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Between threads and shapes: mathematics emerging in teacher training based on Afro-Brazilian fabrics[1]

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ABSTRACT

This article aims to analyze forms of mathematics that emerge in teacher education through studies with Afro-Brazilian fabrics carried out in an extension course. The course is part of a professional doctoral research project in Science and Mathematics Education (EDUCIMAT) at the Federal Institute of Espírito Santo (Ifes), developed within the Research Group on Pedagogical Practices (Grupem) and the Mathematics Club (CluMat). Grounded in Historical-Cultural and Postcolonial theories, the study examines how teachers identified possibilities for working with geometric concepts while exploring cultural artifacts and their relations to Afro-Brazilian culture. This theoretical-empirical research involved Basic Education teachers from different school segments in a continuing education process, during which they identified geometric elements in African and Afro-Brazilian fabrics and possibilities for content to be addressed in geometry lessons. The analyses indicate that, when taken as cultural artifacts, these fabrics fostered reflection on the teaching of geometry and on the inclusion of Afro-Brazilian culture in the school curriculum. It is concluded that the experience contributed to strengthening antiracist pedagogical practices and to reinterpreting teaching as an aesthetic, ethical, and political gesture.

KEYWORDS: Teacher education. Geometry. Historical-Cultural Theory. Postcolonial Theory. Afro-Brazilian fabrics.

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Entre fios e formas: matemáticas que emergem na formação docente a partir de tecidos afro-brasileiros

RESUMO

O objetivo deste artigo é analisar matemáticas que emergem na formação docente mediante estudos com tecidos afro-brasileiros, desenvolvidos em um curso de extensão. Esse curso integra uma pesquisa de doutorado profissional em Educação em Ciências e Matemática (Educimat) do Instituto Federal do Espírito Santo (Ifes), realizada no âmbito do Grupo de Pesquisa em Práticas Pedagógicas (Grupem) e do Clube de Matemática (CluMat). Fundamentado nas Teorias Histórico-Cultural e Pós-colonial, o estudo descreve como professoras/es identificaram possibilidades de trabalho com conceitos geométricos, ao explorarem artefatos culturais e suas relações com a cultura afro-brasileira. A pesquisa, de natureza teórico-empírica, envolveu docentes da Educação Básica de diferentes segmentos, durante uma formação continuada, em que identificaram, em tecidos africanos e afro-brasileiros, elementos geométricos e possibilidades de conteúdos a serem trabalhados nas aulas de geometria. As análises indicam que esses tecidos, tomados como artefatos culturais, favoreceram a reflexão sobre o ensino de geometria e sobre a inserção da cultura afro-brasileira no currículo escolar. Conclui-se que a experiência contribuiu para o fortalecimento de práticas pedagógicas antirracistas e para a reinterpretação da docência como gesto estético, ético e político.

PALAVRAS-CHAVE: Formação docente. Geometria. Teoria Histórico-Cultural. Teoria pós-colonial. Tecidos afro-brasileiros.

Entre hilos y formas: matemáticas que emergen en la formación docente a partir de los textiles afrobrasileños

RESUMEN

El objetivo de este artículo es analizar las matemáticas que emergen en la formación docente a partir de estudios con tejidos afrobrasileños, desarrollados en un curso de extensión. Este curso

forma parte de una investigación de doctorado profesional en Educación en Ciencias y Matemáticas (EDUCIMAT) del Instituto Federal do Espírito Santo (Ifes), realizada en el marco del Grupo de Pesquisa en Prácticas Pedagógicas (Grupem) y del Clube de Matemática (CluMat). Basado en las teorías histórico-cultural y poscolonial, el estudio describe cómo las/os profesoras/es identificaron posibilidades de trabajo con conceptos geométricos al explorar artefactos culturales y sus relaciones con la cultura afrobrazileña. La investigación, de naturaleza teórico-empírica, involucró a docentes de Educación Básica de diferentes segmentos, en un proceso de formación continua en el que identificaron, en tejidos africanos y afrobrazileños, elementos geométricos y posibilidades de contenidos a ser abordados en las clases de geometría. Los análisis indican que estos tejidos, tomados como artefactos culturales, favorecieron la reflexión sobre la enseñanza de la geometría y sobre la inclusión de la cultura afrobrazileña en el currículo escolar. Se concluye que la experiencia contribuyó al fortalecimiento de prácticas pedagógicas antirracistas y a la reinterpretación de la docencia como un gesto estético, ético y político.

