



ISSN: 2230-9926

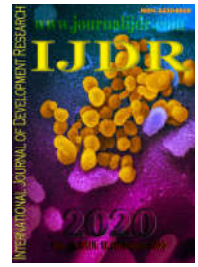
Available online at <http://www.journalijdr.com>

IJDR

International Journal of Development Research

Vol. 10, Issue, 11, pp. 42439-42444, November, 2020

<https://doi.org/10.37118/ijdr.20497.11.2020>



RESEARCH ARTICLE

OPEN ACCESS

AN ETHNOMATHEMATICAL LOOK AT THE SOCIO-CULTURAL DIMENSIONS IN THE TRAINING OF INDIGENOUS TEACHERS IN MARANHÃO

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ARTICLE INFO

Article History:

Received 22nd August, 2020

Received in revised form

19th September, 2020

Accepted 26th October, 2020

Published online 30th November, 2020

Key Words:

Ethnomathematics,
Intercultural Degree,
Knowledge

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ABSTRACT

With the enactment of the 1988 Constitution, which came from the struggles of the indigenous movement and other actors involved in the process, indigenous education is no longer recognized as a colonizing strategy, but rather as a right to be guaranteed, respecting the specificities of the cultures and ways of life of these peoples. In this context, this study makes a cutout for analysis of the various possibilities of building a specific and differentiated indigenous school, with cutout for the practices of mathematics education in the indigenous context. Thus, this study deals with the original quantification knowledge of the Timbira indigenous people, from the class of Nature Sciences of the Intercultural Degree in Indigenous Basic Education of the State University of Maranhão. The research, in progress, seeks to analyze the relationship between teaching and learning in the initial years at the indigenous school, highlighting the processes of initial formation of indigenous teachers, especially traditional knowledge as an important element for the recognition of mathematical knowledge and achievements of the Timbira people. In view of this, this research also intends to present a proposal for teaching material based on the Timbira numbering system in dialogue with Western mathematical knowledge, in order to enhance the political and cultural autonomy of the indigenous school among this original people. The research is qualitative developed from the perspective of Ethnomathematics. The subjects are the Timbira students of the Nature Sciences class of the mentioned course who act as indigenous teachers. The analyses show the need to understand mathematical knowledge as a way of guaranteeing community rights, as well as valuing and disseminating the original knowledge and doings for the maintenance and preservation of indigenous culture.

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Citation: Sérgio Roberto Ferreira Nunes and Márcia Cristina Gomes. "An ethnomathematical look at the socio-cultural dimensions in the training of indigenous teachers in maranhão", *International Journal of Development Research*, 10, (11), 42439-42444.

INTRODUCTION

Supported by the 1988 Federal Constitution, the Law of Guidelines and Bases of National Education (LDBEN), Law No. 9394 of 1996, ensured the principles of differentiated education for indigenous peoples and defined competencies for the provision of bilingual and intercultural school education, aiming to strengthen socio-cultural practices and the diversity of languages of indigenous peoples and communities, in addition to guaranteeing them access to knowledge historically accumulated and propagated by academic institutions (BRAZIL, 1996).

We start from the understanding that the Academy is a place of knowledge production, where teaching, research and extension are developed with the intention of training critical professionals who can meet the demands of society and contribute to the construction of less unequal relationships between people and groups. Thus, we understand the University as a formal space of diversified and plural education, which has the social commitment to promote an emancipatory education to all peoples, reasons why it takes a new look at the forms of learning and teaching developed in formal, non-formal and informal spaces and times. The Intercultural Indigenous Basic Education Degree (LIEBI) at the State University of Maranhão presents itself as a response

to the various challenges of indigenous communities in the state, seeking, in particular, to build a possibility of dialogues of knowledge in the training of future teachers of mathematics, precisely the Timbira.

In this sense, Miguel argues that

Speaking of a variety of ways of practicing a "same" referential mathematics is also to suggest that the possibility of still seeing mathematics in these different ways of practicing it is assured by the contents we are accustomed to seeing as mathematicians, not because of a diffuse tradition, but because of the power of a community to elevate its own way of practicing mathematics to the condition of the only legitimate way to practice it (2014, p.5).

