorisent la construction de la pensée géométrique, en utilisant l'Autoportrait de Tarsila do Amaral comme ressource principale. La méthode utilisée était la recherche-action.

Nous concluons que les enfants sont extrêmement capables d'analyser, de nommer, de relier et de différencier des formes géométriques avec les éléments trouvés sur la toile de Tarsila do Amaral et sur des objets qui font partie de la vie quotidienne, y compris le corps lui-même. Nous avons également constaté que la stratégie d'enseignement basée sur des projets pédagogiques avec un biais interdisciplinaire permet de valider un curriculum qui imprègne la géométrie et l'art, favorisant des dialogues enrichissants pour l'apprentissage intégral des enfants. Ces actions, à leur tour, ont fourni des actions didactiques basées sur la décolonialité et ses conséquences. L'observation et l'analyse de l'Autoportrait nous ont amenés à des réflexions sur la culture afro et la construction d'une identité noire de manière affirmative, privilégiant le protagonisme des enfants.

Mots-clés: Pensée géométrique ; L'éducation des enfants; Culture afro; Décolonialité.

Resumo

Neste artigo, apresentamos e discutimos os dados de uma pesquisa que se propôs a investigar a construção do pensamento geométrico por crianças negras e faveladas na Educação Infantil, na favela da Maré, município do Rio de Janeiro, em uma perspectiva decolonial, a partir da arte. Mais especificamente, desenvolvemos e analisamos atividades que favorecem a construção do pensamento geométrico, tendo como principal recurso a obra *Autorretrato* de Tarsila do Amaral. O método empregado foi a pesquisa-ação. Concluímos que as crianças são extremamente capazes de analisar, nomear, relacionar e diferenciar as formas geométricas com os elementos encontrados na tela de Tarsila do Amaral e nos objetos que fazem parte do cotidiano, entre eles o próprio corpo. Constatamos também que a estratégia de ensino pautada nos projetos pedagógicos com viés interdisciplinar possibilita validar um currículo que perpassa a geometria e a arte, promovendo diálogos enriquecedores à aprendizagem integral das crianças. Essas ações, por sua vez, oportunizaram ações didáticas baseadas na decolonialidade e seus desdobramentos. A observação e análise do *Autorretrato* nos conduziu a reflexões sobre a cultura afro e à construção da identidade negra de forma afirmativa, favorecendo o protagonismo infantil.

Palavras-chave: Pensamento geométrico; Educação Infantil; Cultura afro; Decolonialidade.

Geometric thinking, art and racial issues in early childhood education: decolonial pedagogical possibilities and practices

This present work aims to investigate the construction of geometric thinking by black and favela-dwelling children in Early Childhood Education in the Maré favela, municipality of Rio de Janeiro, from a decolonial perspective through art. More specifically, we have developed and analyzed activities that foster the construction of geometric thinking, using Tarsila do Amaral's *Autorretrato* as a primary resource.

Considering that the experiences children have in early childhood will form fundamental structures for their lifelong development, it becomes essential to think about an educational proposal to construct geometric thinking in the initial stage of basic education, aiming for decoloniality. Thus, the importance of Early Childhood Education goes beyond mere care.

When the school considers the potential of children, it should not focus solely on processes involving writing and oral language, neglecting other areas of knowledge, including mathematical language, with attention to the development of geometric thinking. It is pertinent to explain that geometric thinking encompasses the spatial relations and representations that children develop from a very young age. As Muniz (2013, p. 2) states, geometric notions also involve "the development of spatial awareness, spatial competence, recognition of one's own body, and increased perception of shapes and figures around them."

Muniz (2013) highlights the importance of teaching geometry in Early Childhood Education, starting from basic processes such as observation and investigation of space and the body, and progressing to manipulation, ordering, and representation of figures and forms. Through these experiences, children construct ways of representing the world. According to Smole et al. (2003, p.17), an educational approach to teaching geometry must simultaneously address three aspects for the development of geometric thinking: "the organization of the body scheme, spatial orientation and perception, and the development of geometric notions." This is an important path to be progressively traversed.

Lorenzato (2006, p. 43) understands the construction of geometric concepts in early childhood as a transition from "experienced space to thought space." In the former, the child observes, manipulates, decomposes, and assembles, while in the latter, they operationalize, constructing an internal space based on reasoning. In other words, they build these concepts through experiences that allow them to move from the concrete to initiate a process of abstraction through handling and observation.

In this sense, it is of utmost importance that the teacher proposes to children different engaging games that problematize and enrich their geometric knowledge. According to the National Curricular Reference for Early Childhood Education:

"Children explore the space around them and progressively, through perception and greater coordination of movements, discover depths, analyze objects, shapes, dimensions, and mentally organize their movements. Gradually, they also anticipate their movements, being able to represent them through drawings, and establishing contour and proximity relationships. A rich experience in this field enables the construction of broader mental reference systems that allow children to narrow the relationship between the observed and the represented" (RCNEI, 1998, v. 3, p. 216).[4]

Reinforcing these principles, the National Common Curricular Base (Base Nacional Comum Curricular – BNCC - in Portuguese) also emphasizes the importance of playfulness for the development of a specific vocabulary associated with notions such as inside and outside, front and back, and for the development of visuomotor coordination, which consists of the ability to control hand movement guided by vision: "move your body in space, orienting yourself by notions such as in front, behind, on top, below, inside, outside, etc., engaging in play and activities of different natures" (BRASIL, 2019, p. 47)[5].

Thus, when developing activities for children, we consider the great learning potential of Early Childhood Education, considering that "each moment constitutes experiences, searches, experimentation, discoveries, taking into account that the child has its own characteristics, needs, and unlimited possibilities for development" (Nicolau, 1990, p. 49). In the school routine, specifically in classes, we seek to identify how they compare, analyze, measure, and name geometric shapes.