PALABRAS CLAVE Formación docente. Geometría. Teoría histórico-cultural. Teoría poscolonial. Tejidos afrobrazileños.

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Training as weaving: fundamentals and research paths

This article is based on research conducted as part of a professional doctorate in Science and Mathematics Education (Educimat) at the Federal Institute of Espírito Santo (Ifes), carried out within the scope of the Research Group on Pedagogical Practices (Grupem) focused on theoretical discussions and the Mathematics Club (CluMat), a space for training practices and didactic experiments, linked to continuing teacher training materialized in the extension course

entitled “Patterns in Afro-Brazilian artifacts based on Historical-Cultural Theory.” In these contexts, proposals are conceived, analyzed, and reworked collectively, creating a testing ground between theory and practice. The study analyzed teacher training processes around the geometric patterns present in artifacts of Afro-Brazilian culture, based on Historical-Cultural and Postcolonial Theories.

Inspired by Vigotski (2007) and Leontiev (2021), the research adopts the framework of Guiding Teaching Activity (Moura, 2010). In dialogue with Aimé Césaire (2000), Frantz Fanon (2008), Stuart Hall (2003), and Lélia Gonzalez (2020), Postcolonial Theory can help teachers broaden their possibilities for discussing and teaching geometry, using Afro-Brazilian fabrics as cultural mediators. During the training process, teachers from different segments of Basic Education—Early Childhood Education, Early Years, Final Years, and High School—examined African, Afro-Brazilian, and Brazilian fabrics.

When proposing the reading of cultural objects as pedagogical mediation, we start from the assumption that geometric knowledge is not limited to abstraction, but materializes in cultural practices that express ways of seeing and organizing the world. Analyzing Afro-Brazilian fabrics in teacher training meant revisiting the foundations of an education that recognizes diversity, values identities, and promotes a critical reading of school mathematics.

This article presents an excerpt from a professional doctoral research project involving continuing education, conducted in 2024 through an extension course. The doctoral research sought to investigate how a teacher training movement, based on Historical-Cultural and Postcolonial Theories, can enable processes of study and debate on the teaching of geometry involving Afro-Brazilian culture, especially geometric patterns.

This investigation is justified by the need to rethink teacher training in the face of abstract and decontextualized curricula, which have contributed to the invisibility of Afro-Brazilian knowledge. It also complies

with the legal requirement to include Afro-Brazilian History and Culture in the school curriculum (Law No. 10,639/2003), promoting anti-racist education and valuing diversity as part of teacher training.

Thus, the objective of this article is to analyze mathematics that emerge in teacher training based on studies with Afro-Brazilian fabrics. The originality of the research lies in the articulation between two theoretical strands that, although distinct, converge in the defense of full human development: Historical-Cultural Theory, by highlighting social mediation as the engine of learning; and Postcolonial Theory, by denouncing the invisibility of knowledge produced by colonized peoples. The research is based on Historical-Cultural and Postcolonial Theories, conceived as complementary perspectives that, when intertwined, enable an understanding of teacher training in its human, historical, and political dimensions.

Theoretical basis: knowledge frameworks between Historical-Cultural Theory and Postcolonial Theory

Historical-Cultural Theory is the guiding principle behind this research, as it allows us to understand teacher training as a process of mediation and appropriation of historically produced knowledge. Inspired by Vigotski and Leontiev, this perspective understands learning and human development as processes mediated by culture, language, and socially organized activity. In this vein, we discuss teacher training as a movement of humanization in which the subject, in the relationships they establish with others and with cultural objects, reframes experiences and produces new ways of acting, thinking, and teaching.

Based on Historical-Cultural Theory, we assume that higher psychological functions are not formed spontaneously, but develop through social interactions and the use of instruments and signs (Vygotsky, 2001). Learning is, therefore, a historical and collective process in which

individuals appropriate accumulated human experiences and transform them into new ways of acting in the world. Leontiev (2021) expands on these reflections by placing work and social practice at the center of the constitution of consciousness: it is in activity, guided by motives and objectives, that individuals are formed and transformed.

As a theoretical and methodological contribution, this research is based on the Guiding Teaching Activity (AOE) (Moura, 1996), which dialogues with Activity Theory, arguing that teaching should create conditions for students—or, in the case of this research, teacher trainees—to intentionally and consciously appropriate knowledge. In AOE, training activity is conceived as a collective movement in which teaching and learning are moments of the same pedagogical activity process, mediated by culture, instruments, and language.

