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Mathematical Knowledge in Contexts of Solidary Economic Enterprises

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Abstract**—***This study aims to identify mathematical situations in practices of Solidary Economic Enterprises - EES, as well as to describe the performance of the ethnomatematic program in research with EES. The study consists of a bibliographic review with a qualitative approach, in which articles were selected in the CAPES Journal Portal. Thus, we conclude that there are situations in EES in which mathematical knowledge is used, such as: the understanding of spreadsheets; the organization of tables for production control; the calculation of materials needed for production and the understanding of mathematical operations used for budgeting the enterprise. It was identified that members did not understand these mathematical contents, and pedagogical interventions were carried out that were guided by the Ethnomathematics program, contemplating activities that valued the context of each enterprise and the previous knowledge of the members.*

Keywords**—Mathematics; Solidarity economy; Ethnomathematics.**

I. INTRODUCTION

The concept of education is so broad that it permeates the walls of a school. It is inserted in different contexts, providing a better quality of life for people. Thus, the teacher, as a knowledge facilitator, should act in other scenarios in addition to the school environment.

In this sense, the construction of knowledge, through an interconnection between knowledge, can provide the economic development of the region, based on important values, such as: respect for the environment, solidarity, collaboration and self-management, which leads us to the Solidarity Economy . Thus, when a group of people produce and market their products based on the principles of Solidarity Economy, they constitute Solidary Economic Enterprises (EES).

In strengthening the EES, in the state of Bahia, we highlight the performance of the Public Centers for Solidarity Economy (CESOLs), currently, the state has nine Centers that act not only in strengthening, but also in the generation and promotion of collective work. After visits to CESOL located in the city of Juazeiro and to the EES in which this center operates, a weakness was found in the execution of self-management, an important principle for its maintenance. It was also identified that there are mathematical situations embedded in many practices of these establishments, ranging from the elaboration of products for sale to the management of the enterprise, such as inventory control, cash closing, among others.

With that, we present the following question: What mathematical situations are present in the activities of Solidary Economic Enterprises? In order to support such questioning, a systematic review was carried out in order to identify mathematical situations in practices of Solidary Economic Enterprises - EES, as well as to describe the performance of the ethnomatematic program in research with EES. The research consists of a bibliographic review with a qualitative approach, in which articles were selected in the CAPES Journal Portal.

Thus, the theoretical focus that will be adopted in this study, is based on the principles of Ethnomathematics, characterized as Mathematics practiced by cultural groups, such as groups of workers, indigenous societies among

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others D'Ambrósio (2013); the Solidarity Economy, which comprises "the set of economic activities - production, distribution, consumption, savings and credit - organized and carried out jointly by workers in a collective and self-managed manner" (BRASIL, 2006, p. 11).

To support this research, the main theoretical contributions are: the Solidarity Economy; Ethnomathematics, based on the studies of Singer, D'Ambrosio and Meneghetti.

SOLIDARITY ECONOMY

In the current context, there are discussions regarding the organization of society. In this organizational scenario, capitalism is found. According to Singer (2002), this mode of production, based on the right to property and individual freedom, has become dominant, this in such a way that we see it in a natural way. Thus, it highlights that one of the consequences of this mode of production is a competitive market economy, in which companies compete for sales. In this way, those that sell the most are also those that profit the most and grow the most. And those that sell less will suffer losses and tend to close. This fact has negative social effects: "the winners accumulate advantages and the losers accumulate disadvantages in future competitions. "(SINGER, 2002, p. 08).

According to Silva et al (2016), in the capitalist mode of production, labor for man is no longer used to supply his needs, but is seen as a means of accumulating wealth for the holders of the means of production. In this perspective, capitalism presents a contradiction: initially, it generated material goods necessary for society; therefore it brought a great wave of unemployment.

Contrary to this competitive and exclusive way of thinking, which has social inequality as one of its consequences, Singer (2002) proposes a society that is adept at Solidarity Economy, in which competition is replaced by cooperation between participants in economic activity. In this same perspective, Pitaguari, Santos, Camara (2012) highlight that the potential of the Solidarity Economy is centered on solidarity and equity, with no room for competition and individualism.