Although we are focusing on the construction of geometric thinking, we never lose sight that the activities should compose an educational proposal that recognizes and validates the integrity of children, contributing to their lives in different aspects, expanding their knowledge of the world, their different languages (verbal, written, artistic, mathematical, among others), and the construction of their identities in a constant debate about social order. Therefore, in

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[4] In the original: "As crianças exploram o espaço ao seu redor e, progressivamente, por meio da percepção e da maior coordenação de movimentos, descobrem profundidades, analisam objetos, formas, dimensões, organizam mentalmente seus deslocamentos. Aos poucos, também antecipam seus deslocamentos, podendo representá-los por meio de desenhos, estabelecendo relações de contorno e vizinhança. Uma rica experiência nesse campo possibilita a construção de sistemas de referências mentais mais amplos que permitem às crianças estreitarem a relação entre o observado e o representado" (RCNEI, 1998, v. 3, p. 216).
[5] In the original: "deslocar seu corpo no espaço, orientando-se por noções como em frente, atrás, no alto, embaixo, dentro, fora etc., ao se envolver em brincadeiras e atividades de diferentes naturezas." (BRASIL, 2019, p. 47).

addition to mathematical educators discussing geometric thinking, we also seek theoretical support in decolonial pedagogy.

The decolonial perspective was chosen because we believe that more than an "other" way of thinking is needed. It is necessary to adopt an "other[6]" practice, and this happens when educators act in an insurgent manner. Practices deeply rooted in schools that invisibilize and silence black and favela-dwelling children, disregarding their sociocultural knowledge, are still very present (Oliveira & Candau, 2010). According to Walsh (2017), decoloniality urges us to denaturalize such practices and challenges us to act from the gaps as a place of possibility for individuals who have been silenced by coloniality to become protagonists in the teaching and learning process.

For Gomes (2017), it is possible to find black voices and bodies that work towards overcoming racism and affirming the identity, values, work, culture, and life of the black population through education. Such practices and interventions are carried out by the Black Movement, a movement of black individuals aiming to break free from oppression through emancipatory actions. This reinforces Candau's (2011) ideas when she argues that issues related to differences are inseparable from educational practice because they are present in everyday school life. This led us to conduct a case study in an Early Childhood Education class in a public school located in a favela. To present our research, we organized the text into three stages. Initially, we discussed the importance of geometric thinking and its relationship with mathematics education focused on the early years. Next, we presented theoretical discussions on racial issues and black childhoods from the perspective of decolonial pedagogy. Finally, we concluded with the description and analysis of the activities comprising the pedagogical proposal developed with children in an Early Childhood Development Center in the Maré Complex, located in the municipality of Rio de Janeiro.

Geometric Thinking

This section is dedicated to presenting the study on the construction of geometric thinking based on the Van Hiele Theory, which originated from the research conducted by Dina van Hiele-Geldof and her husband, Pierre van Hiele, during their doctoral studies at the University of Utrecht, Netherlands, in 1957. Dina, in her research, proposed activities to

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[6] "Pensamento-outro" (other thinking) comes from the Arab-Islamic author Abdelkebir Khatibi, who starts from the principle of the possibility of thinking from decolonization, meaning the struggle against non-existence, dominated existence, and dehumanization. It is a perspective similar to the one proposed by the concept of the coloniality of being, a category that serves as a force to question the historical denial of the existence of non-Europeans, such as Afro-descendants and indigenous people in Latin America.

facilitate children's learning, while Pierre focused on understanding the difficulties students faced in the process of learning Geometry (Villiers, 2010). The main feature of the Van Hiele theory is a model for understanding geometry teaching in a sequence of levels that distinguish the learning phases presented in Table 1.

Table 1.

Levels of understanding in the Van Hiele model.

NÍVEIS DE COMPREENSÃO	CARACTERÍSITICAS
NÍVEL 1 - Visualização ou Reconhecimento	- Reconhece visualmente uma figura geométrica; - Tem condições de aprender o vocabulário geométrico; - Não reconhece ainda as propriedades de identificação de uma determinada figura
NÍVEL 2 – Análise	- Identifica as propriedades de uma determinada figura; - Não faz inclusão de classes.
NÍVEL 3 - Dedução Informal ou Ordenação	- Já é capaz de fazer a inclusão de classes; - Acompanha uma prova formal, mas não é capaz de construir outra.
NÍVEL 4 - Dedução Formal	- É capaz de fazer provas formais; - Raciocina num contexto de um sistema matemático completo.
NÍVEL 5 – Rigor	- É capaz de comparar sistemas baseados em diferentes axiomas; - É neste nível que as geometrias não-euclidianas são compreendidas.

Source: Nasser e Sant'anna (2010).

It is possible to perceive the proximity between the development of children in Early Childhood Education and the characteristics described in levels 1 and 2 of understanding. After all, at this level of education, children curiously observe, identify, and analyze the world around them. However, before relating the levels of understanding described in the Van Hiele theory to the work in Early Childhood Education, it is necessary to identify the children's knowledge. In other words, a pedagogical teaching proposal that provides the necessary support for the child to develop geometric thinking starts from what they already know. In this sense,

> Van Hiele attributed the main reason for the failure of the traditional geometry curriculum to the fact that the curriculum was presented at a higher level than that of the students. In other words, they could not understand the teacher, and the teacher could not understand why they could not understand (Villiers, 2010, p. 401).

The general characteristics of each level can be associated with geometry teaching in Early Childhood Education as follows: in the first level of visualization and recognition, according to the Van Hiele Theory, "students visually recognize figures by their overall appearance" (Villiers, 2010, p. 401). In Early Childhood Education, when introduced to geometric shapes such as triangles, squares, rectangles, and circles, among others, children visualize and demonstrate their understanding by relating the presented shapes to other objects, naming and differentiating them from each other. However, they still do not relate these figures perceived in their daily lives through their properties.

Next, at the analysis level, individuals begin to analyze the properties of geometric figures and learn the formal terminology to characterize them. In this teaching stage, as children progress in their development, they can, for example, recognize a figure and say whether it is a circle, a triangle, or a square. They differentiate them, considering their visual aspects through comparison, stating, for example, that the roof in a drawing of a house is a triangle. However, they do not yet correlate the figures or their properties.