In dialogue with this horizon, Postcolonial Theory constitutes a critical field that problematizes the persistent effects of colonialism in the political, cultural, and educational dimensions. More than just recording a historical past, this theory highlights how colonial structures continue to shape ways of thinking, power relations, and knowledge practices, silencing the knowledge of colonized peoples. Frantz Fanon (2008) analyzes the psychological implications of racism on the consciousness of black subjects, showing that colonialism produced an "ontological alienation" by associating whiteness with reason and blackness with the absence of logic. In the field of geometry education, this reflection allows us to question the idea of neutral universality, which excludes other forms of reasoning present in Afro-Brazilian cultures.

In the thinking of Lélia Gonzalez (1988), this critique takes on Brazilian contours by articulating gender, race, and class. Furthermore, by proposing the concept of Amefricanity, the author affirms the centrality of African and Amerindian matrices in the formation of Brazilian society and denounces the myth of racial democracy, which masks racism and the disqualification of black and indigenous epistemologies. In the field of

education, her contribution guides pedagogical practices that both include and depart from Afro-Brazilian knowledge as constitutive of teaching.

The articulation between Historical-Cultural Theory and Postcolonial Theory allows us to understand that educational practices are not neutral, but rather permeated by symbolic and historical disputes. While the former emphasizes mediation and the role of the collective in the processes of learning and human development, the latter denounces the processes of dehumanization and calls for the valorization of Afro-diasporic knowledge and voices — a term that, according to Gonzalez (1988), designates the cultural and political expressions of African and Afro-descendant peoples scattered throughout the Americas, who maintain ties of ancestry, resistance, and creation with the African continent. Although distinct in origin and purpose, both are similar in that they conceive of human formation as a historical and cultural process in which meanings, power, and recognition are disputed.

From this perspective, cultural mediation occupies a central place in the teacher training analyzed. When interacting with Afro-Brazilian fabrics, teachers mobilize not only shapes and colors but also cultural narratives inscribed in these artifacts—stories, memories, symbols, and values. By relating these elements to geometry content, such as symmetries and geometric patterns, they begin to articulate, in the same movement, geometric study and reflection on culture, racism, and ancestry.

African and Afro-Brazilian fabrics thus occupy a privileged place in research, as they reveal modes of aesthetic and symbolic production that articulate art, science, and identity. Fabrics such as Kente from Ghana, Bogolan from Mali, Samakaka from Angola, and Adire from Nigeria feature geometric patterns composed of repetitions, symmetries, and visual rhythms produced in everyday life. Each print, color, and arrangement of shapes carries social, spiritual, and historical meanings linked to values of community, ancestry, and belonging.

FIGURE 1 - African fabrics used in training (Kente, Bogolan, Samakaka, and Adire).

Source: Organized by the author based on photographs taken of personal fabrics, 2025.

By incorporating these artifacts into the educational space, they make visible knowledge that has traditionally been excluded from schools. More than mere decorations, fabrics reveal rationalities and ways of thinking about form, measurement, and spatial organization, becoming cultural instruments that mediate learning and encourage reflection on geometry in different cultural contexts. By exploring African and Afro-Brazilian textiles in teacher training processes, we seek to discuss how geometry can be recognized in historically underestimated Afro-Brazilian cultural practices.

When these fabrics are taken up in educational proposals as carriers of science, in light of postcolonial theory, possibilities open up to challenge processes of silencing and alienation, offering other forms of visibility to historically subalternized knowledge. In González's (1988) analyses, these marks appear in the form of racial and cultural hierarchies that naturalize the inferiorization of Black and Amerindian knowledge; in Fanon (2008), they manifest as psychological violence that permeates the experience of Black subjects. These contributions help us understand that the teaching of geometry is not neutral: it is permeated by cultural choices that can include or exclude voices, bodies, and histories.

In the educational practices analyzed, the inclusion of African and Afro-Brazilian fabrics broadens the dispute over meanings and

representations, reaffirming that images, discourses, and symbols are places of struggle in which possibilities for resistance are woven. Drawing on the contributions of Gonzalez (1988) and Fanon (2008), we understand that the threads and shapes present in these fabrics are not mere aesthetic ornaments, but expressions of geometric, artistic, and cultural knowledge. Introduced into teacher training processes, these artifacts become pedagogical and political mediators, challenging curricular silence and opening paths to new forms of identity recognition.

Based on these foundations, the research was developed in a continuing education program, materialized in an extension course that provided formative experiences to public school teachers, using African and Afro-Brazilian fabrics as cultural artifacts of mediation. Below, we present the methodological approach that underpinned the research, describing the context of the training, the subjects involved, and the procedures for data production and analysis.

