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Cassava flour production in the Quilombola Santa Luzia do Maruanum Community: following ethnomathematical paths

Abstract: The process of producing flour begins with the planting of cassava and ends with the roasting and sale of the products. Observing this process encourages us to look at the ethnomathematical paths of this production and apply them to the classroom. In this context, the objective is to analyze the production of cassava flour in the knowledge/doing for socioeconomic equity in the Quilombola Santa Luzia do Maruanum Community. The qualitative approach and ethnographic research allow the use of instruments such as discussion circles, participant observation, and audio and video capture. However, Mr. José do Carmo's narrative is the focus of the analyses, discussions, and results. It is concluded that the beings, knowledge, and doings make it possible to contextualize some school mathematical concepts, reinforcing identities and local belonging.

Keywords: Ethnomathematics. Flour Production. Narrative. Knowledge and Doings.

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DOSSIER — HISTORY OF MATHEMATICS AND CULTURE

Producción de harina de yuca en la Comunidad Quilombola Santa Luzia do Maruanum: siguiendo caminos etnomatemáticos

Resumen: El proceso de producción de harina inicia con la siembra de la yuca y finaliza con el tostado y venta de los productos. Observar ese proceso nos anima a mirar los caminos etnomatemáticos de esa producción y llevarlos al aula. En ese contexto, el objetivo es analizar la producción de harina de yuca en los conocimientos/prácticas para la equidad socioeconómica en la Comunidad Quilombola Santa Luzia do Maruanum. El enfoque cualitativo y etnográfico de la investigación permite el uso de instrumentos como círculos de conversación, observación participante, captura de audio y video. Sin embargo, la narrativa de José do Carmo se centra en el análisis, las discusiones y los resultados. Se concluye que los seres, los saberes y las prácticas viabilizan la contextualización de algunos conceptos matemáticos escolares, reforzando identidades y pertenencias locales.

Palabras clave: Etnomatemáticas. Producción de Harina. Narrativo. Conocimiento y Prácticas.

A produção de farinha de mandioca na Comunidade Quilombola Santa Luzia do Maruanum: percorrendo caminhos etnomatemáticos

Resumo: O processo de produção de farinha se inicia no plantio da mandioca e se encerra na torra e comercialização dos produtos. Observar esse processo instiga olhar os caminhos etnomatemáticos dessa produção para levá-los à sala de aula. Nesse viés, o objetivo é analisar a produção de farinha de mandioca no saber/fazer para a equidade socioeconômica na Comunidade Quilombola Santa Luzia do Maruanum. Com abordagem qualitativa e tipo etnográfico, a pesquisa utilizou instrumentos como rodas de conversa, observação participante, captação de áudio e vídeo. A narrativa do Sr. José do Carmo foi central para as análises, discussões e resultados. Conclui-se que os seres, saberes e fazeres tornam viável a contextualização de alguns conceitos matemáticos escolares, reforçando identidades e pertencimento local.

Palavras-chave: Etnomatemática. Produção de Farinha. Narrativa. Saberes e Fazeres.

1 Introduction[1]

The exchange between Brazil and Portugal on ancestral and artisanal knowledge developed by small communities — which, in both countries, are invisible — enables the recognition and validation of all the specific particularities in the configuration of this knowledge and practices. In view of this, the importance of combating the exclusion of local knowledge, reinforcing intellectual diversity, is highlighted. With this bias, this research was developed, which is part of the actions of a project started in 2022, resulting from the 2021 Universal Call of the Conselho Nacional de Desenvolvimento Científico e Tecnológico [National Council for Scientific and Technological Development — CNPq].

The focus of this project was on six communities, three Brazilian and three Portuguese: a community of small farmers in Matapi/Amapá and another in Costa da Caparica/Portugal; potters from the Quilombola Santa Luzia do Maruanum Community/Amapá and lace makers from a community in the municipality of Setúbal/Portugal; artisanal fishermen from a fishing community in Bragança/Pará and artisanal fishing communities in the Almada Council/Portugal.