Thus, we identify the challenge as LIEBI's mathematics teacher responsible for the training of the indigenous teachers of the natural sciences class, not only the specificity of their cultures, but also in the study of the ways of dialoguing with the different knowledges of Western and indigenous mathematics. It was then that the need arose for a study on the process of teaching Timbira mathematics that seeks to take into consideration the analysis and understanding of the mathematical process in which the understanding of a mathematical understanding applied in the nature science class of the LIEBI is available and thus contextualize a dynamic of traditional knowledge in the face of the introduction of Western mathematics. Figure 1 shows the indigenous territories in the Centers of Higher Studies that are part of UEMA, plus two that currently make up the State University of the Tocantina Region, which are Imperatriz and Açailândia. According to the pedagogical project of the Intercultural Degree in Indigenous Basic Education of the State University of Maranhão (PPLIEBI), the indigenous peoples who inhabit the territory of Maranhão add up to a population of over 30,000 people who declare themselves indigenous in the 2010 census. This significant population contingent is distributed among nine different ethnicities that can be grouped into two large linguistic trunks: Tupi and Macro-Jê (IBGE, 2012; UEMA, 2016).

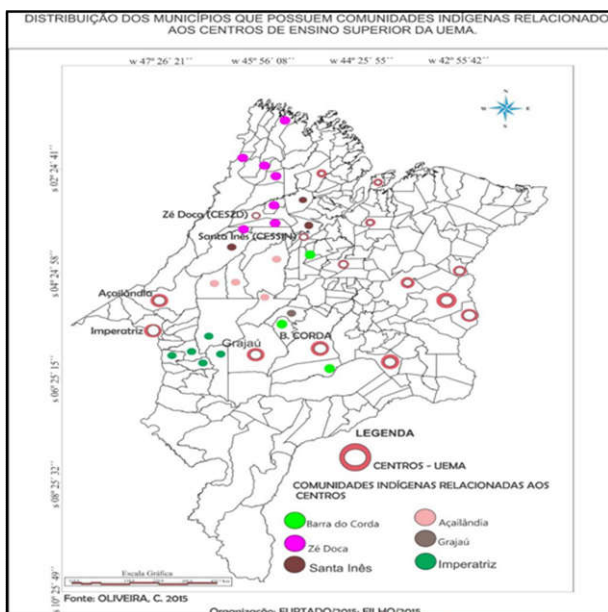


Figure 1. Indigenous Territories around UEMA's Educational Centers

The people who make up the Tupi linguistic trunk are: Tentehar (Guajajara), Awá (Guajá) and the Kaapor. The peoples that make up the Macro-Jê linguistic trunk are: Krikati, Ramkokamekrá and Apaniekrá (Canela), Pukobyê (Gavião), Krepu'kateyé and Krenyê. We emphasize that each of these peoples has its own forms of social and political organization, so in this article we consider the experiences of the Timbira people, which include Ramkokamekrá and Apaniekrá (Canela), GaviãoPykopjê and Krikati.

In this way, the question arises: what are the mathematical knowledges and practices originated from the Timbira people? To unveil the question we have appropriated theoretical references such as KNIJNIK(1996) D'Ambrosio(1993, 1998, 2001), Ferreira(2002), Gerdes(1991), among others that allow us to understand education as a permanent and continuous practice throughout the subjects' lives, and to perceive mathematics as a living activity related to the ways of thinking, comparing, inferring, measuring, present in all human species. On the other hand, we deal with the theme of the intercultural licentiate in the formation of indigenous teachers in a field of socio-cultural plurality, from the studies of Candau (2014), Walsh (2009), Silva (2009), and Lévi-Strauss (1962), which brings dialogue, diversity in educational practice for the formation of reflective and critical teachers.

Mathematics education in the intercultural context

With the promulgation of the Federal Constitution of 1988, indigenous peoples are no longer understood as targets of the civilization process, but as participants in the formation of Brazilian society, being guaranteed the use of their mother tongues in the teaching-learning processes, respect for their distinct cultural forms, and the permanence and enjoyment of their immemorial territories (BRAZIL, 1988). School education for indigenous peoples, in this new legal scenario, is a right to be assured, respecting the principles of specificity, differentiation, and interculturality established in Articles 210 and 215 of the Federal Constitution, according to which:

Art. 210 - Regular primary education shall be provided in Portuguese, with indigenous communities also being assured the use of their mother tongues and their own learning processes [...].