Thus, the intertwining of Historical-Cultural Theory and Postcolonial Theory does not merely constitute a conceptual backdrop, but rather the very thread that guides the interpretation of the data. In light of these references, in the following sections we analyze the formative episode "Symmetries and geometric patterns in Afro-Brazilian artifacts and other instruments" and its scenes, questioning what forms of geometry and humanity are woven when African and Afro-Brazilian fabrics enter the scene in teacher training.

Research paths

The continuing education program took place between August and November 2024, with 13 elementary school teachers who teach mathematics, after approval by the Research Ethics Committee of the Federal Institute of Espírito Santo, under Opinion No. 6,670,157 (CAAE: 75859123.1.0000.5072). The course linked the study of geometric patterns and symmetries to the appreciation of Afro-Brazilian culture through the analysis of African and Afro-Brazilian fabrics, discussion of Law No.

10,639/2003, and local cultural experiences. The proposals involved reading and exploring artifacts, visiting the Capixaba Black Museum (MUCANE), and a roundtable discussion with activists and researchers in the field of education and ethnic-racial relations.

Data production included initial and final questionnaires, written records, teacher statements, photographs, videos, logbooks, and reports presented at the closing seminar. The analysis was guided by the principles of historical-dialectical materialism, taking as a reference the concept of unity of analysis in Vigotski (2009), understood as a meaningful totality that expresses the real movement of the phenomenon and the links between actions and contexts. In line with this principle, we adopted the methodological organization proposed by Moura (2000; 2004), which defines formative episodes as significant excerpts from a collective training movement. Each episode corresponds to a set of actions developed in the extension course—tasks, discussions, and reflections—within which scenes stand out, understood as moments that highlight tensions, advances, or relevant meanings.

This combination of unit of analysis and formative episodes allowed us to examine the teacher training process in its entirety, articulating conceptual, cultural, and historical dimensions that emerged from the collective activities and reflections of the course. From this perspective, teacher training is understood, in the light of Vigotski (2001), as a historical and social movement in which subjects develop practices and meanings with new quality and intentionality by participating in proposals mediated by Afro-Brazilian culture.

By defining the unit of analysis, the research focuses on understanding how participants construct meaning through social and cultural interactions. The formative episode "Symmetries and geometric patterns in Afro-Brazilian artifacts and other instruments," analyzed in this article, consists of different scenes experienced in the context of the extension course, shows how experiences with Afro-Brazilian artifacts

and debates on Law No. 10,639/2003 sparked reflections that go beyond traditional school mathematics, revealing a process of teacher training in which theory and practice, science and ancestry are intertwined, the implications of which will be discussed in the analysis section.

Between threads and shapes: the science encoded in Afro-Brazilian fabrics

It is within this context that we present the following analyses, gathered under the title Between threads and shapes: the science encoded in Afro-Brazilian fabrics, in which we highlight how teachers revisited geometric concepts and developed new understandings of culture and identity.

The training proposal was organized to encourage teachers to engage directly with African and Afro-Brazilian cultural artifacts. In one of the meetings, participants received different fabrics—intentionally selected in advance based on a search for patterns that presented greater diversity of geometric shapes, such as Kente, Bogolan, Samakaka, and Adire. The choice of these materials was intended to provide aesthetic and reflective experiences in which teachers could observe, explore, and discuss the geometric patterns present in the weaves. Initially, we asked them to conduct a free visual exploration, describing what they saw and what the fabrics evoked.

Then, we invited them to identify possible mathematical content—especially geometric concepts such as shapes, symmetries, repetitions, and proportions—and, in a second moment, to recognize the types of symmetry that existed. The collective exchanges that followed highlighted the power of these objects as instruments for reflecting on the teaching of geometry and the place of Afro-Brazilian culture in schools.

Discussions held during the teacher training course revealed that teachers saw both geometry and mathematics in Afro-Brazilian fabrics:

different ways of organizing space, measuring, comparing, repeating, and symbolizing. Each participant, based on their background and the teaching segment in which they work, perceived their own relationships between form, movement, measurement, and proportion. In the table below, we present a summary of the mathematics perceived in the fabrics, offering the reader an overview of the meanings that will be explored in depth in subsequent analyses.

