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Mathematics teaching and the Culture of the "Rezadeiras" (traditional healers) from the perspective of the global approach of Ethnomodelling

Ensino de Matemática e a Cultura das Rezadeiras na perspectiva da abordagem global da Etnomodelagem

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Abstract

This research aims to identify the possible connections between the culture of the "rezadeiras" (traditional healers) and mathematics teaching. As the theoretical basis, we used Ethnomathematics and Mathematical Modelling, which enabled us to establish connections between the mathematical knowledge arising from a cultural group and the academically produced knowledge through Ethnomodelling, which is the guiding methodological approach of this study. Additionally, we used the methods of narrative through interviews to collect the data that subsided the findings of this paper. The interviewee is a black woman residing in Recôncavo da Bahia who has worked as a Rezadeira (traditional healer) for a long time. By conversing with her, we identified how Mathematics is present in healing practices and how this cultural mathematical knowledge can be used for mathematical content in the classroom. The major highlights under these conditions are the teaching of sets through tea indication and the education of Statistics employing data investigation and production by the students, enabling them to be protagonists in their knowledge construction.

Keywords: Rezadeira, Ethnomodelling, mathematical knowledge.

Resumo

Esta pesquisa tem por objetivo identificar possíveis conexões que a cultura das rezadeiras pode ter com o ensino de Matemática. Como base teórica, destaca-se a utilização da Etnomatemática e Modelagem Matemática, estas duas bases quando conectadas permite-nos estabelecer relações entre os saberes matemáticos oriundos de um determinado grupo cultural com os saberes produzidos academicamente por meio da Etnomodelagem, abordagem metodológica que guia esta pesquisa. Além disso, foi utilizada a entrevista por meio de narrativas para coletar os dados que subsidiaram os resultados aqui apresentados. A entrevistada foi uma mulher negra, residente no Recôncavo da Bahia, que atua a muito tempo no oficio das rezas. Por meio do diálogo estabelecido

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com a rezadeira, foi possível identificar como a Matemática se faz presente na prática das rezas e como esse saber matemático cultural pode ser utilizado para conteúdos matemáticos em sala de aula. Destaca-se nessas condições o ensino de conjuntos por meio da indicação de chás e o ensino de Estatística através da investigação e produção de dados pelos estudantes, possibilitando-os o protagonismo na construção de seu conhecimento.

Palavras-chaves: Rezadeira, Etnomodelagem, saberes matemáticos.

1. Initial Considerations

The presence of women in the diffusion of scientific knowledge is frequently hidden from society, given that, in the past, science was considered an activity designated to men. Consequently, women were destined for domestic chores, taking care of the family and their neighbors.

However, according to Santos and Madruga (2022), this scenario has changed over time, and women have been occupying different spaces in society previously occupied only by men.

It is noteworthy that studies and discussions on the history of science, especially concerning the presence of women, contribute to the emergence of stories of women who did/do science, given that many of them were kept hidden due to prejudice.

For Carvalho and Casagrande (2011),

> [...] the knowledge produced by women was not considered scientific simply due to being "feminine". Medicine, for example, has always been practiced by women since ancient times, but, since the 13th century, laws have passed forbidding them to practice it. Nevertheless, they kept practicing it as healers, witchdoctors, or midwives (Carvalho & Casagrande, 2011, P. 22).

Additionally, prejudice in the sciences pervades the gender issue. In this sense, the healing practices, despite being successful when used by those seeking a cure for illness but were unable to go to a doctor, were also considered witchcraft.

To Knijnik (2002),

> Other peoples' (e.g. non-European, non-white, non-urban) ways of producing knowledge, understanding, and giving meaning to their daily experiences are considered non-science, as non-knowledge. In this ethnocentric operation, such knowledge is devalued not because it is epistemologically inferior, but, above all, because they do not stem from the production of western society who is considered capable and worthy of doing science. (Knijnik, 2002, p. 165).

Moreover, healing practices have no scientific proof and stem from indigenous and African cultures with sayings for blessings and indications for herbal teas. These people are overwhelmingly oppressed and subjugated by society's model.

According to Silva (2012),

> [...] the cure through the healers was a common practice among members of the popular classes, dating back to indigenous and African cultures, also being used in the Middle Ages by witches, and in Brazil, it gained strength in the colonization period as an instrument capable of understanding the causes of diseases that people contracted (Silva, 2012, p. 122).