As the project involved researchers from the North and Southeast regions of Brazil, a Portuguese researcher, as well as postgraduate students from Brazil and Portugal and two Brazilian scientific initiation scholarship holders, it is worth noting that it had interinstitutional collaborative scope in Brazil and an international character with Portugal. It should also be noted that the implementation of actions with the communities emphasized the co-construction of knowledge through the experiential, ancestral, and artisanal sharing of knowledge and practices inherent to the communities involved.

The Santa Luzia do Maruanum Community is a quilombola community in which a group of women take responsibility for the socioeconomic and cultural survival of their families through the artisanal production of clay pottery. The objective of this research was to analyze the labor activity in the production of cassava flour for sustainability in knowledge/practice for socioeconomic equity in the Quilombola Santa Luzia do Maruanum Community, adopting a qualitative ethnographic approach as the methodological path (André, 2023).

Ethnographic research requires different tools to validate the results achieved. Therefore, the methodological procedures adopted are based on participant observation, interviews, field diaries for recording observations made in situ, discussion groups, clarification meetings, audio and video production, drawings and photographs, as well as consultation of records previously prepared by other researchers, when necessary.

The artisanal production of cassava flour involves various mathematization strategies, which can be integrated into the classroom as pedagogical resources, making learning more meaningful and significant. In short, it is understood that combining the knowledge and practices involved in flour production is a way to co-construct mathematical knowledge. This co-construction gives visibility to ancestral and artisanal knowledge and practices, following a countercolonial path (Santos, 2015), in defense of oral narratives centered on collective practices and experiences.

In this logic, the results contained in this work indicate that the production of cassava flour can be mobilized as a pedagogical resource that, traversed by ethnomathematical, contemplates various dimensions, such as the educational and cognitive dimensions of D'Ambrosio (2011) and the affective dimension of Mattos (2020).

[1] This paper is an expanded reinterpretation of the work presented at the IX International Seminar on Research in Mathematics Education (SIPEM) as an oral communication.

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2 A little about the communities participating in the project

The first community is composed of small farmers from the Matapi Agricultural Colony, located in the municipality of Porto Grande, in the state of Amapá, Brazil. Founded in February 1949, only five settlers had taken up residence. The following year, almost 100 people lived in the colony. According to Montoril (2017), the plots were divided geometrically into rectangles of the same size. The main purpose of creating this colony was to supply Serra do Navio and the capital Macapá with food such as vegetables, greens, and cereals. Economic activity consists of family farming and small animal husbandry.

The second community in the project, which will exchange knowledge with the first, is the farming community of smallholders in the rural area of Costa da Caparica, Portugal. With a vast fertile territory between the sea and the Arriba Fóssil, subsistence agriculture — practiced in small vegetable gardens on dune land, fertilized for several generations with fish species of lesser commercial and nutritional value — forms the basis of a community composed of men and women dedicated to this labor practice. Currently, there is an urban project, Agroparque, located in Terras da Costa, an area known for its agriculture and the various communities that live there — Urban Frontiers Project. Economic activities include subsistence farming and district trade.

The third community is composed of women potters from the Quilombola Santa Luzia do Maruanum Community, located in the rural area of the municipality of Macapá, in the state of Amapá, Brazil, near the Maruanum River, a tributary of the Matapi River. It is a region rich in ecosystems, with rivers, lakes, and streams, in addition to the Amazon Rainforest. The economic activities are subsistence family farming and the production of clay pottery, also of family origin.

The fourth community, which will share knowledge with the third, is made up of bobbin lace makers from the council of Sesimbra, Portugal. As a village, Sesimbra is home to many arts related to ocean fishing. In ancient times, the women of the Sesimbra Fishing Community helped with fishing or worked as bobbin lace makers in their homes. The economic activity is the manufacture and sale of lace artifacts.

The fifth community is composed of artisanal fishermen from the Fishing Village, located in Ajuruteua, municipality of Bragança, in the state of Pará, Brazil. It is situated on the left bank of the Caeté River. The village contains rustic wooden buildings, where the local artisanal fishermen live. The main tourist attraction is a shipwreck whose wreckage can be best observed at low tide. Economic activities include artisanal fishing for various fish and crab harvesting, depending on the season.