TABLE 1: Summary of mathematics perceived in Afro-Brazilian fabrics

Student	Field of study	Mathematics perceived in fabrics
Lua	Early Childhood	shapes, colors, straight and curved lines; spatial concepts, movement, and games.
Fran	Early Childhood Education, Final Years, and High School Patterns,	sequences, symmetries, correspondences, measurements, and proportions
Bell	Final Years of Elementary Schoo	Regular shapes, area, perimeter, rotational angles, and concentric circles.
Pedro	High School	Rotational symmetries, axes of reflection, proportion, and geometric transformations.

Source: Prepared by the author (2025).

The summary presented in Table 1 highlights the plural nature of training and the presence of different ways of thinking about mathematics based on Afro-Brazilian fabrics. The diversity of perspectives shows that geometric knowledge emerges in dialogue with life experiences, memory, and the pedagogical context of each teacher.

Scene 1: Weaving glances: Lua's reading of Afro-Brazilian patterns

Next, we delved deeper into individual interpretations, showing how mathematics, especially the geometric patterns identified in the fabrics, became learning and reflection experiences during training. The aim of the activity was to encourage observation of shapes, symmetries, colors, and patterns, prompting reflection on how these elements could interact with teaching practice at different stages of education. After the proposal was presented, each teacher received a different Afro-Brazilian fabric to observe and identify recognizable geometric elements, bringing the cultural object closer to pedagogical practice and mobilizing both mathematical knowledge and professional experience.

Among these readings, we highlight that of Lua, a preschool teacher, whose observation of an Afro-Brazilian fabric revealed an attentive eye for the shapes, colors, and rhythms present in the prints. By proposing activities in which children could observe, compare, and reproduce patterns—including through games she called “mazes”—Lua highlighted the power of fabrics as tools that spark curiosity and promote the exploration of spatial notions in dialogue with Afro-Brazilian culture. Her reading suggests that the aesthetic and cultural dimension of these fabrics can constitute paths for teaching geometry in early childhood education in which learning also involves feeling, imagining, and recognizing the presence of Black references in everyday school life.

Teacher Lua, who works in early childhood education, analyzed the fabric shown in Figure 2 and recorded her perceptions in Table 2.

FIGURE 2: Fabric studied by Professor Lua

Source: Author's own photo (2025) based on data from the extension course (2024).

The fabric in Figure 2 became the starting point for the student to think about possibilities for her teaching practice. Upon observing it, she highlighted elements that directly relate to Early Childhood Education.

TABLE 2: Possibilities with fabrics – Lua (EI) Student Lua

Early Childhood Education
In Early Childhood Education, there are many possibilities for activities using fabrics, where we can explore colors, shapes (some children can already name some geometric shapes), straight lines, and curves with young children. In language arts, we can produce texts. Using representations of fabrics, we can create games (mazes).

Source: Extension course – excerpt from Professor Lua's response (2025).

The statement by student Lua, in Table 2, shows that fabric, taken as a cultural object, stimulates reflection on its use in early childhood education. By mentioning colors, figures, straight and curved lines, as well as the possibility of producing texts and games that she called "mazes," Lua listed elements present in the print and transformed them into possibilities for activities with children, articulating the gaze toward geometric patterns while playing. Although she does not explicitly use terms such as Afro-Brazilian culture in her speech, the fact that she takes African/Afro-Brazilian fabrics as a

starting point indicates an initial movement towards bringing together geometry content and artifacts marked by black references.

Fanon (2022, p. 97) contributes when he points out that, upon coming into contact with symbols of their ancestry, subjects can resist the process of "epidermization of inferiority," recognizing themselves as protagonists of their own history.

When schools fail to offer symbols of belonging and ancestry—for example, African geometric patterns as a subject of study in geometry—they reinforce subtle forms of cultural domination that naturalize the superiority of certain types of knowledge and values and feed the idea that only European knowledge is valid. Recognizing and studying the geometric symbols present in Afro-Brazilian fabrics is thus an act of symbolic resistance: breaking the silence and reinscribing the African presence in the curriculum and in teacher training. In these fabrics, designs of suns, spirals, waves, and rhythmic compositions evoke the movement of life and the circularity of time, reaffirming that geometry can express unique ways of existing, knowing, and signifying the world.