Art. 215 - The State will protect the manifestations of popular, indigenous and Afro-Brazilian cultures, and those of other particular groups in the national civilization process. (BRAZIL, 1988, p. 124-126).

In addition to the Federal Constitution, we would like to point out as provisions for the legal regulation of indigenous intercultural education, Resolution 03/1999 which puts an end to the impasse generated by the transfer of the competence of the National Indian Foundation (FUNAI) to offer school education to the Ministry of Education (MEC), which in turn, as a coordinating body and not executor of the policy, delegated to the states and municipalities the offer of indigenous school education, which generated an absenteeism of responsibilities; the National Education Plan (PNE), which was sanctioned by Law nº 10. 172, of January 9, 2001; and Resolution No. 1, of January 7, 2015, which establishes the National Curricular Guidelines for the Training of Indigenous Teachers in Higher Education and High School Courses.

Silva (2000), highlights that both identity and difference are created in the social and cultural field and, in this way, "the affirmation of identity and the enunciation of difference reflect the desire of different social groups, asymmetrically located, to guarantee privileged access to social goods"(81 p). Therefore, the cited documents make possible the formation of indigenous teachers to act in all levels of basic education, ensuring the principles of social equality and difference, specificity, interculturality, bilingualism, political autonomy, and management of ethnic educational territories.

For Catherine Walsh (2001, p. 10-11)

Interculturality means a dynamic and permanent process of relationship, communication and learning between cultures in conditions of respect, mutual legitimacy, symmetry and equality in the struggles of discriminated social movements, as a way to act, to intervene, to transform knowledge, actions and attitudes that promote respect for others.

From this reflection, we highlight the Intercultural Indigenous Degree in the State of Maranhão. A teacher training course at a higher level that proposes to meet the specific and differentiated reality of the indigenous peoples of this State, in addition to meeting a demand presented by the indigenous movement for the formation of indigenous teachers based on the perspective of interculturality. The Intercultural Degree for Indigenous Basic Education (LIEBI) is based on a set of norms, whose constitutionality and other infra-constitutional norms ensure a new legal and conceptual framework for relations between indigenous peoples and the surrounding society. Since 2016 LIEBI has been integrated into the Center of Applied Social Sciences of the UEMA campus in São Luís-MA. It lasts five years, and is held in installments or alternation, during the January/February and July/August school recess periods in modules. It has a total workload of 3,255 hours, being distributed as follows: 795 h/year in general training and 1260h/year in specific training (PAULA, FURTADO, 2018).

The course also aims to create theoretical-methodological and practical conditions so that indigenous teachers can become effective agents in the construction and reflection of the pedagogical project, planning and management of the school where they work. The structure of the contents of the intercultural degree is developed in two moments of formation, namely: a) General Formation (Common Core), of one year and a half with topics and interdisciplinary discussions and being a curricular matrix for all the students. Its objective is to strengthen the ethnic identity of the peoples inserted in the course and to enable complementary scientific knowledge and not as a substitute for traditional knowledge, aiming at overcoming the asymmetrical intercultural relations generated by interethnic contact. b) Specific Formation, of two and a half years, organized in three major reference themes of specialized knowledge, which could be understood as the specific emphases to which each course participant may choose. Such emphases are: Languages and knowledge about the physical world, life and intercultural quantifications (Nature Sciences); Languages and knowledge about the movement of societies in time and space (Human Sciences), Indigenous Languages in interaction with Official Languages (Language Sciences) (UEMA, 2016).

In compliance with the Pedagogy of Alternation, the Intercultural Degree Course for Indigenous Basic Education is carried out in two times: Tempo Universidade (TU) and Tempo Comunidade (TC). The socio-cultural reality is quite diversified in the classroom of LIEBI's Nature Sciences class, as it goes beyond the observation of the physical environment in which the student is involved, it passes through the values, ideas and culture experienced by the student in his/her communities. Each level of social reality appears as an indispensable complement in the absence of which it would be impossible to understand the other levels. Customs relate to beliefs and beliefs to techniques, but the different levels do not simply reflect each other: they react dialectically with each other, in such a way that we cannot expect to know a single level without first having evaluated in their respective opposition and correlation relationships, institutions, representations and situations (LÉVI-STRAUSS, 1976).



Source: own author, 2020.