The sixth community, which will engage in dialogue with the fifth, is made up of fishermen located in artisanal fishing communities on the Costa da Caparica, a coastal area of Portugal. Costa da Caparica was established in the mid-18th century by Portuguese fishing communities originating from Ílhavo and Olhão, towns in the north and south of the country, respectively, revealing the historical multiculturalism present in the artisanal fishing practices of this city. These practices occupy a significant position with regard to bycatch and, consequently, its valorization, highlighting the inseparability between cultural and economic aspects. The economic activity is professional artisanal fishing.

Faced with such pluriversality, resulting from the confluence of different communities, we work with local knowledge and practices and with the possibility of dialogue between communities, in order to further enrich the local intellectuality promoted by ancestral, artisanal, and experiential knowledge.

3 Walking among different communities and the pluriversality of being, knowledge, and

practice

Starting from different communities, we contemplate human beings involved in research, understood as manifestations of the multiplicity and diversity of these entities. Added to these are those who make their knowledge and intellectuality their work practice, contained in ancestral, artisanal, and experiential knowledge/practice. According to Ramose (2011, p. 11), "for this existential condition of entities to make sense, they are identified and determined based on specific particularities" that characterize original pluriversality.

By bringing pluriversality as a path for socioculturally constituted human beings in the process of learning, it is understood that there are several possibilities, related to sociocultural specificities, which foster collective co-constructions, in which learning transcends formal and institutional limits and is configured as a pedagogical resource with the viability of contextualizing school knowledge. Given this, it is pointed out that pluriversality is seen as resistance, due to the realization that there is knowledge in all beings, developed by human experience in the world, coming from ancestry. Therefore, acting in interculturality is the path to dialogue, in the search for the decoloniality of being and knowledge. It should also be noted that the collective is understood as a part of the whole that constitutes each community.

Looking at the decoloniality of being and knowledge, it is clear that there is a coloniality of power, which is Eurocentric and produced by global capitalism. "In dealing with the necessary deconstruction of this hegemony for the emergence of pluriversality, decolonial genealogy prioritizes the subjects, knowledge, and practices that have been subjugated and subalternized in the wake of the colonial/modern pattern of power" (Silva, 2022, p. 95). In this way, the rules are modified to bring the subjugated to new places of enunciation. It is therefore up to these beings to unveil the discoveries and knowledge of intellectual appropriation that have been made invisible and almost erased.

In these communities, there is a common part that can be shared and exclusive parts that define places, beings, knowledge, and practices. This type of organization is understood as sensitive sharing. Rancière (2009, p. 15) states that "this division of parts and places is based on a sharing of spaces, times, and types of activities that determines precisely how a common is lent to participation and how each takes part in this sharing". It is this sharing that we seek to find in the dialogues that narrate experiences, struggles, and resistance.

When observing different communities, it is noticeable that there are community possibilities that move towards the co-construction of ecological societies, based on the theory of social ecology (Bookchin, 1982), in which it is necessary to radically transcend the nature/human binomial, pointing to the totality — understood as more than the sum of its parts. These ecological societies are organically conceived as "a spontaneously formed, non-coercive, egalitarian society — a 'natural' society in the well-defined sense that it emerges from innate human needs for association, interdependence, and care" (Bookchin, 1982, p. 5). Therefore, these societies promote human sociability and free expression.

According to Bookchin (1982, p. 23), by understanding these ecological communities holistically, "in terms of their mutual interdependence, social ecology seeks to uncover the forms and patterns of interrelationships that give intelligibility to a community". It is thus understood that totality is not to be confused with unity, but with plurality articulated to the history of each sociocultural group. Furthermore, holism is "the result of a conscious effort to discern how the particularities of a community are organized" (Bookchin, 1982, p. 23) and how these particularities can help other communities dialogically to co-construct other forms of knowledge and practices. In this way, social ecology deals with a distinct human and natural community, constituted by social and organic factors that interrelate to provide the basis for the community to be ecologically balanced.