In the third level, informal deduction or ordering, students need to resort to the field of abstraction to deduce and understand the correlations between shapes. For example, in class inclusion, when presenting a square and a rectangle, children do not identify the square as also being a rectangle. Ordering can be done more concretely by children, sequentially requiring the student, for example, to relate objects to respective geometric figures by grouping them.

In the fourth and fifth levels, more sophisticated structures are used than appropriate for Early Childhood Education since students need to begin developing more elaborate thinking to understand the higher properties of geometric shapes such as area, and perimeter, assimilate longer sequences of statements, and understand the meaning of deduction, the role of axioms, theorems, and proofs.

According to Barguil (2016), children in the first stage of basic education can reach the first three levels of understanding in the Van Hiele theory, and several factors can contribute to the construction of geometric thinking:

> Geometry teaching in Early Childhood Education and Elementary School covers the first three levels of the Van Hiele Theory. To favor student progress, the following factors contribute: method, organization, content, and teaching materials. The exploration of materials and the experience of situations allow the student to formulate hypotheses and express them to the teacher (Barguil, 2016, p. 5).[7]

As can be perceived, the author emphasizes the importance of experiences in the teaching process for individuals involved to formulate and express their thoughts through active learning. However, it is also worth noting that not all individuals will simultaneously experience the same level of understanding. Therefore, classroom work needs to be reconsidered with different strategies, taking into account that, for the students to progress in their levels of understanding, they need to develop the previous level, which will be initiated in Early

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[7] In the original: O ensino de Geometria na Educação Infantil e no Ensino Fundamental contempla os três primeiros níveis da Teoria de Van Hiele. Para que ele favoreça o progresso discente, contribuem os seguintes fatores: método, organização, conteúdo e material didático. A exploração de materiais e a vivência de situações permitem que o estudante elabore hipóteses e as expressem ao professor. (Barguil, 2016, p. 5).

Childhood Education, through knowledge of shapes, notions of space, time, location, and movement. This is the hierarchical structure—a striking characteristic of the Van Hiele theory.

As for the main characteristics of the Van Hiele model, Nasser & Sant'anna (2010) present the descriptions in Table 2 below.

Table 2.

Main characteristics of the Van Hiele model (Nasser & Sant'anna, 2010)

CARACTERISTICA	DESCRIÇÃO
Hierárquica	Os níveis obedecem a uma hierarquia, isto é, para atingir certo nível é necessário passar antes por todos os níveis inferiores. Por exemplo, o aluno só consegue perceber a inclusão de classes de quadriláteros (nível de abstração) se distinguir as propriedades de cada uma dessas classes (nível de análise).
Linguística	Cada nível tem uma linguagem, conjunto de símbolos e sistemas de relações próprios. Por exemplo, não adianta falar em propriedade com os alunos que ainda estão no nível de reconhecimento, pois eles não conhecem ainda esse significado da palavra.
Conhecimentos intrínsecos	Em cada nível, o aluno tem conhecimentos que estão intrínsecos e eles não conseguem explicar. No nível seguinte é que esses conhecimentos serão explicados. Por exemplo o aluno no nível de reconhecimento é capaz de reconhecer um quadrado, sem conseguir explicar porque aquela figura é um quadrado. Só quando atingir o nível de análise é que será capaz de explicar, através da exploração dos componentes do quadrado e de suas propriedades.
Nivelamento	Não há entendimento entre duas pessoas que raciocinam em níveis diferentes, ou se a instrução é dada num nível mais avançado que o atingido pelo aluno. Por exemplo: Não adianta o professor pedir a um aluno que está relacionando no nível de análise para fazer deduções, pois neste nível ele não denomina ainda o processo dedutivo.
Avanço	O progresso entre os níveis depende da instrução oferecida, isto é, o aluno só progride para o nível seguinte depois de passar por atividades específicas, que o preparem para esse avanço.

Based on these characteristics and what the BNCC (Brazil, 2019) proposes for work in Early Childhood Education, we find that it is through play and interactions with children that the teacher can assess what they bring in terms of learning and what can be expanded so that they understand and construct their learning continuously. In this process, it is essential to respect the repertoire that children bring, and the language they use to name and refer to objects, relating them to geometric shapes. Thus, even though the teacher has complete mastery of the content to be taught and its intricacies, overloading children with nomenclature, hypotheses, and refined connections that they have not yet appropriated is not viable.

Finally, progress is also identified as a necessary attribute in the geometry teaching process. The teacher needs to adopt continuous assessment to ensure that progress is possible. For example, when realizing that a child already recognizes polygons as a circle, triangle, square, and rectangle, the teacher can suggest that the child identify and make connections between shapes and objects in their daily life, encouraging them to differentiate, for instance, a rectangle from a circle. Next, the teacher can explore some of their properties, differentiating the specific characteristics of the flat shapes that have been presented.

Decolonialities and racial issues

In contemporary social contexts, the debate on the importance of valuing epistemological diversities has emerged (Gomes, 2012). Understanding that cultural plurality, represented by the diversities of ethnicities, beliefs, customs, and values, among other elements, which characterize the Brazilian population, also marks Early Childhood Education institutions. The BNCC proposes its approach from this segment:

> Working with diversity and living with differences allows for the expansion of horizons for both the teacher and the child. This is because it enables the awareness that each person's reality is only a part of a larger universe that offers multiple choices. Embracing the different expressions and manifestations of children and their families means valuing and respecting diversity, without implying unconditional adherence to the values of others. Each family and its children carry a vast repertoire that constitutes rich material for the exercise of dialogue, learning from differences, non-discrimination, and non-prejudiced attitudes. These abilities are necessary for the development of an ethical stance in human relationships. In this sense, Early Childhood Education institutions, through their professionals, must develop the ability to listen, observe, and learn from families. Embracing different cultures should not be limited to festive celebrations, occasional presentations of traditional dances, or the experimentation of regional dishes. While these initiatives are interesting and desirable, they are not sufficient to deal with the diversity of values and beliefs (BRAZIL, 2019, p. 77).[8]

In the scientific community, there has been an increasing consideration of identifying knowledge and other wisdom coming from dissident social groups historically subalternized, such as black and indigenous peoples. However, it is crucial not only to recognize or celebrate this diversity but to think about other ways to decolonize and subvert epistemologies marked by colonialism.