Nowadays, some people still use healing practices. However, this culture has been suppressed considering that it is an intergenerational teaching and new generations are not interested in learning such a craft, as Santos (2012) states, even though they understand the importance and contribution these practices have for society.

In this context, the rescue of this culture linked to different areas of knowledge can contribute to forming critical and active citizens in society, once these citizens are able to visualize the cultural elements of their community at school, understanding that their knowledge can be validated and support the interpretation of some topics.

According to Miguel and Miorim (2011):

> Educational situations must consider the significant contributions of cultures without political hegemony. Additionally, the teaching processes should seek to explain, understand, and live with the mathematical procedures, techniques, and skills in the socio-cultural environment of some cultural groups. (Miguel & Miorim, 2011, p. 54).

The traditional healers participate in a cultural group present in the life of some students, either by having a healer woman in the family or by using the benediction to cure diseases. Therefore, Mathematics enables working with such a culture, connecting the community's tacit knowledge and those built at school.

Consequently, this research understands the importance of this culture for society and aims to identify the possible connections between traditional healers and the teaching of mathematics. To this end, Ethnomodelling will be used as a subsidy - a teaching approach that contributes to identifying the cultural knowledge of different cultures and relating them to the mathematical knowledge developed in the school environment.

2. Theoretical Basis – Ethnomodelling

Studies on Ethnomodelling seek to intertwine knowledge and developed by Ethnomathematics and Mathematics Modelling (MM). According to Rosa and Orey (2018, p. 116) analysis:

> [...] ethnomathematics aims to emphasize the knowledge produced, diffused, and accumulated in cultural groups (emic), while ethnomodelling seeks to approximate the academic mathematical knowledge (etic) to this context through modelling.

Each cultural group builds its history, features, and skills, which are interpreted and equally or differently used by other people that do not belong to that environment. Throughout human development, many concepts emerged and re-emerged, focusing on survival and problem-solving in communities. One of them is the mathematical knowledge used by different cultures in their daily lives.

As for teaching and learning processes, cultural mathematical knowledge is not always valued at school. That arises from a historical process that only considers the Eurocentric teaching model for classroom teachings, despite the understanding that mathematics is universal and was developed by various peoples since ancient times.

According to Gerdes (1996, p. 4):

> [...] Colonial education generally presented mathematics as Western, European, or an exclusive creation of the white man. With the forced transplantation of the curriculum - during the 1960s - from the highly industrialized nations to Third World countries, the denial of African, Asian, and American-Indian mathematics continued, at least implicitly.

The negation of other mathematics sometimes makes students uninterested in the teaching practice, since they cannot visualize the applicability of these concepts in the actions they develop outside of school in their daily routine. In this regard, D'Ambrosio (2008) states that the school must present Mathematics both as described in the school curriculum and as practiced in the students' community/culture, making them understand that at certain times they will have to choose to use the one that best suits the current situation.

This action precludes the denial or superimposition of one knowledge over another, considering both equally true, demonstrating that Mathematics is present in different contexts. Therefore, Ethnomathematics seeks to rescue and interpret the mathematical knowledge developed in different places.

D'Ambrosio (2008) defines Ethnomathematics based on three roots:

> [...] ethno, as I understand the diverse environments (social, cultural, nature, etc); mathema, which means explaining, understanding, teaching, dealing with; tics, which derives from the Greek word tecné, referring to arts, techniques, approaches. Therefore, summarizing these three roots, we get ethno+mathema+tics, or ethnomathematics, thus meaning a set of arts and techniques to explain and understand and deal with the cultural, natural, and social environment developed by different cultural groups. (D'Ambrosio, 2008, p. 8, emphasis added).

By working with the Ethnomathematics perspective in the classroom, the teacher allows the students to express their experiences and verify that mathematics is a human construct and that the student's background helps them improve the practices performed at school.

This connection established between tacit knowledge and school knowledge can be interpreted through Mathematical Modelling (MM) in model building. The art of modelling is part of human creativity, which increasingly seeks to enhance and give meaning to the phenomena that occur in society.

> [...] Modelling is a set of symbols that interact with each other to represent something. This set of representations can be a drawing, image, project, scheme, graph, mathematical law, and others. No model or form of representation is casual or rudimentary. It is an expression of reality perceptions, the desire for application and representation. Human history presents countless situations that enhanced the construction of models that transformed into objects, works, methods, or technology. (Biembengut, 2014, p. 201)

MM has different concepts adopted by the authors. However, they merge towards the same goal and only differ in the way they can be worked on in the classroom. In this paper, we work with a conception of MM from Biembengut (2014), which understands it as the teaching method with research. The author indicates three steps to aid in working with modeling;

- Perception and apprehension: recognition of the problem situation and familiarization with the subject to be modeled.

