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A sociocultural approach to mathematical knowledge and its relations with shipbuilding in the Amazon

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ABSTRACT
The work in question approaches mathematical knowledge and its relations with shipbuilding in the Amazon, evidencing the sociocultural practices of artisanal naval carpenters of the Lower Tocantins Mesoregion/PA, based on the consequences of the implementation of large government projects in the practices of these professionals, such as the construction of the Tucuruí Hydroelectric Power Plant (UHT), as well as the development of cities and population growth. It aims to present some studies that deal with mathematical knowledge and its relations with artisanal naval carpentry. It makes relations of sociocultural practices with an Ethnomathematical approach, based on authors such as: D'Ambrosio (2005), Mendes and Farias (2014), Knijnik (1993), among others. It was found that mathematical knowledge and other so-called scientific knowledge are acquired through learning from older carpenters and also through mistakes and successes in daily practice. The little school knowledge they have does not interfere with the making of the boats. However, the sociocultural practices of these subjects, as well as mathematical knowledge, are few or not used in the context of school mathematics.

Keywords: Mathematical Knowledge, Shipbuilding, Tocantina Amazon, Ethnomathematics.

1 INTRODUCTION

The society in which we are inserted goes through constant changes in the most diverse aspects, such as cultural, socioeconomic, scientific, etc. In the face of such changes, mathematics is present in the framework of those that contribute significantly to the achievements of human knowledge. In addition to being part of people's daily lives, it serves to compose the foundations and is an important piece for the activities of different branches of many sciences.

In this context of change, mathematics has been evolving throughout history. From its use by prehistoric peoples to its affirmation as a science par excellence, it has been discussed and unfolded. According to D'Ambrósio (1996), teaching, in general, has undergone transformations over the years and Mathematics has also been the target of these transformations, suffering influences according to its historical context.

For Brandemberg (2015, p.187) "Mathematics is used in all societies and is the only subject taught in the vast majority of schools around the world. A Mathematics clothed in social, cultural,

institutional and pedagogical aspects, which determine different teaching processes in different communities."

Mendes (2016) also states that the mathematics to which we refer is mathematical culture, that is, mathematics constructed socioculturally. It is a culture of practices that are thought, experienced and socially reflected.

In this context of affirmation of mathematics as an instrument by which the individual can conquer his autonomy and social inclusion, the construction of the vessels used by the Amazonian peoples require general and specific knowledge of both the region and the culture, the type of wood to be used, measurements, the application of mathematical, physical and other concepts acquired through the years of experience. "The construction of boats was (and still is) an activity that arose from the need for the indigenous population to move around the Amazonian rivers and streams." (PANTOJA, 2015, p.72). Shipbuilding in the Amazon arose due to the knowledge inherited both by the Europeans, who passed through here, and by the Indians. Their techniques became intertwined making the construction of boats an economic activity and making boats one of the most important means of transport in the region.

From the colonization and settlement of the Amazon region, whether for the purpose of safeguarding national sovereignty or for the exploitation of natural, mineral and tourist resources, its population has grown considerably. With this, there was a need to adapt and increase the fleet of vessels. In this context, the artisanal work of carpenters would not be enough to meet the need of the imposed demand. From then on, the naval industries emerged, for the construction of large vessels, with raw material extracted from the region itself, aiming to transport large amounts of cargo and passengers. The professionals of the local naval carpentry were also used by the naval industry, both in the main activities of the construction process and in the repair process, since the vessels, being of wood, wear out more quickly.

These artisanal activities of carpenters that are passed from generation to generation, within a cultural context, D'Ambrósio (2005) characterizes as Ethnomathematics. From this, the bibliographic research in question, sought to present some studies that deal with mathematical knowledge and its relations with artisanal naval carpentry. It was observed that the knowledge and/or mathematical knowledge were/are acquired by the artisanal naval carpenters through learning from older carpenters and also through the mistakes and successes in daily practice. The little or no school knowledge they possess does not interfere in the construction of these means of transport. The sociocultural practices of these subjects, however, as well as mathematical knowledge, are few or not used in the school context.

2 DEVELOPMENT

The Amazon, being a region interconnected by many rivers, there are localities where it is only possible to reach through boats. Formigosa, Lucena and Silva (2017), state that

> To navigate through the rivers, creeks and holes that "cut" this region is to enter a universe of a sociocultural diversity that is renewed according to the geography of these rivers, creeks and holes or to each riverside community that arises along its banks or at each bend that the river gives, when an isolated house or some other natural element appears, or even in the coming and going of people, who through these "water paths" go through their lives. (FORMIOUS; LUCENA; Smith, 2017, p. 3).

The authors show that navigation through the rivers of the Amazon requires means of transport that are peculiar and adaptable to this environment. Boats are, in most Amazonian cities and their communities, the means of locomotion most used by riverside peoples for the *"going, coming and doing"* of their social, economic, cultural and professional needs. The construction of these vessels also requires general and specific knowledge about the region, the culture, the type of wood to be used, the measurements, application of mathematical, physical and other concepts acquired through years of experience, making mistakes and getting it right.