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The concept of learning community is also presented for discussion, whose cognitive process moves away from the individual and independent and shifts to the group and social. According to Freitas (2010, p. 15), a learning community "is a social organization of people who work together, sharing knowledge, attitudes, and values to achieve mutual goals". From this perspective, it is understood that it is necessary to establish genuine dialogue in order to enable collaboration between members of these sociocultural groups. Furthermore, this dialogue between communities is what Hooks (2022, p. 35) calls "classrooms without borders" — spaces without concrete boundaries, in which it is possible to create co-constructive places for mutual learning.

4 Ethnomathematics and sustainability in knowledge/practice for social and economic equity

As research is being conducted with communities that, in some way, interfere with the environment, it is natural for these communities to pay attention to processes for protecting the place where they operate and from which they derive their family livelihood. D'Ambrosio (2018) expressed concern about the preservation of the human species and, to this end, according to the author, we must focus on social justice and the sustainability of the planet. It is necessary to be attentive to climate issues, biodiversity loss, ecological shocks that degrade the biosphere, among other aspects. This research addresses ecological communities that, in a dialogue of mutual learning, make a difference in their spaces of belonging. From this exchange, new knowledge emerges on how to deal with the environment.

Given this important warning by D'Ambrosio (2018), it is worth investigating how these beings achieve sustainability in their places of origin, as well as understanding the ways of mathematizing the environment developed by all these communities that are being studied.

When researching ways to mathematize the environment, it is important to bear in mind that the communication processes or language used by these people are not developed in the same way as academic mathematics. Referring again to Hooks (2022), classrooms without borders are created to collectively think about the issue of teaching and learning as catalysts "that call on everyone present to become increasingly engaged, to become active participants in learning" (Hooks, 2013, p. 22). This involves the creation of collaborative learning communities.

These collaborative learning communities have developed their own language process that comes from ancestry co-constructed over time. Hooks (2013, p. 173) states that it is necessary to find individuals "who truly occupy different positions within structures and share ideas with each other, mapping their terrain, their connections, and their common concerns regarding teaching practices." Thus, the dialogues describe narratives that are part of the history of these human beings. Through these dialogues — narratives that speak of themselves, the process of generating income, occupying spaces as local work, and experiences — it is revealed how they preserve the surrounding environment, reverberating in a local sustainability that is present in the mixture of beings, knowledge, and practices.

The sustainability that is being considered moves, or should move, towards what D'Ambrosio (2007, p. 12) states as "achieving a state of TOTAL PEACE, without which the future of humanity will be compromised". This state of peace involves social, environmental, and inner peace. The peace sought is one that, while addressing the demands and needs of the present, does not compromise the peace of the future.

It is known that humanity is made up of different sociocultural groups, whose members adopt customs, values, language, rituals, and myths so that, by dominating the outside world, they can also dominate themselves. In other words, the inner self, and this domination allows

them to be at peace with the environment to avoid wars and climate crises.

From this perspective, we move from immanence, understood as the material manifestation of human beings and reverberated in the use of the unique language of each culture and community, to transcendence, which refers to the spiritual and translates into the loving and affective awakening of consciousness. There is, therefore, an interrelationship between the self and the other in the group, and between different groups. These interactions contribute to consolidating knowledge, manifested through the integration of the dimensions of ethnomathematics, especially the cognitive and affective ones.

5 The production of cassava flour by the Quilombola Santa Luzia do Maruanum Community: ethnomathematical approaches

Before beginning this topic, it is important to clarify what is meant by ethnomathematical approaches. The understanding refers to each action developed by a given community, which allows us to get as close as possible to ethnomathematics; however, this action goes further to effectively achieve it. In this sense, as these approaches occur between different mathematics and different contexts, elements are created that are associated with the experiences of each of these communities, going beyond the already known and systematized mathematical knowledge taught in schools, offering support for classroom practice and promoting teaching and learning.

These connections do not seek a common point in all these communities; on the contrary, they seek similarities, a network of similarities "that involve and intersect with each other. Similarities of whole and detail". This is what is called "family resemblances" (Wittgenstein, 1999, p. 52). Consequently, the aim is to weave this network based on the understanding that each thread of the fabric is intertwined with the others. In this way, any activities practiced by these communities are part of these ethnomathematical approaches and, as such, they appropriate them for the whole that they describe and manifest.