- Understanding and explaining: formulating the model and solving the problem situation based on the model.
- Meaning and expression: interpreting the solution, validating the model, and communicating the results.

In the first step, the teacher can suggest or, together with the students, delineate a topic to be explored. Next, they will collect data that contribute to the development of the proposal. In turn, in the second step, students can elaborate mathematical models, reinterpreting the data collected in the previous step. Finally, it will be verified if the previous steps meet the initial goal. If it does not match, students can resume the ideas previously produced and make possible adjustments.

In this sense, Ethnomathematics and MM can work together to reinterpret different cultural knowledge through school practices. This operation is Ethnomodelling.

For Cortes (2017, p. 44), "the pedagogical approach that connects the cultural aspects of mathematics (Ethnomathematics) to the aspects of academic mathematics (Modelling) is called Ethnomodelling".

Similarly, Rosa and Orey (2017) define three approaches that help to understand and use Ethnomodelling: The Emic Approach - Local; the Etic Approach - Global; and Dialogic Approach - Glocal. According to Rosa and Orey (2020),

> Global (etic) is the outsiders' perspective on the beliefs, customs, and mathematical knowledge developed by members of distinct cultural groups.
> Local (emic) is the perspective of distinct cultural groups on their own culture, beliefs, and mathematical knowledge. Local knowledge is relevant because it is valued, tested, and validated within the local context.
> Glocal (emic-etic) or glocalization represents a continuous interaction between globalization and localization, offering a perspective that both approaches are relevant elements of the same phenomenon (Rosa & Orey, 2020, p. 265).

The etic approach concerns the researcher's mathematical knowledge applied to a studied group's cultural life practices, reinterpreting tacit mathematical knowledge for an academic bias. This approach results in some content to be worked on in the classroom with local culture.

In the emic approach, the researcher seeks to study and identify how mathematics is present in the daily routine of the chosen cultural group. The researcher does not interfere, thus indicating that one can solve the situation using other methods. In this approach, he is merely an observer who seeks to raise the cultural values and knowledge of that space.

Finally, the dialogic approach allows the other two approaches to connect, such that mathematics can be taught through cultural rescue. As Rosa and Orey (2020, p. 278) state, "one of the most important features of Ethnomodelling is the engagement in a glocal dialogue between the global (etic) and local (emic) approaches through which diverse forms of mathematical knowledge are interwoven".

Consequently, students can assiduously participate in classes, viewing Mathematics from a new perspective, understanding its applicability to daily life, and validating and valuing knowledge historically hidden in the building of the educational scenario.

3. Methodological Assumptions

This is qualitative-approach research, according to Bogdan and Biklen (2010). To this intent, we carried out a narrative interview with a collaborator, aiming to know and acquire subsidies to allow the researchers to interpret and identify the mathematical knowledge intrinsic to the culture and establish connections with mathematics teaching.

> The use of stories (narratives) as research data can facilitate the classification and identification of categories to develop the analysis, consequently assisting in the elaboration (ethno)models in Ethnomodelling (Santos & Madruga, 2021, p. 200-201).

In this context, we elaborated a guide script without the intention of directing the interview. It served to start the dialogue and resume ideas when needed, given that, in such spaces, the interviewees feel free to express their feelings and memories experienced, causing a mix of emotions. Therefore, it is important to use a guide script when using the narrative interview.

The interview was recorded with the collaborator's permission and later transcribed for analysis. The analysis of the interview was inspired by Content Analysis (Bardin, 2016), aiming to systematize and reinterpret the data through the emic, etic, and dialogical approaches of Ethnomodelling.

The interviewee is a black woman, with no formal education, residing in Recôncavo da Bahia. People also frequently seek her to hear about her experiences and contributions to

society. In this context, the use of interviews through narratives was vital to understand her history and interest in healing practices (rezas).

In the following sections, the interviewee will be referred to as Rezadeira, the local name for a traditional healer, and the excerpts from her speech will be presented in italics.

4. The indication of teas and the global Ethnomodelling approach

Rezadeiras (traditional healers) have a unique knowledge, in which, regardless of the community or place, the healing practices and conditions are the same. There are specific times to heal, each disease has a type of prayer, and there are special care practices and teas to be indicated.