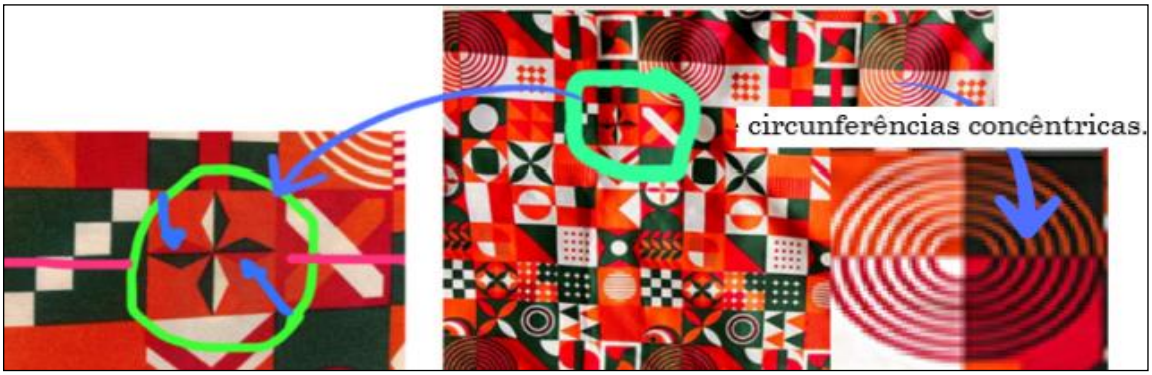
Lua's perceptions indicate that the use of Afro-Brazilian fabrics can open up ways for geometry to be worked on in Early Childhood Education in contexts permeated by affection, imagination, and culture. Her teaching proposal, mediated by Afro-Brazilian cultural artifacts, suggests that the study of shapes, colors, and patterns does not need to be dissociated from children's experiences and black references present in everyday life. From a theoretical point of view, using these fabrics as a support for teaching geometry brings teaching practice closer to a perspective that values ancestry and seeks to build more humanizing pedagogical practices, without this appearing explicitly in the student's speech. Lua's perceptions, presented in the previous analysis, highlight geometry as a sensitive and playful expression in Early Childhood Education. In the following segments, this view changes: the students begin to recognize, in the same Afro-

Brazilian fabrics, more complex geometric structures, linked to school concepts and everyday experiences. In this movement, the voices of Bell, Fran, and Pedro emerge.

Scene 2: Bell and the analytical view of Afro-Brazilian fabrics

To illustrate how Bell began to interpret fabrics in geometric terms, we present her formative journey based on her experience as a teacher in the final years of elementary school. The image brings together some of the patterns she identified, highlighting, in particular, the presence of sliding reflections and concentric circles in the Afro-Brazilian fabrics worked on in the course. By highlighting these choices, in Figure 3 we materialize the shift from the idea of a "beautiful pattern" to treating fabric as a legitimate medium for the study of geometry, developing marks and arguments that can be revisited with students in future activities.

FIGURE 3: Geometric patterns, sliding reflection, and concentric circles identified by Bell in Afro-Brazilian fabrics



Source: Prepared by the author (2025).

A visual reading of Figure 3 reveals a pattern constructed by successive symmetries—combinations of rotations and reflections (or reflections followed by translations)—which can be described in the literature as sliding reflection, in addition to the concentric circles

highlighted by Bell. Table 3 shows the geometric elements that Bell identified in the Afro-Brazilian fabric he analyzed.

TABLE 3: Geometric elements identified by Bell in Afro-Brazilian fabric

Geometric shapes, perimeter, area, sequences, symmetries, rotational angles, location of points and concentric circles, sliding reflection symmetry, and rotation

Source: Research archive. Own photo (2025).

In Table 3, Bell identified different elements of mathematics in her Afro-Brazilian fabric. Among these elements, she pointed out, as shown in Figure 2, concentric circles and sliding reflection symmetry. Bell's interpretation as a teacher of the final years of elementary school on Afro-Brazilian fabrics reveals a keen eye for the structures and repetitions that make up the patterns. Her discourse shifts the focus from aesthetic ornamentation to the systematic study of forms, which seems to highlight a conceptual appropriation mediated by culture.

Historical-Cultural Theory contributes to understanding this movement. According to Vigotski (2007, p. 63), "instruments and signs are mediators between the subject and knowledge." Here, the fabric takes on this mediating function, enabling the teacher to perceive new ways of signifying geometric concepts from a cultural artifact steeped in history.