The Modernity/Coloniality group is formed by Latin American intellectuals from different fields of human and social sciences seeking to construct, through the critique and historical revision of Western modernity, other epistemological possibilities from the South and with the geographical South (Oliveira & Candau, 2010). Their contributions have generated

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[8] In the original: O trabalho com a diversidade e o convívio com a diferença possibilitam a ampliação de horizontes tanto para o professor quanto para a criança. Isto porque permite a conscientização de que a realidade de cada um é apenas parte de um universo maior que oferece múltiplas escolhas. Assumir um trabalho de acolhimento às diferentes expressões e manifestações das crianças e suas famílias significa valorizar e respeitar a diversidade, não implicando a adesão incondicional aos valores do outro. Cada família e suas crianças são portadoras de um vasto repertório que se constitui em material rico farto para o exercício do diálogo, aprendizagem com a diferença, a não discriminação e as atitudes não preconceituosas. Estas capacidades são necessárias para o desenvolvimento de uma postura ética nas relações humanas. Nesse sentido, as instituições de Educação Infantil, por intermédio de seus profissionais, devem desenvolver a capacidade de ouvir, observar e aprender com as famílias. Acolher as diferentes culturas não pode se limitar às comemorações festivas, a eventuais apresentações de danças típicas ou à experimentação de pratos regionais. Estas iniciativas são interessantes e desejáveis, mas não são suficientes para lidar com a diversidade de valores e crenças (BRASIL, 2019, p. 77).

reflection in various areas such as ethnic-racial relations, gender, sexuality, education, and other fields of knowledge.

A key criticism of this group is the myth of modernity, which coincides with the concept of modernity. According to Oliveira (2021), modernity was an invention of European whiteness in its invasion and exploitation of America. Modernity was not a self-emancipation but, on the contrary, the European elite, in claiming this modernity, seeks to conceal all the colonial violence that sustained this supposed "self-emancipation" (Dussel, 1993).

Colonialism and coloniality, according to Maldonado-Torres (2007), are different concepts but intersect because:

> Colonialism denotes a political and economic relationship in which the sovereignty of one people is in the hands of another people or nation, constituting the latter as an empire. Unlike this idea, coloniality refers to a pattern of power that emerged as a result of modern colonialism. Instead of being limited to a formal power relationship between two peoples or nations, it relates to how labor, knowledge, authority, and intersubjective relations articulate themselves through the global capitalist market and the concept of race. Thus, despite colonialism preceding coloniality, coloniality survives colonialism. It remains alive in textbooks, criteria for good academic work, culture, common sense, the self-image of people, the aspirations of individuals, and many other aspects of our modern experience. In this sense, we breathe coloniality into our everyday modernity (Maldonado-Torres, 2007, p. 131).

We agree with the idea that, to this day, our society is marked by different social asymmetries, and education is also marked by colonial epistemologies. This highlights that the field of education is not neutral or one that is oblivious to contemporary social and political relations and the different manifestations and actions of contemporary colonialism. In this sense, it is important to think of a plural education that can question monocultural epistemologies marked by racism and other forms of exclusion. In this process, educators need to thoroughly understand and confront the mechanisms of coloniality to which historically invisibleized groups have been and still are subjected, namely the coloniality of power, the coloniality of knowledge, and the coloniality of being.

The coloniality of power, as Quijano (2005) points out, constitutes a worldwide, capitalist, modern, and Eurocentric colonial power pattern, based on the creation of the concept of race as a way to colonize and subordinate the colonized about European whiteness. This pattern of power domination has persisted even after the period of independence of colonized countries, enduring to this day, including in education.

The coloniality of knowledge refers to the hegemony of knowledge and its relation to the unique perspective associated with European knowledge. In this perspective, European

knowledge is taken as the only one and structuring of society, imposing a monocultural epistemology and ignoring all the diversities of knowledge, wisdom, and epistemologies that existed before colonization and are erased and exterminated.

The coloniality of being, according to Walsh (2009), is crucial within the colonial matrix pattern, acting and imposing the denial of the condition as a person and being of the subalterns. The institution of the idea of race, as a biological factor, as a way to legitimize inferiority from the Eurocentric perspective, is based on the internalization of the idea of the subaltern's inferiorization, subalternization, and annihilation. Thus, the appreciation of knowledge, epistemologies, sexualities, and gender expressions is denied as a way of differentiating and classifying. In the field of education, there is a hegemony of knowledge from the global North, where diversity has no space, and when it is addressed, it is considered folklore or minor culture.

Decoloniality emerges as a way of thinking beyond coloniality, as a resistance from dissident bodies in a world marked by modern colonialism:

> "The term decolonial derives from a theoretical perspective that these authors express, referring to the possibilities of critical thinking from those subalternates by capitalist modernity and, in the wake of this perspective, the attempt to build a theoretical project aimed at critical and transdisciplinary rethinking, also characterized as a political force to counter dominant academic tendencies of a Eurocentric perspective in the construction of historical and social knowledge" (Oliveira, 2016b, p. 1).[9]

In this direction, critical interculturality refers to the importance and necessity of a social, political, epistemological, ethical, and educational project that can critically dialogue with cultures, to rethink, question, and transform social inequalities (Oliveira & Candau, 2010). According to Catherine Walsh (2017), critical interculturality would be a kind of tool that not only celebrates diversity but proposes a profound change and transformation in society from dissident and racialized epistemologies. In other words, critical interculturality, according to Walsh (2009, p. 24), "is to indicate the need to make visible, face, and transform the structures and institutions that differentially position groups, practices, and thoughts within an order and logic that, at the same time and still, is racial, modern-Western, and colonial."