That said, during one of the visits to the Quilombola Santa Luzia do Maruanum Community, we had the opportunity to experience the process of producing cassava flour. The entire process was explained by Mr. José do Carmo, son of the matriarch and leader of the *quilombola* community, Mrs. Marciana. After planting and harvesting, the cassava is taken to the *flour house.* According to Lima and Mattos (2017, p. 58), this house

> is where cassava is processed. It consists of a shed covered mostly with *inajá* straw, with a dirt floor and no walls, where the oven and other utensils necessary for processing cassava are located. It is usually located near fields and waterways, but today it can also be located near residences, due to the ease of using electricity owned by one of the community residents.

The *flour mill* in the community surveyed is located near Mrs. Marciana's house, more precisely in front of her residence. The entire production process takes place there, beginning with the peeling of the roots and washing them one by one in a basin. The washed cassava is placed in a wooden container called *a catitu,* which contains an electric grater that grinds the roots (Figure 1).

Part of the cassava is soaked for five days and then mixed into the final dough to prepare the cassava flour (Figure 2). Mr. José do Carmo estimates the proportion of cassava to be set aside based on the amount of cassava harvested. According to Bezerra (2006), the flour produced with this mixture is called *mixed flour.* According to the author, this flour is composed of "[...] grated cassava dough with fermented cassava dough, in a proportion of 75% to 80% of the first dough and 20% to 25% of the second [...]" (Bezerra, 2006, p. 11).

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Figure 1: Cassava in *the catitu* being grated (Own collection, 2023)

Figure 2: Cassava soaking to be mixed at the end of the cassava flour preparation process (Own collection, 2023)

Observing this stage of the artisanal cassava flour process, several ethnomathematical approaches can be identified, such as the ancestral estimates made by Mr. José do Carmo who, based on his experience, stipulates the amount of cassava to be soaked. This step can be characterized as a good resource for introducing the concepts of percentage, ratio, and proportion. In the context of mathematical practice and the search for new directions or new alternatives for teaching mathematics in schools, it is clear that bringing this daily activity into the classroom — especially in schools that receive students from communities that produce cassava flour — enables a better understanding of the mathematical concepts to be learned.

Continuing with the production of flour, it can be observed that the roots are handled with extreme care in order to avoid accidents when inserting the cassava into the grinder (Figure 3). It should be noted that one hand remains very close to the equipment, which represents a risk of accidents. The other hand, responsible for pushing the cassava, is also subject to injury if care is not taken when finishing the root. In the past, according to Mr. José do Carmo, a manual grater was used, a more laborious method that, although less dangerous, still caused minor accidents. He himself claims to have grated his own finger during the process.

Once all the cassava has been grated, it is placed in another rectangular wooden container, where the dough waits for the *tucupi* to be removed. To remove this liquid, the cassava dough is placed in a handmade device called a *tipiti*.

The tipiti is a cylindrical instrument of indigenous origin used to extract a yellowish liquid contained in the cassava. Many artisanal flour producers, such as indigenous people, still use *tipitis* made of straw; however, today there are *tipitis* made from recycled nylon, as is the case with Mr. José do Carmo (Figure 4).

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Figure 3: Mr. José do Carmo grating cassava in the *catitu* (Own collection, 2023)

Figure 4: Handcrafted *tipiti* artifact (Own collection, 2023)

According to Mr. José do Carmo, the straw *tipiti* is more efficient at removing the yellow liquid from cassava; however, it is less durable. Even so, when considering issues of environmental preservation and sustainability, the straw *tipiti* is more environmentally friendly, even though the nylon is recycled.

First, because the straw used comes from palm trees, which are easy to reforest; second, because the amount of leaves used is small in relation to the artifact's lifespan. Nylon *tipiti*, on the other hand, despite being more durable, is not sustainable, as its improper disposal can cause environmental damage. Despite this, he currently opts for nylon *tipiti*, disposing of it correctly.

The *tipiti* has two rings at its ends—one at the top and one at the bottom. The upper ring is used to hang the *tipiti* filled with cassava dough on a wooden beam, while the lower ring is used to insert a stick that acts as a lever, as shown in Figure 5. When the *tipiti* is stretched, the diameter of the cylinder decreases, compressing the cassava dough and releasing the yellow liquid.