The analysis of Bell's participation in the course and her response to the final questionnaire highlight the mediating function of the training activity, enabling the teacher to attribute new meanings to geometric concepts based on a cultural artifact steeped in history. While reading the Afro-Brazilian fabric, Bell recognized different geometric elements and reflected on how these could dialogue with her teaching practice, shifting the print from the status of "decorative background" to that of a support for the study of geometric patterns in an Afro-Brazilian context. This elaboration is expanded upon in question 3 of the

final questionnaire: “After the course, do you feel more prepared to articulate African and Afro-Brazilian culture in the teaching of geometry? Justify your answer.” Bell stated: “I think I am better prepared, but I am not completely confident yet.” This statement indicates an important shift: she did not declare herself “ready,” but acknowledged progress in relation to her starting point. In Vygotskian terms, this statement can be read as evidence of a Zone of Proximal Development: there is knowledge that can already be mobilized with more confidence and other knowledge that still requires support, study, and sharing (Vygotsky, 2007).

From a post/anti-colonial perspective, this insecurity is not only individual: it reflects the effect of a Eurocentric school education, in which African and Afro-Brazilian references are rarely treated as a legitimate source of mathematical knowledge (Fanon 2008; Gonzalez, 2020). In saying that she is “better prepared,” Bell pointed out that the course offered her a starting point to break this silence and begin to introduce, in geometry classes, the geometries that inhabit African and Afro-Brazilian fabrics.

In dialogue with Caraça (1951), this oscillation can be read as an expression of the very dynamics of science, conceived as “work of reflection and continuous deepening, where contradictions arise, are debated, and resolved” (Caraça, 1951, p. XIII).

TABLE 4: Bell's response to question 3 in the final questionnaire

Bell: I had never thought that a fabric could show so many geometric shapes and, at the same time, tell a story.

Source: Prepared by the author and taken from the final questionnaire, question 3 (2025).

This movement reveals that fabric is now recognized as a potential teaching object, in which the geometry taught in school, marked by a Eurocentric tradition, and the geometries produced in Afro-

Brazilian matrices are brought into dialogue, recognizing both as legitimate forms of knowledge production. This perspective breaks with the naturalization of geometry as a neutral and universal field. When Bell observed the concentric circles and symmetries of the fabrics, she reinscribed the study of geometry in a context of aesthetic appreciation that is simultaneously political.

Césaire (2020, p. 42) recalls that recognizing beauty in black expressions constitutes "an act of decolonization of the gaze," as it is a matter of recovering sensitivity and the right to exist in full humanity—a right denied by colonialism. From this perspective, Bell's gaze on fabrics goes beyond the visual dimension and becomes a gesture of restitution of denied humanity: by identifying the geometric shapes and properties that inhabit African fabrics, she reinserted the black subject into the field of creation and thought.

By recognizing the geometries that inhabit African fabrics, Bell contributed to reconstituting the humanity that colonialism tried to erase—a gesture that Fanon (2022, p. 31) understands as the "symbolic reappropriation of being." This movement is not just about identifying shapes, symmetries, and patterns, but about rewriting, in the school environment, histories and memories that have been systematically silenced. Her reading of the fabric was close to what Lélia Gonzalez (2020) describes as Amefricanity, that is, the affirmation of a field of experiences and knowledge produced in the interweaving between Africa and the Americas. From a theoretical point of view, this way of reading the fabric indicates that the teaching of geometry can also take on a political and cultural dimension, opening up possibilities for approaching historically denied knowledge and other forms of identity recognition.

The insights expressed by Bell in Table 4 show the potential of geometry to reveal senses of belonging and resistance. In narrating what she sees, she not only described geometric elements, but also explained the

emotional and cultural ties that run through the print. The figures cease to be simple “decorative motifs” and begin to operate as signs of a collective history, which calls on subjects to see and recognize themselves in what they study. In this sense, the activity promotes an important shift: instead of taking geometry as an abstract and distant field, the training brings concepts and definitions closer to lived experiences, producing a context in which learning also involves legitimizing one's own existence and voice. In the voices that follow, this movement takes on new contours: patterns and symmetries are interpreted in relation to everyday life and interactions between teachers, revealing how geometric knowledge is produced, shared, and re-signified in training practices.

It is in this intertwining of experiences that Fran and Pedro's analyses emerge. Their readings, sometimes convergent, sometimes tense, broaden the field of possibilities opened up by Bell, showing that the discussion of geometric patterns is not limited to the correct application of terms, but involves disputes over meaning, negotiations of language, and choices about what counts as valid knowledge in teacher training.

Scene 3: Fran and Pedro: plots between everyday life and formalization

FIGURE 4: Fabric analyzed by Fran.

Source: Research collection (2025).