Born in the contexts of indigenous and Afro-diasporic struggles, critical interculturality can be understood as a strategy to make visible, confront, and transform structures and

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[9] In the original: O termo decolonial deriva de uma perspectiva teórica que estes autores expressam, fazendo referência às possibilidades de um pensamento crítico a partir dos subalternizados pela modernidade capitalista e, na esteira dessa perspectiva, a tentativa de construção de um projeto teórico voltado para o repensamento crítico e transdisciplinar, caracterizando-se também como força política para se contrapor às tendências acadêmicas dominantes de perspectiva eurocêntrica de construção do conhecimento histórico e social. (Oliveira, 2016b, p. 1).

institutions based on the power of a colonial pattern. It creates other ways of living and being because they are "projects, processes, and struggles that conceptually and pedagogically intersect, encouraging forces, initiatives, and ethical perspectives that question, transform, shake, rearticulate, and build" (Walsh, 2009, p. 25).

Critical interculturality requires alternative pedagogies and praxes that value subalternized knowledge and practices. To achieve this, Walsh (2009, p. 27) proposes decolonial pedagogies, in the plural, as "pedagogies that strive to transgress, displace, and impact the ontological, epistemic, and cosmogonic-spiritual denial that was - and is - a strategy, purpose, and result of the power of coloniality; that is, 'decolonial pedagogy(ies).'"

Decolonial pedagogies and practices must question colonial structures, insurgents, and values, and recognize other praxes. Decolonial pedagogy not only denounces and criticizes dominant structures but engages in the struggle alongside the knowledge and wisdom that were once invisibilized to promote radical transformation.

Law 10,639/03, which mandates the teaching of Afro-Brazilian history and culture in basic education, can be seen as a law that favors a decolonial pedagogy. This reality, achievement of social movements, especially the Black movement, is seen as a way to decolonize curricula in educational spaces marked by colonial, cis-heteronormative, and patriarchal hegemony because:

> "The introduction of Law No. 10,639/03 not as more disciplines and new content, but as a cultural and political change in the curricular and epistemological field, may break the silence and unveil this and other pedagogical rituals in favor of racial discrimination" (Gomes, 2012, p. 105).[10]

This is a paradigm shift in Brazilian education, where educators, inspired by the law, make educational processes and practices a fertile ground for anti-racist education. However, 20 years after its promulgation, we still face challenges, especially in training fields, which does not prevent us from celebrating its legacy and power in education.

Advocating for education on ethnic-racial relations is fundamental in today's context. It is essential to recognize the plurality of different cultures that make up Brazilian society, as well as their diversities of religious and ethnic manifestations, and their dissenting identities that are constantly evolving, among other aspects. It is not enough to just recognize and

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[10] In the original: A introdução da Lei nº 10.639/03 não como mais disciplinas e novos conteúdos, mas como uma mudança cultural e política no campo curricular e epistemológico poderá romper com o silêncio e desvelar esse e outros rituais pedagógicos a favor da discriminação racial. (Gomes, 2012, p. 105).

dialogue; it is necessary to re-educate the gaze towards issues of blackness, allowing it to question the social structures that cause racism in our society.

> Education for ethnic-racial relations that fulfils its role is one in which children, adolescents, young people, and adults, both black and white, as they go through basic school, question themselves about their prejudices. They become willing to change discriminatory attitudes, recognize the beauty and richness of differences, and understand how these differences have been transformed into inequalities in power and domination relationships (Gomes, 2013, p. 83).[11]

However, education for ethnic-racial relations in Early Childhood Education is still a field under construction. This stage is essential in human development to build a new perspective on social and racial relations. Therefore, we advocate for thinking about childhood from a plural perspective. According to Santiago (2016), education for ethnic-racial relations in preschool occurs in daily life, in play, in leisure moments, during bath and meal times, revealing that racial relations are structurally present in the Early Childhood Education environment. Hence the importance of anti-racist and decolonial practices for valuing, recognizing, and reflecting on ethnic-racial diversity.

In support of these ideas, it is worth emphasizing that it was through the struggle and resistance of the Black Movement that we made social progress in the anti-racist struggle and managed to bring discussions about racial issues and black identity affirmatively into the classroom. Gomes (2012) adds:

> From a perspective of decolonizing curricula and understanding the epistemological and cultural ruptures brought about by the racial question in Brazilian education, I agree that this perspective is an important alert. Understanding how Black culture, gender issues, youth, social movement struggles, and popular groups are marginalized, treated disconnected from broader social life, and even discriminated against in everyday school life and curricula can be considered an advance and an epistemological rupture in the educational field. However, we must go further (Gomes, 2012, p. 104).[12]

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[11] In the original: A educação para as relações étnico-raciais que cumpre com seu papel é aquela em que as crianças, os adolescentes, os jovens, e os adultos negros e brancos, ao passarem pela escola básica, questionem a si mesmos nos seus próprios preconceitos, tornem-se dispostos a mudar posturas e práticas discriminatórias, reconheçam a beleza e a riqueza das diferenças e compreendam como essas foram transformadas em desigualdades nas relações de poder e de dominação (Gomes, 2013, p. 83).

[12] In the original: Numa perspectiva de descolonização dos currículos e na compreensão das rupturas epistemológicas e culturais trazidas pela questão racial na educação brasileira, concordo com o fato de que esse olhar é um alerta importante. A compreensão das formas por meio das quais a cultura negra, as questões de gênero, a juventude, as lutas dos movimentos sociais e dos grupos populares são marginalizadas, tratadas de maneira desconectada com a vida social mais ampla e até mesmo discriminadas no cotidiano da escola e nos currículos pode ser considerado um avanço e uma ruptura epistemológica no campo educacional. No entanto, devemos ir mais além (Gomes, 2012, p. 104).

hooks[13] (2017, p.31) emphasizes that "it is possible to teach without reinforcing existing systems of domination." Therefore, it is necessary to assume the premise that it is impossible to foster a politically neutral education (hooks, 2017). This applies to the teaching of Mathematics, given that every act in the educational field is a political act, including the choice to remain silent about social issues in pedagogical practice – which is also a political stance.