The transformations that have taken place in the world of work have made workers and poor communities organize themselves in the form of self-management, an important characteristic of the Solidary Economy (BRASIL, 2006). In a simple way, Santos (2012) clarifies that "self-management would be self-management. It starts with the intention that men can be responsible for organizing an activity, without the necessary intervention of a leader, or a superior "(SANTOS, 2012, p. 106).

In the company with an integral profile of the Solidarity Economy, management takes place in a democratic manner, which characterizes self-management. Thus, depending on the size of the company, decisions can occur through assemblies, in the case of small companies, or through the election of delegates, elected by section or departments, where they meet to deliberate on behalf of all (SINGER , 2002).

According to the author, all workers of the solidarity company understand what happens in the enterprise, appropriating the problems and looking for possible solutions. This fact contributes to a lack of appreciation of competition among members, since they will not be encouraged by competitions in the group, to know who is better than the other.

When a group of people produce and market their products based on the principles of Solidarity Economy, they constitute Solidary Economic Enterprises (EES). These enterprises can be: "cooperatives, associations, self-managed recovered companies, solidarity finance organizations, informal groups, etc. (MENEGHETI, 2016, p. 3).

Solidary Economic Enterprises, over time, receive support from entities. In the university context, we highlight the work carried out by NuMI-EcoSol-Integrated Multidisciplinary Center for Studies, Training and Intervention in Solidarity Economy, a teaching, research and extension unit directly linked to the Rectory of the Federal University of São Carlos (UFSCar). One of its objectives is to provide qualified and free assistance to groups of people who are in situations of social vulnerability from the perspective of the Solidarity Economy. One of the group's lines of action discusses issues of Gender and Mathematical Education, based on Ethnomathematics.

In this same perspective, we highlight the performance of the research group EduMatEcoSol, coordinated by Professor Renata C.G. Meneghett, being one of his lines of research on Education in Solidarity Economy. Meneghetti (2016) identifies the Ethnomathematics present in the EES and, from there, carries out interventions, contributing to the self-management of such enterprises.

ETHNOMATHEMATICS

Mathematical knowledge appears in the most varied social contexts, from the bricklayer when calculating the

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area of a wall to make its covering; a farmer when calculating the amount of fertilizer he needs to use in his crops. In this sense, D'Ambrósio (2013) discusses contextualized mathematical know-how, which seeks explanations and ways of dealing with the environment. Thus, he points out Ethnomathematics as the mathematics practiced by cultural groups, such as groups of workers, indigenous societies, among others.

D'Ambrósio (2008) points out that the definition of Ethnomathematics is very difficult and, therefore, uses an explanation of an etymological character, in which ethno are the most varied environments, from the social, cultural and nature; matema, which means to explain, understand, teach, deal with; tica, which resembles the Greek word tecné, which refers to arts, techniques, manners. In summary, there is Ethnomathematics, which means "the set of arts, techniques of explaining and understanding, of dealing with the social, cultural and natural environment, developed by different cultural groups" (D'AMBROSIO, 2008, p. 8).

In the field of solidarity economics, we highlight the studies by Meneghetti who, in his postdoctoral research, concluded that "such an investigation pointed to the importance of the theory of Ethnomathematics, both with regard to the characterization of the Ethnomathematics of Enterprises in Solidary Economy, as regards the consideration of this Ethnomathematics in educational practices in the context of higher education "(MENEGHETTI, 2013, p. 537). Meneghetti, Giaquinto (2017) approached the process of teaching and learning mathematics in a contextualized way, meeting the specific demands of mathematical knowledge inherent to the activities of a Community Bank. The research by Meneghetti et al (2013) aimed to meet the specific demands of Mathematical Education with three Enterprises in Solidarity Economy (EES): a cleaning cooperative, a women's collective joinery and a group of homemade soap manufacturing.

The researcher conducts her research in EES as follows: Initially, she understands the Mathematics used in EES and how it is used within these environments. Then, from this survey, pedagogical activities are developed that are experienced through workshops, in order to facilitate an understanding of the mathematics used by the members of the EES, thus contributing to the self-management of such enterprises (MENEGHETTI, 2016).