Figure 5: Removal of the yellow liquid from the cassava dough in the *tipiti* (Own collection, 2023)

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After all the yellow liquid has been removed, the squeezed pulp is placed back into the same container, keeping it separate from the pulp that is still to be processed. It can be seen that the unsqueezed pulp is more yellow in color than the squeezed pulp (Figure 6).

Figure 6: Cassava dough before and after squeezing in the *tipiti* (Own collection, 2023)

The liquid that has been removed is placed in a bowl to be boiled the next day, as it cannot be boiled on the same day, as this would make it sweet. After boiling, which serves to eliminate the poison, this liquid becomes known as tucupi—a sauce that is very popular in the cuisine of northern Brazil. This sauce has indigenous origins and, before boiling, is used by some indigenous peoples to kill ants.

To prepare mixed cassava flour, the dry dough is mixed with the cassava that has been soaked and kneaded by hand, as it is very soft. Three measures of grated dough are added to one measure of fermented and kneaded cassava. Bezerra (2006, p. 20) warns that

> this is one of the main stages in the preparation of mixed flour, as it is the exact percentage of fermented dough that gives this product its characteristic flavor. To prepare mixed flour, three quarters of grated root is usually mixed with one quarter of softened or fermented root in water.

As can be seen, both artisanal and industrial processes use the same percentage of each type of dough. This shows that the ancestral indigenous origins of the cassava flour process have crossed different cultures, whether *quilombola* or urban, reinforcing the recognition of indigenous peoples as the first cultivators and processors of cassava in Brazil.

To confirm the indigenous origin, we turn to the history of cassava, in which Rodrigues (2017, p. 74) points out that:

> One of the first to mention indigenous knowledge and the nutritional properties of cassava was the French Protestant Jean de Léry, who gave a lengthy description of the preparation of this food in 1556. He said there were two species of roots, *aypi* and *maniot,* which took 3 to 4 months between planting and harvesting, "becoming as thick as a man's thigh and about a foot and a half long".

As noted, even at that time, there were two types of cassava: one considered poisonous and the other not. However, only the indigenous peoples were able to distinguish between them, identifying them by the color of their foliage. In addition, there are historical records about the removal of *tucupi*, as can be seen in this excerpt:

> [...] once harvested, the cassava underwent its first processing: it was soaked

> in water for 3 to 4 days, after which “they trample it very well” and squeeze the mass in a long, narrow instrument, “woven[o] in the manner of a basket”, until “nothing remains to be drained”, extracting the poison “that if a person or any other animal drinks it, they will soon ... die” (Rodrigues, 2017, p. 75).

There is also information about the production of flour by indigenous peoples, as can be seen in the following excerpt:

> It was the women who prepared the flour, grating the fresh root until it turned into “flour as white as snow”. The next step was to cook it: the grated root was placed by the Indian women in large clay pans produced by them, where they were stirred continuously with half gourds “until ... it takes the form of hailstones or sprinkles”, according to Léry. The process took about half an hour, according to Gândavo. A kind of underground oven could be used by the Indians to obtain the flour (Rodrigues, 2017, p. 76).

It is clear that the *quilombolas* learned how to handle and prepare cassava from the indigenous people. D'Ambrosio (2009, p. 13) states that “the encounter between cultural groups, which characterizes the moments of globalization recognized throughout human evolution, is an opportunity to create something new, thanks to the dynamics inherent in such encounters”. In this understanding, it is clear that, in his artisanal work, Mr. José do Carmo estimates the proportion of each of the masses to be placed in the mixture. In the industrial process, however, this proportion is rigorously measured. Recovering this ancestral and artisanal knowledge for pedagogical purposes implies learning from students and, at the same time, valuing the different existing cultures.

Thus, three dimensions of ethnomathematics stand out: educational, affective, and cognitive. The cognitive dimension refers to the need for human beings to produce knowledge to meet their daily demands for survival and transcendence. Consequently, when a sociocultural group mobilizes its own material and intellectual tools, it reveals multiple cognitive abilities to interact with the environment and co-construct the world.