Figure 2. Moment of time Community (TC) of students in the construction of the counting process

Gerdes (1991) says that Ethnomathematics is contained in Mathematics, Ethnology (Cultural Anthropology) and the Didactics of Mathematics. In this context, Ethnomathematics currently considered a subarea of the history of mathematics and mathematics education emerges as a research program with evident pedagogical implications focusing on the recovery of human cultural dignity (D'AMBRÓSIO, 2011). According to (KNIJNIK, 1996) Ethnomathematics is a proposal for the teaching of mathematics that seeks to rescue the intentionality of the subject manifested in his or her mathematical doing, by worrying that the motivation for learning is generated by a problem situation selected by him or her, by valuing and encouraging the manifestations of the ideas and opinions of all and by questioning a somewhat Manichaeic view of the right/wrong of mathematics (school). It is necessary to interact with the other, to value their culture, their knowledge, to give them a voice in the educational school context, understanding the indigenous culture as a space for the production of knowledge, their own ways of learning and dialogue with other forms of knowledge. "It is in this perspective that Ethnomathematics Education seeks to establish itself, with the objective of making different mathematics respected and seen in a more humanitarian way in the broad sense of the term" (SILVA, 2009, p. 18). In this way we try to present a dialogue of traditional and western knowledge that seeks to understand the mathematical knowledge/task constructed throughout the history of humanity by different social groups, linked to a certain model of transmission of the academy or to the way we have been

taught and it seems more and more interesting to take into consideration ways of circulation of knowledge that happen inside and outside the academy. The interculturality present in the proposals for indigenous school education has a clear identity and political claim (WALSH, 2009). The inter-cultural gap starts from the perspective of reopening the path and replacing the colonized subjects, silenced, and dominated from their autonomy of knowledge to an interaction of dialogues, coexistence, and dialogical coexistence. Thus, understanding interculturality, in the words of Candau (2012) means:

Question the monocultural character and ethnocentrism that are explicitly or implicitly present in the school and in educational policies and impregnate school curricula. To ask ourselves about the criteria used to select and justify school content (p.48).

Intercultural education from a critical and emancipatory perspective points to a fundamental action: deconstruction. To deconstruct it is necessary to penetrate the universe of prejudice and discrimination present in Brazilian society. On the other hand, indigenous societies share a set of basic elements that are common to all of them and that differentiate them from non-indigenous society. Thus, indigenous peoples have their own ways of occupying their lands and exploiting the resources found in them. They have their own forms of community life, and they have forms of teaching and learning, based on the oral transmission of collective knowledge and the knowledge of everyone (BRAZIL, 1993).

The Knowledge and Doings Originated from the Timbira Students: In our contacts with Timbira, a member of LIEBI/UEMA's Nature Sciences class, we noticed a dispersion and distinction between the Timbira, based on language differences, which also correspond to a geographical distribution. Let us establish these differences by ethnic group. Here reference will be made to sources that deal with the entire Timbira people. Timbira is the name that designates a group of peoples: Ramkokamekrá and Apaniekrá (Canela), GaviãoPykopjê, and Krikatí. The Timbira people currently live in different regions, in the Timbira villages, the houses are arranged next to each other, along a wide road, to form a large circle. From each house there is a narrower walkway, towards the center, where the patio is. Within the village space, the directions have meaning. It is necessary to be attentive to oppositions like center/periphery, East/West, high/low and others in order to have some understanding of the various rituals that take place in the villages. These rites include relay races, in which each of the two teams disputing them carry a circular section of buriti (or other vegetable) trunk.

The male name is transmitted by relatives of a category that includes the maternal uncle, maternal grandfather, and paternal grandfather, among others. The female name by the category of parent includes paternal aunt, maternal grandmother, and paternal grandmother among others. Its myths that are referred to its entries to each ethnic Timbira, in the great majority, the same, with small variations: the sun and moon and the creation of human beings, work, death, menstruation, pesky and venomous animals, the star woman, who teaches the use of cultivable vegetables. Besides the myths, the different Timbira peoples make narratives of a more historical character, usually episodes of conflict and war (RICARDO, 1996).