II. METHODOLOGY

This study consists of a bibliographic review, with a qualitative approach (GIL, 2017), in which articles published between the year 2000 and January from indexed Portal de Periódicos CAPES / MEC were selected. In the search, the following keywords were used "Ethnomathematics' '," Solidarity Economy "interconnected with the Boolean operator" AND ".

III. RESULTS

After searching for the words "Ethnomathematics " and" Solidarity Economy "in the Capes Journal Portal, 6 articles were identified, 3 of which were duplicates and one was not considered in the analysis, as it was intended to investigate, the point from a theoretical point of view, possible approximations between Mathematics Education and Solidarity Economy (MENEGHETTI, 2013), did not address mathematical situations present in EES practices. Thus, for the analysis of the results, 2 studies were considered, which are: Meneghetti; Barrofaldi (2015) and Meneghetti et al. (2013).

The study by Meneghetti and Barrofaldi (2015) aimed to develop mathematical activities in a contextualized way, aiming to meet the specific demand of a Community Bank (BC). Thus, initially there was an understanding of the daily life of this enterprise; seeking to identify the mathematical knowledge needed in its production chain and the difficulties presented by its members.

According to the initial survey, most of the activities carried out in the BC revolved around handling a spreadsheet for the analysis and control of productive credit, used for the analysis and granting of loans. Thus, it was identified a greater difficulty of the members in the use of this spreadsheet, more specifically, in relation to the mathematical concepts necessary for its completion and analysis, which involve basic operations with decimal numbers, calculation of averages, percentages, rule of three and conversions of measures. In view of this, in a second step, interventions were carried out in which these mathematical contents were worked on, valuing the prior knowledge that each member had. It was also found that the interventions provided the learning of mathematical content in which several difficulties initially pointed out were remedied, in addition, they indicate that these actions helped in the self-management of that enterprise.

The research by Meneghetti et al (2013) aimed to meet the specific demands of Mathematics Education with three Enterprises in Solidarity Economy (EES): a cleaning cooperative, a women's collective joinery and a group of homemade soap manufacturing. At first, the mathematical knowledge present in each of the groups found difficulties

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members regarding mathematical knowledge. Thus, in the cooperative, participation in public notices that need to present contracts with values based on the type of service to be provided was identified, including calculations such as: number of members to perform the service; quantity of cleaning products required, displacement of products and people, etc. In these actions, operations with rational numbers in decimal form are used.

In the collective women's joinery, mathematical situations were identified, which involved everything from calculating the amount of wood used to make furniture to discussions about the use of a calculator, abacus and equations.

As for the group of homemade soap manufacturing, the researchers realized that the partners had difficulties in making the tables used to control the production and count of the product produced. In this sense, intervention activity was carried out in order to guide the construction of tables. Thus, after that moment, it was identified that as for filling the table, they understood how to fill and interpret a table, which consisted of an advance in search of self-management of this EES.

IV. CONCLUSION

When resuming the objectives of this work, of identifying mathematical situations present in practices of Solidary Economic Enterprises (EES), as well as describing the performance of the ethnomatematic program in research with EES, it is concluded that there are several situations in EES in which mathematical knowledge is used . According to the research analyzed, the following should be highlighted: the use and understanding of spreadsheets; the organization of tables for production control; the calculation of materials needed for production, as well as the understanding of mathematical operations used to prepare the project's budgets.

It was identified that the members of the EES involved in the research had difficulties in the manipulation of these mathematical contents, which resulted in a difficulty in carrying out the activities. Thus, in the three studies, pedagogical interventions were carried out, in which activities were considered that valued the context of each enterprise and the previous knowledge of the members, these actions provided a certain autonomy in the execution of activities, contributing to the strengthening of self-management.

We also highlight that, in all the studies carried out, the Ethnomathematics program was of fundamental importance because it was used as theoretical and methodological support both in the initial survey, in which it was sought to know the daily life of the enterprises as well as to guide the pedagogical interventions carried out, which were also elaborated with theoretical contributions of Mathematical Education, like the Problem Solving. In relation to this fact, Meneghetti (2016) points out that his work may guide other research in strengthening self-management in Solidary Economic Enterprises, and pedagogical interventions may be developed using other teaching methodologies.

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