Thus, one cannot think geometrically without considering a social experience, especially when aiming to include students' culture in school. We understand that thinking about spaces, shapes, and locations using only fictional elements means acting in the direction of supposed neutrality, which, as we have seen, is extremely harmful and conducive to maintaining inequalities. The activities we propose, drawing on the works of Tarsila do Amaral, allow us to integrate geometric concepts with artistic ones, contributing to the development of children's creativity and the collection of data related to their reality. Reflecting on this data, especially in Early Childhood Education, brings racial, economic, and gender issues into the classroom.

> Therefore, early childhood education institutions must establish themselves as anti-racist spaces, places where we can easily identify actions and attitudes that point to solutions in combating any racist practice, discrimination, and racial segregation. Simultaneously, these places should value black children (Dias et al., 2022, p. 473).

It is urgent to propose training focused on education for ethnic-racial relations in Early Childhood Education spaces, especially in peripheral contexts marked by the colonialities of power, being, and knowing. We understand that these formative processes for racial relations must create environments that can not only denounce racism but also ensure and develop the self-esteem and identity of black children, contributing to an emancipatory education (Gomes & Araújo, 2023).

Method

The present work can be classified as qualitative research in education with characteristics of action research. According to Thiollent (2009), action research can be defined as:

> "a type of social research based on empirical evidence that is conceived and carried out in close association with an action or the resolution of a collective problem, and in which

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[13] The writer's name is spelled in lowercase as a political stance of intellectual egoic refusal advocated by the author. Bell hooks asserted that her works deserved more attention than her person.

researchers and participants representing the situation or problem are involved cooperatively or participatively" (Thiollent, 2009, p.16).

Action research is understood by Tripp (2005) as a generalized term to describe "any process that follows a cycle in which practice is enhanced by systematic oscillation between acting in the field of practice and investigating it." In this way, the author understands action research as a differentiated form of action research, as it is a "continued, systematic, and empirically grounded proposal to improve practice," which is one of the main elements of this research (Tripp, 2005, p.445).

To investigate the emancipatory potential of the meaningful appropriation of interdisciplinary geometric thinking allied to the teaching of arts, the daily life of Early Childhood Education at the Solange Conceição Tricarico Child Development Center (EDI) was chosen for the development of the research, located in the Complexo da Maré, a neighborhood on the outskirts of the city of Rio de Janeiro consisting of 16 favelas.

The educational model of the space is intended for early childhood and currently serves around 200 children, aged 1 to 5 years and 11 months. The service is exclusive to daycare and preschool, which is divided into eight Early Childhood Education classes.

In this research, we developed and analyzed activities that were experienced by children from the aforementioned public Early Childhood Education institution during a project developed in 2018. Our subjects were exactly 25 children aged 3 and 4 years old.

Previous interaction with them allowed us to perceive their great interest in activities involving the use of paint. The drawings that are part of the children's daily lives showed their perception of the world and led to the conceptualization of an Annual Pedagogical Project to expand their developed interest, bringing works of art from different painters into the classrooms. This was how the "Art Everywhere" Project was born. The activities we developed and analyzed in this article are part of this project. They made up the stage that focused on Tarsila do Amaral's *Autorretrato* painting.

Engaging in project-based practices begins with the children's interests and generates possibilities for the construction of investigative work. In this approach, the teacher takes on the role of a mediator and contributes by giving intentionality to the experiments carried out by the children. Furthermore,

> Projects create spaces where children's curiosity can be communicated more spontaneously, enabling them to experience the joy of independent learning. Well-developed projects lead the child to use their mind and emotions, becoming adventures in which both students and teachers embark with satisfaction (Helm, 2005, p.23).

The stage that involved the work of Tarsila do Amaral corresponded to these expectations for the successful development of projects. We chose to conduct our research during this stage because this Brazilian painter and draftsman portrayed landscapes, people, and animals similar to those that the children also sought to depict in their daily drawings and paintings.

The intervention took place in April 2018 and consisted of three activities, which are: a) collective observation and analysis and individual recreation of the artwork; b) collective analysis of the artwork, one's own body, and the external area of the school; and c) description of the self-image seen in the mirror and construction of the individual self-portrait. In Table 3, we present a synthesis of the objectives underlying each activity and the resources used.

Table 3.

Proposed Activities

Analyzed work	Objectives	Resources used
Autorretrato (1923)	● Enable the exploration and expression of different forms of language (body, oral, written); ● Explore spatial concepts as necessary tools in their daily lives; ● Encourage self-recognition and awareness of differences with others.	- Image of the artwork; - Reproduction of the artwork in black and white; - A4 sheets; Colored shredded paper; - Glue; - Crayons; - Book "O espelho de Lelê" (Lelê's Mirror).

The activities were planned to be implemented over one week, but we needed to use the beginning of the following week for closures because, due to incidents of violence in the community, the presence of the children in school was impossible for two days due to police operations and clashes between rival groups.

For data recording, we used an experience notebook, along with records in photographs and videos, duly authorized by the guardians.

Analysis of the activities

Throughout the activities, we noticed that the class had a lot of curiosity about topics related to mathematical concepts. This curiosity was reflected in questions asked during the activities and became evident in the group discussions we proposed at the end of each one.

During these discussions, the children shared their experiences, aspirations, and learning. Some of the most significant moments of knowledge exchange, the construction of new knowledge, and oral expression occurred during these times. In Early Childhood Education, children need to be heard; their questions are part of their educational process and often guide and promote new learning. In line with this aspect, Warschauer states:

> "[...] a characteristic of what I am here calling a Circle is to bring together individuals with different life stories and their ways of thinking and feeling, so that the dialogues, born from this encounter, do not follow the same logic. They are sometimes crossed by the different meanings that a theme awakens in each participant. This moment means still being on the periphery of a spiral where individual differences and subjectivities exceed the approximations. The constancy of the meetings promotes a greater intertwining of individual meanings, interaction increases, and common meanings are created, sometimes even a language of their own. I feel this moment as the generative fertilization of life. From the encounter, the egg is born. From intersubjectivities, the group is born" (Warschauer, 1993, p.46).