Ramkokamekrá (Canela): Located in southern Maranhão, Canela is the name by which two Timbira groups became

known: the Ramkokamekrá and the Apanyekrá. There are significant differences between these neighboring groups, but both speak the same language and are guided by the same cultural repertoire. Ramkokamekrá means "Indians of the almécega tree" and Apanyekrá means "the indigenous people of the piranha" (ISA, 2018). Remembering that in the class of the LIEBI's Nature Sciences we have only 2 students of the group KanelaRamkokamekrá. In the territory of Ramkokamekrá/Canela there are 2 schools installed and functioning, in which are enrolled a quantity of 735 students. Of this total 506 are from 1st to 5th grade, 178 are from 6th to 9th grade, and 667 are high school students. In these schools there are 28 teachers, 15 of whom are indigenous and 13 non-indigenous. Of the indigenous teachers mentioned above, 10 are in high school, 3 have already completed high school and 2 are in higher education (UEMA,2019).

GaviãoPykopjê Students: Currently, Pykopjê are distributed in three villages - Governador, Rubiáceos and Riachinho - and have a population of 577 people. The Pykopjê, when they must refer to the group itself, use the term Pykopcatejê. The other Timbira people also call them Pykopjê. The Kricati, their neighbors, refer to them as Ironcatejê, which means "those in the forest", indicating the environment dominated by the Hawks, a term by which they are known by the regional population and called by FUNAI (ISA, 2018). There is a Gavião student resident in the Governador indigenous land, municipality of Amarante, in the classroom of the Nature Sciences class. In the Pukobyê/Gavião territory there are 6 schools installed and functioning, in which 312 students are enrolled. Of the total number of students enrolled, 136 are from 1st to 5th grade, 130 are from 6th to 9th grade, and 46 are in high school. There are 35 teachers in these schools, 18 of whom are indigenous and 17 non-indigenous. (FURTADO,2019; UEMA,2019,p.33).

Krikati Students: The group's self-denomination is Kricatijê, which means "those from the big village", a name that is also applied to them by the other Timbira. Their immediate neighbors, the Pukopjê, refer to them using the designation Pôcatêgê, which means "those who dominate the slate". The Indigenous Land Krikatí is located in the municipalities of Montes Altos and Sítio Novo, in the southwest of the state. The tribe is bathed by rivers and streams of the Tocantins basins (Lajeado, Arraia, Tapuio, among others).Krikati had its territory declared an Indigenous Land on July 8, 1992, through Ministerial Ordinance no. 328. We have two Krikati students from the Krikati indigenous land, São José village, municipality of Montes Altos. In the Krikati territory there are 5 schools implanted and functioning. In these schools 316 students are enrolled. Of this total, 36 students are in Pre-School, 133 in the 1st to 5th grades of Elementary School, 104 in the 6th to 9th grades and 40 in High School. In the Krikati schools there are 31 teachers, of which 20 are indigenous and 11 are not indigenous. Of the total number of indigenous teachers, 2 are in high school, 2 have already completed high school and 16 are in higher education (FURTADO,2019; UEMA,2019, p. 35).

Timbira Counting Principle: For D'Ambrósio (2008) methodologically to work in the Ethnomathematics perspective it is essential to develop the capacity to observe and analyze the practices of different cultural groups, followed by the analysis of what they do and why they do it by focusing on the mathematical knowledge and doings originating from the

Timbira people, the present research uses the Qualitative Approach. Our perspective is of the Ethnomathematics thought by D'Ambrósio (2011, p. 17) as a research program that seeks "[...] understand the adventure of the human species in the search for knowledge and the adoption of behaviors". The techniques of information collection used in the research were: a) Focal group, used for a deeper vision of how the students counted, because we have in the class of Nature Sciences of LIEBI, two language courses, Tupi and Macro-Jê; b) Interviews with the students of LIEBI and two elders Timbira and Tentehar from the villages for a better understanding of different mathematics; c) Field diary, used to record the activities experienced by the students in the University (TU) and Community (TC) times; and d) Participant observation that took place in the Nature Sciences class of LIEBI, in the Mathematics classes.