According to Pantoja, Silva and Palheta (2017), "shipbuilding is a cultural symbol of the Amazon. Such a culture was generated and organized from the time it was inhabited by its first residents, the Indians." It is true that some cities located in this region have been influenced by technological and communication media. However, the construction of small and medium-sized vessels, which are the most common means of locomotion, are still carried out by naval carpenters.

Many of these carpenters are riverside[1] or have riverine origins. These professionals work in a thorough and detailed way, applying the various knowledge acquired throughout their life and their profession, learning on their own through mistakes and successes or with other more experienced carpenters, in the construction of the vessels. In this sense, we will seek to evidence this knowledge, especially mathematicians, discussing with the most varied theorists who deal with the theme.

According to D'Ambrose (2005),

> Individuals and peoples have, throughout their existences and throughout history, created and developed instruments of reflection, observation, material and intellectual instruments [which I call ticas] to explain, understand, know, learn to know and do [what I call matema] as a response to the needs of survival and transcendence in different natural, social and cultural environments [which I call ethnos]. (D'AMBRÓSIO, 2005, p. 60).

Also according to D'Ambrósio (2005), Ethnomathematics seeks to understand the cycle of generation, intellectual organization, social organization and diffusion of mathematical knowledge of various cultures. For Machado, Soares and Gonçalves (2008), "all peoples, all peoples, in different

[1] According to Pantoja, Silva and Palheta (2017) "Ribeirinhos are people who inhabit the banks of the rivers of the Amazon. They generally live from handicrafts, agriculture, hunting, plant extractivism and, especially, fishing."

cultures, have ways of dealing with the mathematical knowledge that are their own, whether they are the indigenous groups of the Amazon, the agricultural communities of the interior of Brazil, or the residents of large urban centers, all produce, in some way, mathematical knowledge. Of course, this knowledge will be very strongly linked to the practices and experiences (and needs) of each of these groups in question." (AXE; SOARES; GONCALVES, 2008, p. 49).

According to Knijnik (1993), Mathematics needs to be understood as a type of cultural knowledge generated by different cultures, as well as language, beliefs, rituals, specific production techniques, in this way, the Ethnomathematical approach should be understood as "the investigation of the conceptions, traditions and mathematical practices of a subordinate social group and the pedagogical work that develops in the perspective that the group interprets and codifies its knowledge; acquire the knowledge produced by academic mathematics, using, when faced with real situations, the one that seems most appropriate to you." (KNIJNIK, 1993, p.88).

In this perspective, Mendes and Farias (2014) state that "it is possible to admit that mathematics is, of course, a part of cultures. Each society inherits from its predecessors, or contemporary neighbors, some ways of counting, calculating, measuring and exercising other skills that make mathematics become a form of conduct in search of answers to the questions generated in the sociocultural context." (MENDES; FARIAS, 2014, p.43).

The socio-cultural practices exercised by artisanal naval carpenters in the Amazon, in the view of Pantoja *et al* (2017, p.8) "brings with it tradition and culture through knowledge and doings". Given this, Vergani (1991) *apud* Mendes and Farias (2014) considers that there is an inseparable relationship between mathematics, society, cognition and culture. Hence the author proposes the expression mathematics, sociocognition and culture to express their way of thinking and acting with mathematics in the process of mathematics education in educational training at all levels of education. (*apud* MENDES; FARIAS, 2014, p.44).

This knowledge, even if sometimes imperceptible, according to Gualberto (2009, p. 20) *apud* Pantoja *et al* (2017, p.8), consists of "[...] knowledge in the field of mathematics, chemistry, physics, geometry, education, administration, economics, ethics, art, history", in short, areas of knowledge taught in school that are developed and exercised by carpenters in the craft of their daily work without having had contact with such knowledge in schools.

3 CONCLUSION

Mathematics needs to transcend the walls of the classroom, go beyond tasks and exercises disconnected from the reality of the subject, because it is important for understanding and analyzing the flow of information that we receive daily through the media and the various social interactions typical of human activity. Mathematical culture is always connected to social practices carried out in

the context of different human activities. When the intentions of a social practice are made explicit, they can become educational practices, which occur inside and outside the school. These social practices will only become educational by the explicitness / understanding / awareness of their objectives, the task of scientific investigation in education.

Taking as a starting point the Amazon region of the Lower Tocantins, where until the 70's naval carpentry was predominant and, later, with the construction of the Tucuruí Hydroelectric Power Plant and the modernization of the cities, the shipyards of the region began to fall into decay and the professionals of naval carpentry were being pulverized to act in the most diverse branches that could survive. Many of them continued to exercise the activity in an artisanal way, building small and medium-sized vessels, to order and others went to work on the construction of the said hydroelectric plant.

Given this context, it was observed that mathematical knowledge and other so-called scientific knowledge are acquired through learning from older carpenters and also through mistakes and successes in daily practice. The little school knowledge they have, does not interfere in the making of the boats. However, the sociocultural practices of these subjects, as well as mathematical knowledge are few or not used in the context of school mathematics.

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