Supporting these ideas, we understand that group discussions, by legitimizing individual knowledge and the knowledge produced in their interactions, constitute an important resource for confronting the processes of the coloniality of knowledge (AUTHOR, YEAR) to which children and their social groups have been subjected for centuries of colonialism. However, we also recognize that, from the beginning of the activities, there was still much to learn. Considering our intention to break with more traditional approaches that, even in Early Childhood Education, present the first geometric notions in a decontextualized way, we sought to integrate observations of works of art with observations of the body and space because:

> The development of spatial concepts, spatial competence, self-body recognition, and increased awareness of shapes and figures around them is essential to promote the

exploration and learning of geometric concepts with children from an early age (Muniz, 2013, p.2).[14]

In this way, the activities we developed were characterized by integrating knowledge of geometric concepts with arts through everyday elements, naturally and spontaneously. During these moments, we noticed that a group of children had some basic geometric notions, such as body awareness, orientation in relation to objects and people, vocabulary, and the identification of some flat figures. Other children did not have such notions, requiring a differentiated approach. It is important to mention that these approaches were permeated by reflections on elements that favored the construction of children's identities and the visibility of Black and favela residents.

In the classroom, the first activity consisted of a conversation circle for a more detailed observation of the *Autorretrato* painting. To arouse the children's curiosity and perceptions of the work, questions such as: What do you see? Is it a man or a woman? Is this person a child or an adult? What colors do you see in this painting? What shapes appear in this painting?

These questions, besides guiding the children's gaze to the artwork, favored the emergence of new questions, this time posed by them, wanting to know more about the work: "Who painted this painting?"; "Who is this lady?"; "Can a child paint a picture?".

They also made some unexpected observations: "It looks like a very large ID photo."; "My mom has a blouse like that."; "I have a dress that color."; "My grandmother ties her hair like that when she goes to work.".

Thus, as the children advanced in appreciating the beauty of the work, they associated the elements present in it (colors, shapes, characters) with elements from their experiences. In addition, they understood the process of creating a work of art and raised hypotheses about their possibilities of producing paintings.

In this activity, black and white printed images of the painting were provided for the children to paint according to their taste or recreate the painting using a collage with colored shredded paper.

The second activity took place in the school's outdoor area. In a conversation circle, we explored the notion of body and space, through the reinterpretation of the *Autorretrato* painting. Understanding that the first geometry is constituted by the body, with this activity, we sought

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[14] In the original: O desenvolvimento das noções de espaço, da competência espacial, do reconhecimento do próprio corpo e o aumento da percepção das formas e figuras presentes ao seu redor é essencial para favorecer a exploração e aprendizado das noções geométricas com as crianças desde a mais tenra idade (Muniz, 2013, p.2).

to create conditions for children to become aware of parts of their bodies. We initially explained the definition of self-portrait, informing them that it is a painting made from observing our face or body, with our characteristics such as body parts, skin color, hair color, and hair type. Thus, simultaneously, the children orally reproduced Tarsila's self-portrait and began observing their bodies.

It is worth noting that body perception in this activity focused on the position of body parts: the neck is under the head, the arms at the top of the body, and the legs at the bottom; the navel is on the belly; the ears are on either side of the head, where the mouth and eyes are. These data reinforce the idea that, among other aspects, the teaching of geometry can provide awareness and organization of the body schema. This awareness is of utmost importance because it is the first step in the construction of more elaborate concepts. The child appropriates spatial relationships first through self-perception, passing through her conception and that of the world around her, to then arrive at a space represented in the form of maps, sketches, models, figures, coordinates, etc. According to Smole et al. (2003), "such an approach is neither quick nor simple, and initially, it is closely related to the organization of the body schema, spatial orientation, and perception" (p. 25).

Thus, we concluded the activity by also proposing an observation of the school's outdoor area, which caused the children to move and led once again to the use of vocabulary associated with geometric concepts used in observing their bodies.

In the third activity, each child had to draw their self-portrait. For this, sitting in the classroom in groups of 3 or 4 members, they had to observe their image in a mirror and describe themselves orally to their groupmates. Observations were guided by questions such as: What color is your hair? What is your hair like? What color are your eyes? What is the color of your skin? What is your nose like? What is the shape of your mouth?

These questions led to realizations that referred to shapes ("my eye is round," "my nose is round," "my nose is a thin stick," among others) and colors ("I am yellow," "my mom is yellow"). In this last case, we realized that it would be very important to have a box of colored pencils with all skin tones, which was not available at the school.

We infer that access to collections of colored pencils with a wide variety of skin tones can contribute to the construction of pedagogical practices that allow for the re-signification of the racial identity of Black children. However, even without the use of this material, we encouraged children to explore other colors; after all, a more common box of crayons offers 12 possibilities. Here, it is worth highlighting the joy of a Black child upon finding a crayon whose color resembles their skin tone: "Aunt Ari, I found my color!"

We understand that being surprised and expressing joy at the simple act of finding one's color among many crayon options are events that should be experienced by all Black children in childhood, as they foster the construction of their identity and the elevation of their self-esteem (Gomes & Araújo, 2023). Moreover, in this activity, we have an example that it is possible not to reinforce a system of domination that subordinates Black people (hooks, 2017).

Next, we explored the possible crayon colors that would be similar to each child's skin tone. We brought each crayon close to the arm of each child until they identified which one was most similar to the color of their skin. Each child made their choice from the different available colors.

It is also important to mention that in this activity, we observed an idea of universalizing skin color, as if only one color represented the skin color of all people in the world. This is a crayon of a pinkish color that does not fit or correspond to the skin color of anyone but is known among children as the "skin color crayon."