Given this, D'Ambrosio (2011) emphasizes that the behavior of a group associated with knowledge can be modified by the presence of another group that also produces knowledge and develops behaviors originating from its sociocultural group. This interaction leads to the educational dimension as a strategy for accepting the different types of knowledge produced by humanity over time, recognizing them as equitable and essential for building global peace.

The affective dimension, as presented by Mattos (2020), shows that it is intertwined with the cognitive dimension, making the acquisition of knowledge a more enjoyable and harmonious process, capable of awakening in students the desire to learn. The author understands that this intertwining of dimensions is related to culture, which constitutes both groups, each bringing its own concepts, customs, and values. For Mattos (2020), culture is reaffirmed through identity and a sense of local belonging, which favors student engagement and enhances interest in learning mathematical concepts at school.

These dimensions, when related to everyday practices, become evident in the process of producing cassava flour, as observed in the experience of Mr. José do Carmo.

We continue to observe the cassava flour production process, which is nearing completion before roasting, considered another stage. Mr. José do Carmo mixed the grated dough with the fermented cassava, which had been soaked in a container of water. According to him, this mixture makes the cassava flour tastier.

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After this procedure, the mixed cassava dough is stored in a rectangular wooden container and covered with plastic (Figure 7) until the next day. At this point, the process continues with the dough being squeezed again to remove the water mixed with the yellow liquid. It is then sieved and taken to be roasted in an oven.

Figure 7: Cassava dough covered to dry until the next day (Own collection, 2023)

The next day, the final stage of cassava flour production takes place. It is important to note that the grated dough, mixed with the fermented cassava, must be roasted on that day to prevent it from souring. The dough is then passed through the *tipiti* again to extract the liquid, which is discarded at this point, and then sifted to make the flour finer (Figure 8). This stage is quite laborious and tiring, mainly due to the intense heat of the oven. Normally, two people are involved in this process: while one squeezes the dough in the *tipiti* and passes it through the sieve, the other prepares the oven and takes care of roasting the flour.

In the roasting process, there is a slight change from the original indigenous practice. The oven, which used to be underground, is now a kind of fire with a large pot, where the flour is roasted. It should be noted that many indigenous people also use this type of structure today, no longer exclusively underground ovens. Thus, there is a set of correspondences, with one detail that distinguishes one knowledge from the other, even though they share the same origin.

Figure 8: Sifting the cassava dough (Own collection, 2023)

In the oven, two people work together, taking turns due to the intense heat, the physical effort required to continuously stir the flour so that it does not burn, and the need to add wood to the oven to maintain the proper temperature (Figure 9). To remove the flour from the oven, while one person pulls it out with the same instrument used to stir it, the other uses a shovel to place it in a bucket, where it will be stored and later sold.

The cassava flour produced is sold by the liter, not by the kilo. According to Mr. José do Carmo, at the end of the production process, about 70 liters of flour and 20 liters of tucupi

are obtained. This work is carried out once a week, with a small portion of the flour being consumed by them and the rest being sold at a price of R$ 8.00 per liter.

Figure 9: Roasting cassava flour (Own collection, 2023)

It should be noted that the kilo is the most commonly used unit of measurement for the sale of grains. The use of *the liter* as a unit of measurement in these cases corresponds to a practice based on the equivalence between volume and mass, since "the weight of one kilo is equivalent to that of one liter of water at its maximum density" (Inácio, 2021). However, scientific research has not revealed the origin of the adoption of the liter as a unit of measurement for the sale of cassava flour.

6 Final considerations

Returning to the objective of this work, it can be observed that the people who work in the community preserve ancestral and artisanal knowledge and practices. It should be noted that the ethnomathematical approaches sought establish a dialogue with similarities in terms of both the whole and the details — the same ones appropriated by producers to meet their socioeconomic and subsistence needs. By mathematizing flour production, producers can establish parameters without prejudice or loss, both for those who produce cassava flour and for the people with whom they will trade these products.

That said, as this research progressed over the years of the project, it became clear how much knowledge exchange is possible between communities located in Brazil and Portugal. We sought to align communities with common interests in order to enable the sharing of knowledge and practices and, through dialogue, promote the exchange of experiences and insights. It is clear that each community has its own specific characteristics, related to its geographical location and climatic variations; even so, they showed great interest in learning about, exchanging, and keeping alive the effervescence of the different types of knowledge produced by human beings over time. Based on these understandings, we move towards the concept of *family similarities* to seek, in each community, their similarities as a whole and in detail.