In the perspective of seeking to understand the construction of the process of teaching mathematics in the class of Sciences of the Nature decided as the support of the coordination of the LIEBI, to investigate the difficulties encountered by the cursistas in the dialogue of knowledge of the western and indigenous mathematics, especially the knowledge of quantification of the Timbira people. This search began in community and university classes when we realized that students did not make use of their own development of Timbira mathematics. The LIEBI students to understand the counting principle of their people use the words to express their way of thinking the numbers, in this understanding the Macro-Jê we can identify that the number 1 (one) is PEHXEHT, the number 2(two) EHJPEHJCROT and the number 3(three) ÊHNCRIL, thus identifying the base of the numbering system as being the base three, represented by the numerical denominations of counting principle that are determined in the logic of base three (Notes of the author, 2019).

It is initially observed that the counting takes place as follows

- ONE - PEHXEHT
- TWO - EHJPEHJCROT
- THREE - ÊHNCRIL

The counting principle comes in oral form, such as PEHXEHT, EHJPEHJCROT and ÊHNCRIL, the representation of the other numbers comes borrowed the sound of our way, that is, the Portuguese (Urucu course participants). We highlight speeches of those interviewed that show mathematical knowledge originating from the Krikatí people and the difficulties encountered by indigenous teachers to teach mathematics.

Professor Jenipapo "*The number one we call pehxeh, the two ehjpehjcrot and the three ehncrili, the representation of the others comes from the sound of our way of Portuguese, we use our sound in the numbers*".

Professor Urucu "*Before there was no need to count up to twenty to one hundred, but today it's because it was in small numbers, there was no need to buy only an exchange between one indigenous person and another, so they did not need to create names for other larger numbers only needed for small numbers, today we are*

already having the need to try to create names for larger numbers".

Professor Urucu reports that "*there are things that have already been done in math books, but we need other knowledge*".

The observations made by Professor Jenipapo say that "*the secretary of education sends the books, (...) but out of our context, out of our reality, that's why we are creating textbooks, on our own to use with the students according to the child's reality for him to understand*".



Source: LIEBI,2019

Figure 3. Macro-Jê linguistic trunk courses in the construction of the counting process

For Ferreira (2002), knowing that there are several mathematical knowledges and that it is possible to understand and adapt them according to the context values and enriches the process of knowledge construction, proper of the specific and differentiated education to which the indigenous peoples are entitled. Thus, according to the interviewees, indigenous people need to appropriate their academic knowledge to guarantee their rights, and mathematics is fundamental in this process. To do this, it is necessary to translate it into their mother tongue or to develop strategies that favor their understanding, and it needs to be proper to that people and be expanded to answer current questions.

Ethnomathematics fits in our discussion because it provides the adoption of non-academic ways of doing mathematics. Mathematics which, when used in specific cultural contexts, moves away from the hegemonic model, but reveals the meeting of knowledge which lends itself to the resolution of daily problems and, at the same time, shows how social practices relate to the mathematics used by these groups, being, therefore, a mathematics which arises from the needs inherent to them. This approach highlights pedagogical dimensions, such as interactivity, socio-cultural presence, and collaborative learning in the process of teaching and learning mathematics.

Some Considerations

In this work we verify that maternal mathematical literacy, and the fact that it does not have numerical writing, does not devalue this language nor makes this literacy less effective in maintaining a social cohesion of quantification, the principle

of counting through reasoning and of allowing understanding of the phenomena. We understand that any language is capable of being written, this we have in mind in the action research carried out in the time community (TC) where we observed several written works produced by indigenous people in their villages.

Therefore, math literacy is not a project that is being imagined for the future, it already exists in the State of Maranhão, since there are several research groups in which the Indians are literate in their mother tongues, sometimes in smaller numbers, sometimes in a broader way in their school activities that are already becoming more regular, that is, we have written productions in indigenous languages. In this sense, we see Ethnomathematics as an adequate and necessary research program for the teaching of mathematics, which in this case allows the professor to adopt a methodological posture that provides the recognition, appreciation and use of the knowledge proper to a people, as pedagogical possibilities to teach and learn both in the indigenous school and in the university itself, particularly in Mathematics classes. The possibilities of the dialogue of Western and indigenous knowledge can serve as a reference for a theoretical and empirical deepening in the formation of other indigenous teachers, as they reflect on the teaching of mathematics from an Ethnomathematics perspective that, in this case, allows the teacher to adopt a methodological posture that provides the recognition, appreciation, and use of a people's own knowledge as pedagogical possibilities to teach and learn both in the indigenous school and in the university itself, particularly in the mathematics classes of LIEBI/UEMA.

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