Fran, a trainee teacher working as an intern in Early Childhood Education and a math teacher in the Final Years and High School, analyzed the fabric in figure 4, whose geometric patterns, according to her, feature overlapping shapes, repetitions, and variations in size. In her reading, she highlighted sequences, symmetries, measurements, correspondences between figures, and proportional relationships, pointing out possibilities for working with notions of area, perimeter, and scale. For her, children and young people could "play at discovering" these repetitions, count how many shapes are repeated, and compare their dimensions. From a historical-cultural perspective, Fran's movement indicates a process of approximation, which Vigotski (2007) calls mediated appropriation: by interacting with the fabric—a cultural artifact steeped in history—she transformed the initial experience into a possibility for conceptual elaboration. The fabric acts as an instrument of mediation that connects everyday practice to scientific knowledge, encouraging the teacher to attribute geometric meanings based on elements present in her life and teaching context.

TABLE 5: Discussion about the term "anagram" during the course

Fran: I can count the anagrams; then I can measure them, identify the shapes...
Pedro: Where did you see an anagram, guys?
Fran: You don't believe it's an anagram? You can't read!
Cida: What Fran said convinced me, because it expanded the content—I imagined the measurements, the width and height of the shapes.
Pedro: Oh! I have no doubt about that.
Sandra: When she talks about anagram, maybe she means combination; anagram involves swapping letters.
Fran: Doesn't the order make a difference to you?
Pedro: It does, but then it's a combination.
Cida: So let's go with combination. Do we agree?

Source: File produced during the course and prepared by the author (2025).

The dialogue recorded in Table 5 reveals a formative process in motion, in which thinking is constructed through confrontation and the sharing of ideas. By questioning the presence of the term anagram in the fabric analyzed by Fran, Pedro seemed to seek conceptual precision, while she seemed to indicate a broadening of the field of understanding to forms and patterns. This tension seems to highlight the transition from the everyday to the scientific (Vygotsky, 2007), showing how shared language acts as a mediator in the constitution of thought.

In his dialogue with Fran, Pedro demonstrated concern for conceptual precision, questioning the use of the term anagram to describe the shapes observed in the fabric. His gesture reveals a way of thinking typical of school geometry, guided by the search for rigor and clarity.

Weaving meanings: teacher training as knowledge production

FIGURE 5: Fragments of the fabrics analyzed by Lua, Bell, and Fran

Source: Research collection (2025).

The task proposed to the course participants consisted of analyzing two Afro-Brazilian fabrics (the first two on the left) and one African fabric, shown in Figure 5, from a geometric perspective, which constituted an exercise in cultural mediation. By observing, comparing, and discussing shapes, repetitions, and symmetries, teachers were invited to also signify memories, identities, and ways of seeing the world. In this movement, the fabrics acted as cultural instruments that enabled the transition from the

lived to the conceptual, opening space for geometry to be understood in its human and historical dimension.

In light of Historical-Cultural Theory, we understand that the teacher training program analyzed functioned as a space for symbolic mediation. By interacting with Afro-Brazilian fabrics, teachers reworked ways of teaching and learning geometry, linking the concepts studied to their own cultural and school experiences. This movement, observed in the course's statements and records, expresses what Vigotski (2007) calls the dialectical relationship between the social and the individual in the development of thought: learning occurs in the encounter between subjects, signs, and cultural objects.

Postcolonial theory broadens the critical reading of this process: Césaire (2020, p. 44) states that "decolonization begins with the revaluation of culture"; Fanon (2022, p. 31) highlights that this symbolic reconquest restores the subject's right to exist in fullness; Hall (2003, p. 13) reminds us that identities are constructed on difference; and Gonzalez (2020, p. 76) invites us to recognize, in Afro-Americanity, the political gesture of producing knowledge from the Black experience.

The training analyzed, developed within the scope of Grupem and Clumat, showed that the teaching of geometry can become a field of political resistance when anchored in Afro-Brazilian fabrics. In this context, it is not the school, but the teacher—and, in this case, the group of trainers—who intentionally organizes teaching actions, choosing objects and materials that can articulate pedagogical activity and development. The Teaching Guidance Activity (Moura, 1996) underpins this intentionality by understanding teacher training as a social practice designed to generate meaning, mediation, and reflection on the action itself.

The collective work of teachers with Afro-Brazilian fabrics revealed that teaching is also an act of creation and resistance in which sensitive, scientific, and ancestral threads are intertwined. From this experience

emerges the understanding that the teaching of geometry, mediated by cultural artifacts—African fabrics—can produce new ways of knowing and being a teacher.

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