


Chapter 25

Interculturality and ethnomathematics: theoretical perspectives for the formation of indigenous teachers of the degree in mathematics

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ABSTRACT

In this text we approach the issue of Interculturality and Ethnomathematics as perspectives for the formation of indigenous teachers of the degree in Mathematics, aiming to present the ideas of several authors who have based this issue. The reported research is framed as bibliographic research, whose authors constitute references to analyze some problems of teacher education, among which the valorization of indigenous mathematical knowledge when compared with Eurocentered knowledge. It

seems that Interculturality and Ethnomathematics are theoretical perspectives that can contribute "to" and "with" the recognition and appreciation of indigenous culture and the struggle for a differentiated and more human indigenous school education. In this sense, the training of indigenous teachers becomes more complex, since, in addition to teaching future teachers the mathematical concepts/contents, it has to prepare them to act in two worlds, indigenous and non-indigenous. The training of indigenous teachers is, therefore, conditioned by multiple factors and because it is a relatively recent theme of research, requires much deepening and investment in the process of building a teaching practice that respects indigenous culture. Teacher training, based on Interculturality and Ethnomathematics, may become one of the ways to "keep moving" so that indigenous undergraduates and teachers can overcome the current challenges of the devaluation of their culture.

Keywords: Training of Indigenous Teachers, Indigenous Degree - Qualification in Mathematics, Ethnomathematics, Interculturality.

1 INTRODUCTION

Today, as always, it is clear the need to dialogue/value the culture of indigenous peoples, since the current policy, mainly, emanating from the federal government, seeks to "erase" the historical debt that Brazil has with indigenous peoples, in the name of the "traditional Brazilian family", advocating an assimilationist perspective expressed in phrases such as; "Increasingly, the Indian is a human being just like us."¹

This fact highlights the need to identify studies related to education and, mainly, to the field of teacher education - in this case of Indigenous Teacher Education and Indigenous School Education,

¹ From 2019 to 2022.

considering that the recent educational policy, despite all the advances of research in the area, constitutes a setback in that it tries to impose a standard culture to be followed.

In this sense, some historical dilemmas remain, such as indigenous children do not learn in a schooled way, the Portuguese language appearing as a barrier, the curriculum does not respect local specificities, and some teachers having difficulty reconciling the teaching of non-indigenous knowledge with indigenous knowledge. For these reasons, we will conduct a bibliographic review, to deepen the studies and believe in Interculturality and Ethnomathematics as theoretical perspectives for the Formation of Indigenous Teachers, giving visibility to the investigations related to the theme.

2 INDIGENOUS SCHOOL EDUCATION: LET'S THINK ABOUT ANOTHER MATHEMATICS THAT CAN OVERCOME CURRENT DILEMMAS?!

Thinking about the training of indigenous teachers, we carried out the following questions, namely: what characteristics are essential for a degree that forms indigenous teachers? Can Interculturality and Ethnomathematics contribute to the training of indigenous teachers?

To understand and enable answers to previous questions, at first, we highlight the ways indigenous peoples educate themselves, specifically linked to the teaching of mathematics and then the training of indigenous teachers who will teach Mathematics.

We recall that indigenous peoples learn, [mathematics], in everyday activities, without a process of schooling. This way of teaching and apprehending is known as Indigenous Education. However, from the contact with the non-indigenous, this knowledge became insufficient, making an Indigenous School Education necessary, i.e.:

It is now also necessary to know the codes and symbols of the "non-Indians" since these and their actions began to populate the indigenous environment. And this is how, historically, "Indigenous School Education" emerged. It is from your contact with us that writing, formal mathematics, and several other of our knowledge have entered the Yanomami world, the Tikuna world, the Yawalapiti world, etc. (...) In indigenous societies, teaching and learning are blended actions, incorporated into the routine of daily life, work, and leisure, and are not restricted to any specific space (MAHER, 2006, p. 17).

In indigenous societies, the action of educating is not linked to an institution, to the school, for example, but to daily cultural activities. In non-indigenous societies, it is commonly the responsibility of the school, which hinders the education of indigenous children, since they have difficulties in apprehending in schooling way and a language other than maternal.