The healing practice is passed on from generation to generation. It is not knowledge learned in the classroom, and therefore its value is the of people's illnesses cure, either through the indication of teas, herbal remedies, or benediction.

All this care the healer has for her neighbor are teachings they keep in their memory. For rezadeiras, healing is a gift from God, and they are merely mediums for that cure. Hence, *Faith* is a powerful instrument. In this way, the healer's mediation with the sacred is not the only component that matters; the diseased must also believe in praying and the power to deliver them from evil.

Many pieces of knowledge belong to such a culture. These lessons relate to different fields of understanding. However, this conception does not come from the people inserted in the studied culture, but they arise from external people instead. Therefore, the researchers, using the global approach of Ethnomodelling, visualized mathematical concepts in healing practices, and they can be used in the teaching and learning of Mathematics.

According to Rosa and Orey (2020, p. 266), "the global approach is comparative, contrasting, and cross-cultural, seeking to understand and explain cultures according to the perspective of external observers."

In healing practices, the diseased people are often blessed for three days or more, but the number of days should always be odd. When asked about the reasons, the Rezadeira said that: "*Four can't be because three is not married, but four is already married (laughter), do*

you get it?" ([...] Quato já não pode mais, porque três não é casado, quato já é casado, tá entendendo?"). In this case, we can perceive mathematical knowledge arising from Rezadeira's experience.

For Rezadeira, four is not married, which could be translated to an academic mathematical language as four being even. Three, on the other hand, "is not married" thus it is an odd number. In other moments, we observed that the number of prayers must always be an odd number, as seen in the following excerpts: "[...] *when I was good, I used to pray seven times, but now I don't" (Quandi eu tava boa, rezava sete vez, mas agora não."* Or *"We get three branches of bassorin and pray with them. All are performed with three, just the passage is performed with seven." (A bassorina a gente pega três ramos, reza com ele, tudo é com três, só é a passage que é com sete"*. Or: *"I get seven boughs of brandy, and the brandy." ("eu pego assim sete galho de brandero e o brandeiro")*.

According to D'Ambrosio (2001, p. 31), "the mathematical ideas, particularly comparing, classifying, quantifying, measuring, explaining, generalizing, inferring, and, somehow evaluating, are ways of thinking found in all the human species". As for the interviewee, we noticed that she uses mathematical knowledge inherent to her culture, even if implicitly.

The information acquired through the narrative interview allows us to realize that Rezadeira uses mathematical knowledge in her practice, even if it is not explicit because it is understood that linking her practices to these sorts of discussions is not part of her culture.

In this sense, we emphasize the relevance of contacting the studied subject, given that there are different interpretations according to the subject's local knowledge and the researchers' global knowledge. To Rosa and Orey (2020, p. 260), "[...] mathematics often hides behind the various ideas, procedures, and practices performed in daily routine". Therefore, a global view of Ethnomodelling enables such ideas, connecting them to school practices, as understood from tea indication.

To mediate healing, Rezadeiras emphasize that some cases require prayers, while others demand additional action with the tea indication. Moreover, one indication can help heal different illnesses, and distinct teas operate only cure one malaise, as Rezadeira explains in the following excerpt,

> *We use Melissa officinalis, citronella, which we take citronella, put it on the fire, cool it down, and give it a stomachache. Boldo is also good, together with basil, boldo together with basil is good for stomachache, pure boldo is bad. Only garlic works with headaches, I pray with garlic, clench it against my forehead and order them to be good.*
> *(Pra dor de barriga é eva-cidreira, a 'eva-cideira, que a gente pega a eva-cidreira, põe no fogo, bota pra esfriar e dar pra dor de barriga. O bôdo também é bom, junto com quioiô, bôdo junto com quioiô é bom para dor de barriga, bôdo puro faz má. Dor de cabeça é só o alho, eu rezo ele com o alho, cerro na testa e mando ficar bom.*

Other diseases require tea indication. In this sense, the researchers worked with their academic knowledge indicating some of them, thus establishing connections with academic mathematical learnings. Nevertheless, it should be noted that such indications do not seek to invalidate the inherent cultural knowledge, but to allow it to be used in parallel with the contents worked on in the classroom. Chart 1 shows some diseases and the indicated teas by rezadeira.

