

Conceptions of interculturality in Physics Education in Bahia

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Abstract— *This work constitutes a reflection on the function of Physics teaching within an indigenous school scope and the possibility of interculturality as epistemological basis in the elaboration and production of intercultural indigenous learning materials in Physics teaching. In this sense, it is important to highlight the compatibility between the idealized learning material and the local context, having as proposal the interculturality and the study of Physics to found a meaningful learning of the physical processes. At the same time, the relationship between teacher, student and community represents the differential of an intercultural education in the whole indigenous school system.*

Keywords—*Interculturality; Physics Teaching; Indigenous Education.*

I. INTRODUCTION

What is Physics teaching for at indigenous school? And why the local knowledge and its culture are considered inferior to Physics teaching? Is there a possibility of intercultural dialogue in Physics teaching? Through these questions we feel the need of an epistemological approach with respect to the interculturality in Physics education.

The concept of interculturality defended here moves the mutual recognition of all cultures without knowledge hierarchisation and superiority. From this standpoint, we try to observe and understand worldviews of indigenous people, particularly the Pataxós, and their conceptions related to physical phenomena. The proposed question from this is: what are their conflict in relation to the hegemonic knowledge presented by the occidental society?

The intercultural perspective whilst promotes the recognition, allows the appreciation of other systems and cultures, without envision ranking but complementarity, enabling the construction through dialogues whose knowledge overcome the limit between modern and traditional, written and oral, rational and emotional, inherent concepts to learnings and to human relations (MARÍN, 2009).

Since the invasion of Brazil by the Portuguese, in the colonization process the missionaries sought to impose their culture to the people who was settled here. The ethnocentrism, obviously, forestalled them to recognize and understand the peculiar meanings of indigenous cultures. As Fleuri (2009, p. 3) points,

[...] By the epistemology of orthodox thinking the western settlers were not predisposed to recognize other people and their culture, in its otherness, as autonomous subjects, as sovereign social groups with who would be possible to dialogue on equal terms and, in reciprocity, learn together.

Unfortunately, this ideological vision of the settlers is present on High School Physics textbooks of indigenous schools of Bahia and they transmit the content with a totally western perspective, with the aim of reduce the content to simple mnemonic information, not recognizing the local knowledge and its culture as important processes to a meaningful learning. This harms the teaching-learning process since recognize another culture as significant is what allow the groups to communicate with each other.

The concept of culture that we adopted is essentially semiotic, because we assimilate the culture as the total accumulated of cultural patterns, in other words, of “organized systems of meaningful symbols” (GEERTZ, 1989) on the basis of which human organize and guide the aim of these actions.

Comprehension of human being in its essential dimension can be find justly on the cultural particularities of peoples. Therefore, from a scientific view it is necessary to seek to understand it on cultural phenomena, not on empirical similarity between the behavior of the different social groups, but on the relationships established between different groups with different cultural patterns (Ibidem).

To Quijano (2002), this reflection is made from the intercultural perspective, because he believes that this is a possibility of analysis that allows to descolonize the

knowledge and consequently the imaginary sustained by it.

This approach elicits the proposition of interculturality with the decolonization of power and knowledge. Therefore, it is about the cultural and historical rationale on the production of an alternative material contextualized with the indigenous reality and that incorporate its cultural diversity, complying the cultural wealth of the cultures as significant on the learning process of the student.

Reflect about the response of local knowledge relation, identified for some as inferior in relation to the global knowledge in a determined context, led us to study the history of power relations between the dominant and dominated culture.

The axis of this reflection allow us to question the historic separation of nature and culture on Physics teaching, enforced by the Eurocentric vision on the rationality of positivism that is the basis of normal science defended by dominant class. We understand that normal science is the state of a science in which researches and results are predictable, in other words, it is not concerned about create newness but on specialize in that is already established by the current paradigm. Actually, the experiences intention is not to create novelty, "The result is already known previously, the fascination is how to arrive on this" (KHUN, 2009, p. 60).

The challenge of teaching Physics on indigenous community is try to understand their culture and particularities, engaging with the community and mainly listening to them, not only talking about them or for them. Dialogue with the other not refraining from doing a judgement of the called knowledge common sense (called so by normal science), using our own conceptions about science, may be the biggest paradigm.

Therefore, can we think about teaching Physics in indigenous communities if we do not respect the cultural approach produced on the local we are inserted? We think not, since on this panorama the relation between teaching Physics and the culture are woven and we consider that Physics is a share of social and cultural traditions. In addition of being human constructions, the sciences are, consequently, social and historical constructions too.

II. INTERCULTURALITY IN PHYSICS TEACHING

Physics teaching linked to interculturality in an indigenous context is a challenge to theoreticians of current Education. In Brazil, the coexistence of different cultures has always existed and has always been part of our reality. However, on an oppressing way, the dominant ideology has always searched for the devaluing of

dominated cultures along the colonial and post-colonial period.