The curriculum and pedagogical practices of some non-indigenous teachers, for example, do not recognize or value the culture of indigenous peoples. Often this is due to lame initial training and not because of teachers. In this understanding, non-indigenous teachers are victims, as are indigenous children.

Most of the dilemmas and tensions related to Indigenous School Education that persist to this day have their origin in the valorization of Eurocentric knowledge, considered by society as being "superior/better" when compared with the traditional/cultural knowledge of indigenous peoples.

Given these considerations,

The teaching of mathematics to indigenous children must start from what they already know, from their experiences and experiences. For example (...) they have an experience with mathematics when they are in contact with money, the family encourages this contact, because when they receive the coins, they count, keep, and want to buy something, thus participating in the family economy (ANDRIOLI; OLIVEIRA, 2020, p. 630).

For this, we believe it is of elementary importance to invest and think in the formation of indigenous teachers, seeking to overcome the current dilemmas of Indigenous School Education.

In the non-indigenous degree in Mathematics, there are still some dilemmas, such as the dissonance between theory and practice, the technical rationality expressed in the dichotomy between the content of the disciplinary and pedagogical expressed in the difficulties of the 3+1 model, the conflict between bachelor's and bachelor's degree in mathematics, etc.

In the case of the formation of indigenous teachers, other dilemmas appear: first, the non-valorization of the knowledge and indigenous levels learned in intercultural courses, the scarcity of indigenous intercultural courses, that is, there are not enough indigenous teachers to meet the demand of the communities, in intercultural courses, there are also non-indigenous teachers who do not master the mother tongue of indigenous peoples, and so on.

In the case of the indigenous degree with a degree in Mathematics, indigenous students are aware of the belief that school mathematics is superior to indigenous mathematical knowledge, as Oliveira and Mendes point out (2018, p. 180).

This tension has also generated effects on the performance of these teachers when they seek to assume the discipline of mathematics in indigenous schools. They undergo initial training focused on a teacher profile to act in an intercultural perspective, which proposes a dialogue between different ways of knowing. However, when they arrive at the indigenous school, which still has the performance of non-indigenous teachers, they are commenced with a homogenizing curricular organization, imposed through education departments. Due to the model that is put, many indigenous peoples declare that, when they return to indigenous schools, they do not assume teaching in the final grades of elementary school and high school, because *there is a current discourse that the intercultural degree does not prepare these teachers well. (our italics).*

Society, more specifically, the indigenous school, in a non-explicit way, devalues the entire personal and professional trajectory of indigenous teachers who have formed intercultural courses. This can be evidenced when we observe that the curriculum brings Eurocentric mathematics (as if it were "neutral" and "universal" knowledge) without any connection with the culture of the local indigenous peoples.

We stress that it is essential to question the neutrality and universality of school mathematics, considering that:

[...] *the process of coloniality of knowledge* that indigenous peoples suffer through schooling and that should be questioned (...) because *the naturalization and neutrality* of Mathematics have fixed a single *image* on it that imprisons us that has perpetuated itself causing fragmentation of knowledge while legitimizing epistemic domination that is organized based on the hegemony of the conception of Mathematical knowledge (RODRIGUES-MONTEIRO; TAMAYO-OSORIO, 2018, p. 84, *italics in the original*).

Complementing the issue of neutrality and universality, Oliveira and Mendes(2018, p. 179-180) advocate the challenges that intercultural courses face when training indigenous teachers:

The establishment of the dialogue between indigenous knowledge and university knowledge has become an ongoing challenge for the teacher trainers and for the indigenous information (...) indigenous knowledge ends up going through the interactions in the university, in the pedagogical actions of the training course (...) These crossings generate tensions regarding the profile of the indigenous *mathematics teacher because the mathematics present in the curriculum of indigenous schools has still been treated as neutral and universal knowledge, from a rationality that does not establish relationships with the different knowledge (mathematicians) belonging to these groups.* The teaching of mathematics, as it is placed in indigenous schools, has no relation to local culture. Thus, rationality, imposed from a homogenizing logic, delegitimizes the indigenous teacher, as well as puts in doubt his formation with an intercultural perspective. (*our italics*).