Chart 1 - Teas indicated in case of illness

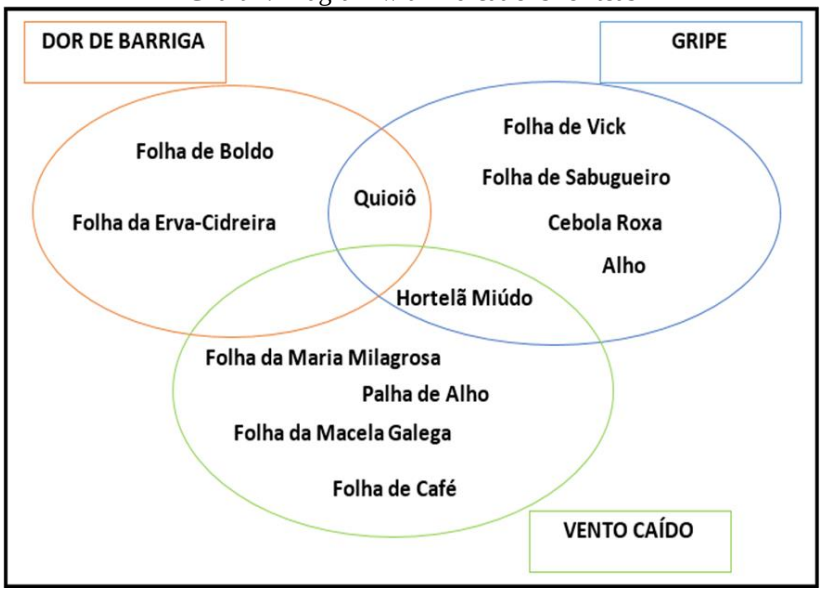
Diseases	**Indicated teas**
Stomachache	Melissa Officinalis
	Boldo + Basil
Hex (Vento Caído)	Maria Milagrosa (Cordia verbenacea)
	Steel wool
	Basil
	Coffee leaf
	Peppermint
	Macela Galega (Matricaria discoidea)
Influenza	Peppermint
	Corn mint
	Garlic
	Red Onion
	Elderberry leaf

Source: Santos & Madruga (2024).

As D'Ambrosio (2008) states, a type of mathematical knowledge should not supersede another one, and Mathematics has a privileged situation because it connects to different fields

of expertise. The discussions regarding the culture of Rezadeiras usually focus on human sciences, but this case sought to connect this knowledge to exact sciences, given that we can work with operations between Sets through this scenario, as presented in Chart 2.

Chart 2: Diagram with indications for teas



Source: Santos (2022).

Note that this observation stems from the researcher's experience with the school environment. However, Rezadeira's interpretation does not come from the same bias since her intention with healing practices is to cure the person who sought her. This is evident in the following excerpt from the interview transcript:

> *"It's up to you (laugh); it probably involves it, right? Because everything there is to do some good, not evil, right?"*
> *(“Vocês é quem sabe (risos); deve de envolver, né? Porque tudo aí é pra o bem, né pra o mal, né?”.*

This was Rezadeira's response to being questioned about whether healing practices involved Mathematics. In this sense, we emphasize the importance of not overriding different types of knowledge and trying to identify that each cultural group has various learnings and interpretations concerning a topic. Therefore, according to Ethnomodelling, the teacher/researcher must explore such knowledge.

> [...] ethnomathematics aims to emphasize the knowledge produced, diffused, and accumulated in cultural groups (emic), while ethnomodelling seeks to approximate the academic mathematical knowledge (etic) to this context through modelling, (Rosa & Orey, 2018, p. 116).

We emphasize that in addition to the relations to teaching operations with Sets, others can emerge once that tacit knowledge from that culture is rich and has different contexts.

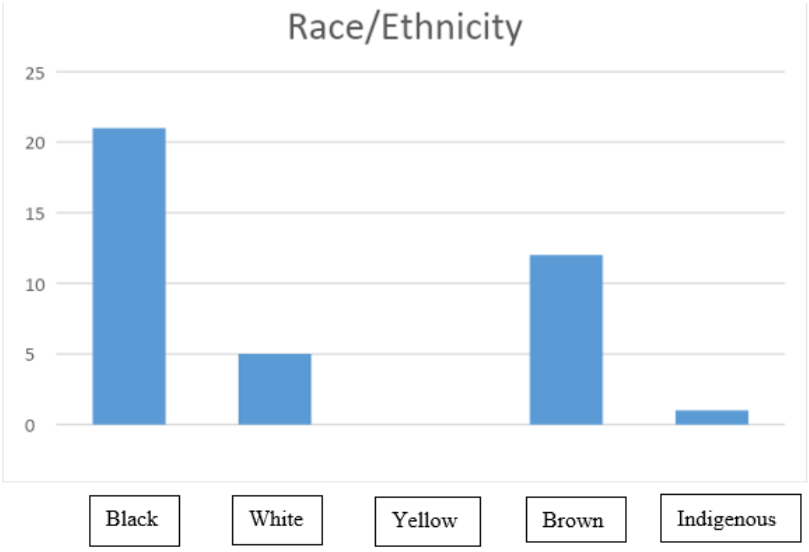
Working with a determined culture, especially with Rezadeiras, enables students to interact in class and build their knowledge, suggesting they investigate Rezadeiras in the community they find themselves, aiming to work on building graphs, tables, and other statistical content. You can see below the representation of a situation (Table 1, Figure 1, Table 2 and Figure 2).