We verify that traditional school was in charge of transmitting the dominant world perspective, language and culture, and it was an effective institution in its purposes of reducing, denigrating and marginalizing the indigenous language, world perspective and local knowledge. Moreover, on this process the textbook had the primary role due to its educational function of knowledge diffusion.

In the view of Fleuri (2009), "[...] Father Antônio Vieira considered that the difference of so many languages of the different indigenous peoples founded by the colonists in the Americas was a work of the demon [...]". In our view, diversity of languages was an obstacle to the colonists in recruitment of labour to maintain the economic demands of the invaded territories.

Interacting with other people spark to us the comprehension of the respective meanings allocated to their actions, causing a discomfort in terms of the behavior of the others because the determining logic of the cultural context is distinct from the characteristic logic of our culture patterns. To understand the behavior of another person it is necessary to understand the logic of organization of the meaningful symbols developed by this person's group (Ibidem).

At the same time, the comprehension of the logic of different cultural patterns enables to understand the specificity of the logic of our cultural patterns and the relativity of the meanings we attribute to our actions. Thus, reflecting on our actions from other cultural patterns perspective, we can discover other meanings that our own actions may take on and thereby discover different ways of directing them.

Referring to Indigenous Education, D'Ambrósio (2001, p.76) instruct us that the teaching may use contextualized resources and instruments, because "contextualization is essential to any education program of native and peripheral populations". And he explains too that "it is possible to avoid cultural conflict that result from the introduction of "white mathematics" in indigenous education" (Loc. cit.). By analogy, we believe that Physics teaching may be approached considering the cultural context, in what way the problems founded on Physics textbooks bring an appropriate treatment of formulation and solution of physical phenomena problems founded in the school community at hand, in other words, referring to the weather, agriculture, fishing, to one that applies to community daily life.

[...] the daily life is impregnated of the knowledge and tasks specific of the culture. At all times, individuals are comparing, classifying, quantifying, measuring,

explaining, generalizing, implying, and somehow, evaluating, using material and mental instruments that are specific of their culture. (Idem, 2002, p. 22).

It is argued that Mathematics should be thought from the needs and/or concrete situations of the specific community. In this case, we seek to encourage the survival of indigenous culture through a Mathematics teaching proposed by Ethnomathematics as follows:

[...] the math practised by cultural groups such as urban and rural communities, groups of workers, professional categories, children of a given age group, indigenous societies and so many other groups that conform to each other by objectives and traditions commons to the group (Idem, 2001, p. 9).

Agreeing with the author, we believe that both Physics and Math should be linked to real and natural phenomena; and a great example of this is in indigenous school education. Indigenous common sense, for example, the ancients, fathers, mothers and chiefs are inexhaustible source of scientific knowledge.

The Ethnophysics proposed by our work appropriates Ethnomathematics to discuss the possibility of incorporation of indigenous culture in Physics teaching at indigenous schools. As a field of study, Ethnophysics is emerging slowly from Ethnomathematics researches. Therefore, it is a new field of study in Western Science. However, because they are similar researches at least methodologicaly, we can base our Ethnophysics study on some Ethnomathematics benchmarks.

Until now, having as assumption the few founded research, it is possible to consider that they aim to motivate Physics learning while try to relate somehow the traditional knowledge on Physics to the classroom school knowledge. Consequently, It should be pointed the uniqueness of the studies in this indigenous catchment area.

By analogy, for Souza (2013), an ethnophysics view means consider ontologically the view mode, the mode of interpreting, understanding, explaining, sharing, working, dealing and feeling physical phenomena. In other words, the pedagogical work with Ethnophysics request appropriation of the cultural memory, codes, symbols and macro social universe of the research subject.

The inclusion of Ethnophysics on teaching and learning process can allow the student to “understand how the knowledge creation and transfer of each group happens when they “practice science”” (SANTOS, 2009, p.108). The “practice science” is producing a knowledge that controls consciously the procedures of its

constructions. Although there is not the mastery of scientific concept, the indigenous carries out the activity because the indigenous village chief, his father, grandparents or other relative taught him to do that way. Thus, he is able to solve a problem and explain the phenomena related to his daily with his own conceptions. We believe that Ethnophysics enables to understand nature and its phenomena in its general aspects associated to a culture or to the specific popular knowledge of each ethnic group, from the concepts operated by the subject on each context. Therefore, promoting the dialogue with experiences and collective categories in relation to the phenomena and technologic solutions with the conceptual framework of scientific physics (SOUZA; SILVEIRA, 2015), it is provided a mutual understanding, resultant from the translation of empirical to abstract and vice versa.

III. INTERCULTURALITY CHALLENGES IN PHYSICS EDUCATION

Trying to understand and accept new cultures is not an easy relation on our daily. History reveals that many of these relations between different peoples and social groups have resulted in holy war, genocides, process of settlement and domination. According to Geertz (1984, p.54), “understand the culture of a people exposes its normality without reduce its particularity”, bringing, according to History, deeply conflicting and dramatic relations.