Based on the above, we emphasize that, because it is a "hard science" [Eurocentered] has no obvious relationship with the cultural practices of indigenous peoples, which makes the Formation of Indigenous Teachers who will teach Mathematics more complex.

3 INTERCULTURALITY AND ETHNOMATHEMATICS: THEORETICAL PERSPECTIVES FOR THE FORMATION OF INDIGENOUS TEACHERS

Taking into account that school mathematics has no obvious relationship with the cultural practices of indigenous peoples, it becomes of elementary importance the Formation of Indigenous Teachers who aim to recognize and value the local knowledge of these peoples.

Aiming at both indigenous school education and the formation of quality Indigenous Teachers, we believe that Interculturality, a political project that advocates dialogue between cultures aimed at decolonizing, transforming, and recreating the school, will enable education to give time and voice to the "other", respecting the different cultures, beliefs, values, and ways of being (WALSH, 2010).

Generally speaking, Interculturality:

[...] parte de reconocimientos legales y de una necesidad cada vez mayor de promover relaciones positivas entre distintos grupos culturales, de confrontar la discriminación, el racismo y la exclusión, de formar ciudadanos conscientes de las diferencias y capaces de trabajar conjuntamente en el desarrollo del país y en la construcción de una sociedad justa, equitativa, igualitaria y plural (WALSH, 2010, p. 2).

The perspective of Interculturality is interesting in proposing possibilities for changes in society based on people's education. However, it is worth mentioning that we are aware of the difficulties in relating interculturality with mathematics, so the urgency of also using Ethnomathematics, as Bernardi and Santos suggest, (2018, p. 151).

El ámbito de la matemática es particularly difficult to adapt interculturally por tratarse de una ciencia dura con conceptos y criterios define claramente y que, en principio, no tiene relaciones evidentes con las prácticas tradicionales de las comunidades. La decisión entonces fue la de sumar al currículum elementos de la Etnomatemática, disciplina que estudia y pone en valor las formas en que las culturas tradicionales utilizan conceptos, ideas y prácticas matemáticas, a fin de resaltar el valor de esas prácticas y saberes de las comunidades tradicionales.

One of the possibilities is precisely for indigenous teachers to teach based on an intercultural perspective, that is, to use "mathematics", as pointed out by Ethnomathematics, produced by culture, to provide autonomy for their people based on intercultural dialogue, without the hierarchy of knowledge. In addition, indigenous students may have an education with more meaning relating school knowledge with daily life. Such education will enable, for example, indigenous peoples to trade safely with non-indigenous peoples.

Thus, Ethnomathematics is an important alternative since it recognizes and values the different cultures and mathematics of indigenous peoples. The Formation of Indigenous Teachers should contemplate the dialogue between mathematics (institutionalized [school] and traditional/cultural [indigenous]) so that there is no appreciation of one over the other. The indigenous (and non-indigenous) teachers must apprehend and teach that each (Etno) mathematics has a role, whether in the village or society, and that all are important (D'AMBROSIO, 2013). That is, "it is necessary to consider that there is much mathematics, recognizing that each society has a way of understanding the world and specific ways of counting and quantifying" (ANDRIOLI; OLIVEIRA, 2020, p. 635).

In general terms, Ethnomathematics can be conceptualized: as "[...] such as art or technique of teaching, explaining, knowing and understanding, in the various cultural contexts." (D'AMBRÓSIO, 2013, p. 2).

We believe that Interculturality and Ethnomathematics are fundamental perspectives to train indigenous teachers who will teach Mathematics, based on this, may be aware of the importance of teaching school mathematics, usually "centralized euro", without devaluing the mathematics used in the village.