Knowing that attempts at universalization deny diversity and, more critically, favor the characteristics of the dominant group (Walsh, 2007), during the activity, we sought to break with the universalization of skin color. To do this, we offered, as an option the "skin color crayon," the brown crayon and the black crayon. Thus, we believe we have contributed to the deconstruction of universal ideas that carry within them the same biased, depreciative, and prejudiced content that society demonstrates regarding Black individuals (Gomes, 2017).

Regarding Afro-textured hair, the scenario is no different. According to Gomes (2002), "Hair has been one of the main symbols used in this process, as since slavery, it has been used as one of the defining elements of the individual's place within the Brazilian racial classification system" (Gomes, 2002, p. 43).

Indeed, hair is a component of the body that holds great importance and meaning concerning the construction of human identity. Specifically, for the construction of the identity of Black children, this element is significant and, together with skin color, fosters the social, cultural, political, and ideological construction of individuals. However, despite efforts by the Black movement (Gomes, 2017) to reverse the situation, in different social contexts where Black individuals are inserted, hair continues to be seen as a mark of inferiority, and one of these contexts is the school, even with very young children. Thus, the reflection on hair promoted in this activity was another element of resistance to the domination that may be present in the classroom (hooks, 2017). The following dialogue, established between a child and the teacher, provides an example of how hair was addressed:

- (Child) Aunt Ari, what are you doing?

- (Teacher) I'm fixing my little curls.

- (Child) Oh, okay! I also have curls! I do too! Aunt Ari, does everyone have curls?

Continuing this dialogue, we all observed our hair, realizing that most children in the class have curly hair and that there are differences between the curls. We also showed the class the children's storybook "O espelho de Lelê" by Valéria Belém, which tells the story of a Black character going through different changes, evident in her Afro-textured hair with various hairstyles shown in the illustrations. Thus, we aimed to counter classic children's books that feature a white character as the main, kind character, while relegating Black characters to secondary roles and even villains.

We argue that gradually, through experiences and reflections like these, children can perceive that many stories are told through Eurocentric lenses that erase African, Afro-Brazilian, and Amerindian knowledge. It's not just about hair. It is necessary to encourage Black children to learn about their history, leaders, protagonists, origins, spirituality, and ancestry, as proposed by Law 10639/2003:

> § 1º The programmatic content referred to in this article will include the study of the History of Africa and Africans, the struggle of blacks in Brazil, Brazilian black culture, and blacks in the formation of national society, rescuing the contribution of the black people in the social, economic, and political areas relevant to the history of Brazil. § 2º The contents related to Afro-Brazilian History and Culture will be taught within the scope of the entire school curriculum, especially in the areas of Art Education and Brazilian Literature and History. (BRAZIL, 2003, art. 26).[15]

It is always worth emphasizing that this law is one of the many achievements in the long journey of demands for the promotion of racial equality by the Black movement. However, there is still much to advance, especially regarding the implementation of this law in classrooms during moments when mathematical concepts are privileged. Understanding that an initial approach to geometric concepts can lead to a broader reflection that favors the construction of identities for Black and favela children is not a simple task. It is bringing social experience into geometry classes and breaking with the perspective of mathematics' neutrality (Skovsmose, 2002).

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[15] In the original: O conteúdo programático a que se refere o caput deste artigo incluirá o estudo da História da África e dos Africanos, a luta dos negros no Brasil, a cultura negra brasileira e o negro na formação da sociedade nacional, resgatando a contribuição do povo negro nas áreas social, econômica e política pertinente à História do Brasil. § 2o Os conteúdos referentes à História e Cultura Afro-Brasileira serão ministrados no âmbito de todo o currículo escolar, em especial nas áreas de Educação Artística e de Literatura e História Brasileira (BRASIL, 2003, art. 26).

Unfortunately, the repression of racism against Black bodies is still a reality in Brazil. However, the activities presented create conditions for Black bodies to stand out and affirm themselves in public spaces without falling into exoticization or folklore (Gomes, 2017). Focusing on geometric thinking, the activities raised aspects such as:

> The political construction of Black aesthetics and beauty. Dance as an expression and liberation of the body. Art as a form of expression and liberation of the body. Afro-textured hair, Afro hairstyles, clothing, and ways of dressing convey a recreated and re-signified African ancestry in Brazil. (Gomes, 2017, p. 97).

In this sense, they were extremely relevant for us to implement a pedagogy influenced by decolonial principles. As Walsh (2013) proposes through the concept of decolonial pedagogy, we intertwine the pedagogical and decolonial, attempting to tension learning in a way that allows for other knowledge within the proposed activities, knowledge of (re)existences. It is essential to explain that when we talk about (re)existence in this study, we are bringing Gomes' (2017) thoughts and touching on issues related to prejudice, representations of Black people, and identities—themes that schools today are increasingly challenged to confront and address pedagogically and didactically. This implies intentional and directed social, cultural, and political intervention by Black individuals throughout history, in society, in processes of production and reproduction of existence.

Final considerations

Geometry education in Brazil exhibits gaps in basic education, particularly in the early school years, which bear the stigma of being a care-oriented space. In this context, the construction of geometric thinking is even less considered in Early Childhood Education.

Given this scenario and the elitized nature of mathematics, which poses a significant challenge throughout the school lives of most students, this study aimed to investigate the construction of geometric thinking in Early Childhood Education from a decolonial perspective through art. We chose action research as the methodology for developing the study and conducted three activities with 4- and 5-year-old children from a public school, using the observation and analysis of Tarsila do Amaral's painting *Autorretrato* as a starting point.

An analysis based on the Van Hiele Theory revealed that children are extremely capable of analyzing, naming, relating, and differentiating geometric shapes with the elements found in Tarsila do Amaral's painting and everyday objects, including their bodies.

We also found that an interdisciplinary pedagogical approach validates a curriculum that encompasses geometry and art, fostering enriching dialogues for the comprehensive learning of children. These actions, in turn, provided didactic opportunities based on the decolonial perspective and its implications. The observation and analysis of *Autorretrato* painting led us to reflect on Afro culture and the affirmative construction of black identity, promoting child protagonism.

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