Persuant to Messeder (2018, p.10), “culture is a symbolic tapestry that organize and guide collective meanings of being and of being in the world, a cognitive and perceptive map translated to codes of behavior, relations of human being with nature and with themselves”. Culture as language only can be understood in its context and specific logic of conception, enunciation and practice.

So, understand these processes of intercultural relations become the condition to understand not only the logic that lead to destruction or mutual subordination, but especially to discover the creative and dialogic possibilities of the relations between groups and different cultural context, making the intercultural didactic material differentiated and appropriate to certain realities.

In the conception of D’Ambrósio (2002), the intercultural relations should be comprehended in a global dimension at which the mass media would facilitate the transport of this cultural plurality. Thereby:

[...] the relations between individuals of the same culture (intracultural) and mainly the relations between individuals of distinct cultures (intercultural) represent the creative potential of the species. As well as

biodiversity represents the way to the emergence of new species, cultural diversity represents the creative potential of humanity (p. 28).

To Fleuri (2009), intercultural relations are not relations whose meanings are configured from singular or individual perspectives, neither are consolidated in a short time. Cultural patterns formation and educational processes inherent to that are configured at the paradoxical intersection of many perspectives that, consequently, are constituted in a dynamic and conflicting way. And although every act has educational effects that contribute to the configuration and transformation of cultural patterns, these are only constituted in historical processes of long duration.

For this reason, the intercultural perspective involves a complex comprehension of the education searched by it – apart from teaching strategies and even the immediate interpersonal relations – understand and promote, slowly and progressively, the relational and collective context formation of meanings elaboration that guide people's life from collaborative principles.

Studying a people, a community or only a group of rural workers is insert yourself in the intended daily. It is talking, hearing, understanding the process, understand the origin, never losing the individuality, but considering the activities generalization, analyzing each word, perceiving in small details the scientific background that exists, remembering that “nevertheless, these descriptions and interpretations will be always from the view of a scientific view” (SILVA, 2003).

Therefore, to achieve the proposed goals, we believe that the ethnographic methodology is the most suitable to our purpose since the study of intercultural relations only can be developed from the interpersonal relationships in their historical facticity. To a research with this character,

[...] it is not the occurrence while occurrence that interest the ethnographer, the brute social discourse of which construction he did not participate; primarily, it is the occurrence meaning of the speak – speech act, of some small parts of the informant speech – that can lead to the comprehension of the reality (Ibidem, p. 4)

In this regard, the relation between people is a relation between projects, purposes, meanings. And the relation between cultures, that occurs in the meeting of persons from different cultures, calls into question all the symbolic apparatuses on the basis of which each subject is oriented. That is what the intercultural relation is about, in our view. Subjects, people from different cultures that

attribute distinctive meanings to their actions, when interacting they put into question not only the meaning of their action or speech, but put on the line all their cultural referential that allow them to grant meaning to each one of their actions, words and feelings (FLEURY, 1996).

Therefore, the relation of Physics teaching and, consequently, of Physics textbook with the student should have as epistemological basis the intercultural and ethnographic context, allowing, thus, the dialogue of the community, that brings intrinsically its previous knowledge, in other words, more general, serving as a bridge to more specific knowledge, namely, scientific. Therefore, it should recognize the importance of culture on the construction and appreciation of local knowledge or of an ethnicity.

IV. METHODOLOGICAL PROCEDURE

This work aimed to construct strategies to implementation of an intercultural Physics teaching in Pataxó indigenous schools, as well create purposes of alternative learning material to support teaching practice.

Systematic bibliographic studies were done to characterize the fundamental concepts present in Physics of the First Year of High School, in the contents of kinematics, vectors, dynamics, universal gravitation and hydrostatic, that are taken in a school year, in different contexts of epistemological approach, as well as detail study of their main characteristics in indigenous reality.

Thereafter, the studies have focused in the conceptual exploitation and on the use of interculturality to organize the concepts studied in Physic within an alternative model of intercultural educational.

V. CONCLUSION

This study aimed to verify the possibility of an intercultural dialogue in teaching and the construction of a didactic material of Physics focused on students of first year of High School, in addition to investigate the role that the Physics teaching has in the context of indigenous High School. This journey was guided by the concept of interculturality. In this connection, it was exploited the concepts of interculturality, valuing the indigenous knowledge on the entire journey.

The study convinced us of the great didactic-conceptual advantage of ethnophysical knowledge use to represent and model the main concepts of Physics. This is mainly due to the ability of dialogue between indigenous culture and natural phenomena studied in Physics. The relation of cultural appreciation in the indigenous context was fundamental to the construction of didactic material and the acceptance by the school community. We believe that the local conceptions, pedagogic practices of the teachers and the comprehension of the process are

fundamental to the meaningful answer by indigenous students.

The compatibility between the produced teaching material and the local context, having as purpose the cultural appreciation of indigenous people in the study of Physics is fundamental to a meaningful learning of physical process focused on the students of first year of High School. At the same time, the relation between teacher, student and community arises as a differential, overpassing the interculturality in the whole process of indigenous school education.

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