Table 1: Healing practices as Race/Ethnicity in the Luz city

	Black	White	Yellow	Brown	Indigenous	Total
Race/Ethnicity	21	5	0	12	1	39

Source: Santos & Madruga (2024).

Figure 1: Healing practices as Race/Ethnicity in the Luz city



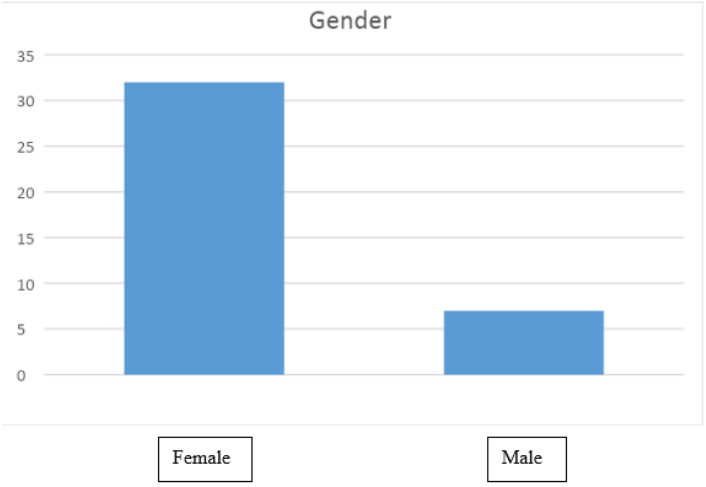
Source: Santos & Madruga (2024).

Table 2: Healing practices as Race/Ethnicity in the Luz city

	Female	Male	Total
Gender	32	7	39

Source: Santos & Madruga (2024).

Figure 2: Healing practices regarding Gender in the Luz city



Source: Santos & Madruga (2024).

Other variables will arise during the development of the teaching proposal. In such a moment, besides the discussions about the content, the students will be able to acquire new knowledge about the investigated culture and realize that elements present in their daily lives can be linked to the teaching and learning process.

To D'Ambrosio (2001, p. 81)

> Formal education, based on the transmission of explanations and theories (theoretical teaching and lectures) and the training in techniques and skills (practical teaching with repetitive exercises), is entirely mistaken, as demonstrated by the most recent progress in the understanding of cognitive processes. We cannot evaluate cognitive skills outside of their cultural context. Clearly, cognitive capacity is unique to each individual. We find that cognitive styles must be recognized between different cultures, in the cross-cultural context, and within the same culture, in the intracultural context.

In this sense, we notice that healing practices, which currently have been suppressed, can awaken the students' curiosity to learn this craft, since they could visualize its different aspects. Furthermore, allowing them to learn through cultural investigation enables eliciting the contribution of these people belonging to such a context to society.

5. Final Considerations

This research aims to identify the possible connections between the culture of the "rezadeiras" (traditional healers) and Mathematics teaching. Using the interview through narratives, we observed that some mathematical content to be worked on in the classroom may arise from it.

Additionally, when investigating a culture, Ethnomodelling enables the cultural valuation of a group and provides the enhancement of Mathematical teaching-learning processes. It indicates that mathematics is not pure and isolated, and it can connect with different areas of knowledge, such as in the healing practices present in most discussions in the humanities.

Furthermore, using Ethnomodelling in the teaching practice can allow the students to visualize mathematics of easy access and understanding from the moment that they will be

able to connect the mathematical knowledge developed in their daily life with the knowledge worked on at school.

Accordingly, the knowledge of Rezadeira and the researchers comes from different perspectives, which highlights the importance of students knowing the different (ethno)mathematics. Therefore, they will understand that their knowledge from life experiences is not wrong, but it has different applications to the school.

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