By choosing to look at the beings, knowledge, and practices of these communities, we understand that these three elements are inseparable in the co-construction of knowledge. In this logic, entering into pluriversality means recognizing that all perspectives are valid and that there are misconceptions in privileging a single point of view. It is also understood that it is the beings who are responsible for the development of knowledge and practices over time and in the geographical space that gives them belonging and strengthens identity within each sociocultural group.

The choice of a single community in this work was based on the details provided by Mr. José do Carmo during a visit to the Quilombola Santa Luzia do Maruanum Community, and on the proximity in time to the dissemination of the research results, in addition to the researchers' experience and ancestral and artisanal experiences with the production of cassava flour. It is also worth noting the opportunity to bring in ethnomathematical approaches, which converged on the contextualization of some school mathematical concepts, such as percentage, ratio, and proportion. But not only that: it is about going beyond what is already systematized and taught in school.

The details of each stage, reported and practiced by Mr. José do Carmo, brought possibilities and ethnomathematical approaches to transcend the classroom, reverberated by the use of language and enhanced by the pedagogical strategies developed by teachers and students. Through this knowledge and experience gained by the flour producer, it became clear how much intellectual production, with regard to the mathematization contained in this process, can be transformed into a pedagogical resource for teaching and learning mathematical concepts, but not only that. It goes further, by providing opportunities for interdisciplinary teaching, encompassing different areas of knowledge, and intercultural teaching, promoting respect for the understanding that there are different cultures that dialogue with each other.

Given these choices, it was possible to detail the production of cassava flour using traditional and ancestral knowledge and techniques, since this activity was, and still is, originally developed by indigenous peoples, long before the Portuguese invasion of Brazilian lands. The history surrounding the production of cassava flour was also another option for addressing the dialogue between socioculturally diverse peoples who developed similar processes, with minimal modifications.

The historicity of knowledge and practice cannot be left aside, at the risk of reinforcing continued invisibility. From this perspective, we can understand the construction of the flour house, very characteristic of indigenous buildings, equivalent to *tapiris*, spaces for socializing and learning. In addition, it was possible to observe utensils such as the *catitu* and *tipiti*, both originating from indigenous ethnic groups. With this perspective, it was possible to dialogue with different communities, seeking *family similarities,* an approach adopted throughout this project.

The approaches taken, in accordance with strategies for mathematizing the production of cassava flour, point to the dimensions of ethnomathematics, emphasizing mainly the educational, cognitive, and affective dimensions, which does not mean that the others do not apply. D'Ambrosio (2011) highlighted the multiplicity of possibilities in each of its six dimensions, brought to the debate with the most diverse sociocultural groups; Mattos (2020), in turn, did the same with its affective dimension.

This approach also directs attention to the culture that permeates flour production, in which, due to common interests, indigenous, African, and Afro-Brazilian knowledge and practices are articulated. This cultural dynamic (D'Ambrosio, 2011) reverberates the incessant exchange and constant transformation between groups, rendering the dichotomy between beings, knowledge, and practices false. It should be noted, in this scenario, that the sustainability achieved by this community translates into a harmonious relationship between human beings and nature. Therefore, there is no need to exhaust the land, but rather to keep it protected.

In summary, it can be concluded that cultural dynamics open up possibilities for dialogue and exchange between sociocultural groups. Beings, knowledge, and practices become elements that enable the contextualization of some mathematical concepts taught in school, while reaffirming identities and reinforcing local belonging. Finally, it is reaffirmed that

community differences are part of the diversity of each sociocultural group, which is inherent to human life in the world. Consequently, it is possible to take advantage of these differences as opportunities for ethnomathematical approaches, which enable meaningful teaching and learning.

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Conflicts of Interest

The authors declare that there are no conflicts of interest that could influence the results of the research presented in this paper.

Data Availability Statement

The data produced, collected, and analyzed in the paper will be made available upon request to the authors.

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