Based on these perspectives, we believe that we can (re)think critically about the Formation of Indigenous Teachers who teach Mathematics (SANTINO; CIRÍACO, 2020) from an intercultural and ethnomathematics perspective.²

For the development of this work, from the perspective defended here, one could, for example, work with field research in the villages of indigenous peoples, bringing to the university as academic activities that aim to verify how indigenous students themselves use mathematical knowledge to solve problems, survive and "see" the world. It is an opportunist that indigenous students dialogue in their mother tongue, explain and bring elements of their culture; gastronomic, religious, vestuary, health (medicinal plants), and

² We use the term *mathematics* aiming to recognize the existence of other forms of mathematics, deconstructing the universality of school mathematics.

the proper modes of education in the indigenous village. In addition to inviting a chief or shaman to dialogue with students and answer doubts.

Examples of activities that can provide benefits to indigenous students, because it is a pedagogical proposal that seeks to overcome pre-concepts, include socially marginalized knowledge, and broaden the educational horizons of indigenous students. The perspective of Interculturality and Ethnomathematics seeks to respect the beliefs and values of the local indigenous community, teaching the historically accumulated knowledge of indigenous and non-indigenous peoples, without hierarchy, in favor of the political, social, and economic emancipation of indigenous peoples.

There is still much work to be done, whether in the Formation of Indigenous Teachers who will teach mathematics or in indigenous schools where such indigenous teachers will act. What we propose is Interculturality and Ethnomathematics as an alternative project of Indigenous Teacher Training so that they can educate culturally excluded or/and socially subalternate peoples.

4 FINAL CONSIDERATIONS

The perspectives of Interculturality and Ethnomathematics can help in the teaching of mathematics schools for indigenous peoples and supposedly for teacher training since there are some dilemmas to be faced in this process. Mathematics can be an element of transformation as a tool for inclusion or social exclusion. Inclusion because those who "dominate" it can be approved in entrance exams and public tenders, for example. Exclusion because those who "do not know school mathematics" do not have the same opportunities concerning non-indigenous society.

Thus, we believe that the characteristics that are essential for a degree that forms indigenous teachers are work through Interculturality and Ethnomathematics, perspectives that can contribute to the formation of indigenous teachers, since they seek an emancipatory education based on dialogue, without the existence of hierarchy between knowledge.

Interculturality recommends that education give a turn and voice to the "other", in this case, indigenous students, respecting their culture, beliefs, values, and ways of being and educating themselves. Even in the urban context, it is possible to emphasize and value the cultural knowledge of indigenous peoples, thus strengthening the identity and culture of indigenous students.

The work with the knowledge of indigenous and non-indigenous peoples needs to be much thought of since it is not a transposition of a context to the classroom and vice versa. In this sense, Ethnomathematics and Interculturality can provide a better understanding of how to conduct the teaching and training of teachers of indigenous peoples.

In summary, we raise some items that may contribute "to" and "with" Indigenous School Education and Indigenous Teacher Training. We believe that the idea is that the Formation of Indigenous Teachers does not work for the sake of acculturation, that is, it is of elementary importance that the university and university professors take into account the specificities of indigenous culture and do not seek to

"standardize" knowledge. In addition, the cultural knowledge of indigenous peoples can underlie the Pedagogical Project of the Course and the pedagogical practice of university professors, for example, as mentioned in the text, the presence of indigenous teachers, chiefs, and shamans may contribute to the teaching of the mother tongue and indigenous culture.

The laws that underpins indigenous school education and the training of indigenous teachers are of paramount importance. To do so, they need to be respected, valued, and put into practice in undergraduate courses. We identified in the Formation of Indigenous Teachers the possibility of indigenous peoples fighting so that the historically constructed achievements are not eliminated/erased by the current federal government.

By proposing an intercultural work, we are not wanting to pass on the idea that there is higher mathematics. Thus, if an indigenous student solves a mathematical exercise based on the knowledge of their culture, we should not use such knowledge as a springboard to teach Western/school mathematics or vice versa. We are mentioning that it is different knowledge that must be respected and valued, that is, the idea is that there is no hierarchy between the Ethnomathematics present in the classroom.

Therefore, it is of paramount importance to undertake more research and reflections on the Formation of Indigenous Teachers, since this study does not claim to exhaust discussions, but rather to contribute to those interested in teacher education and struggle with indigenous peoples.

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