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AWARENESS OF STUDENTS, CHILDREN OF FAMILY FARMERS IN THE SEMI-ARID, ABOUT THE CONCEPT OF SYNTROPIC AGRICULTURE[1]

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1. This work is a subproject of the research project entitled: The awareness of students and teachers of public schools, in the municipality of Jequié in Bahia, during experimental activities.

Abstract: Research in Science Teaching has sought theoretical references to deal with the complexity of teaching-learning processes. The objective of this work was to monitor the awareness of the concept of syntropic agriculture, proposed by Ernst Gotsch. The foundation was Piaget's awareness. This research was qualitative, of the participant type. The collection instruments were: semi-structured interviews and Logbook. The subjects were fourteen students, children of farmers, in a municipal school in the semiarid region of Bahia. The analysis process started from the answers of the interviews and the Logbook, in three different moments. The results showed a significant learning, through awareness. The representations of the subjects differed in: (a) pre-conceptual, with transductive thinking (Level I – 78.6%) and inductive thinking (21.4%) – first moment; (b) conceptual representation (Level II), with the understanding of the totality that he came to build (sublevels IIA- 71.4%, IIB - 28.6%, IIC- 42.9% and IID- 57.1%) – second and third moment.
KeyWords: Syntropic Agriculture, Awareness, Science Teaching.

INTRODUCTION

In a report, the UN certifies that the **Family farming is largely responsible for the process of eradicating hunger in Brazil** and highlights policies such as the National Program for the Strengthening of Family Agriculture – PRONAF and the Food Acquisition Program – PAA as factors in reducing hunger in Brazil. With this, the country managed to reduce the number of people who go hungry by 50%, leaving the World Hunger Map in 2014, noting that 70% of Brazil's domestic consumption comes from Family Farming. In Brazil, 12.3 million people are employed in family farming, in contrast to 4.2 million employees in non-family establishments (ORGANIZATION OF THE UNITED NATIONS FOR BRAZIL, 2017).

In view of the above, this work is justified, therefore, to promote a teaching-learning methodology for students from rural areas, children of family farmers in the semi-arid region, focused on the apprehension of topics such as organic production, food security, nutrition and sustainability. is fundamental for a change in behavior that opposes the reality of conventional agriculture, based on the use of external inputs, mostly synthetic chemicals, harmful to life.

It is a qualitative research (DEMO, 2000; LÜDKE, 1988), of the participant type (TRIVINOS, 1987; BRANDÃO, 1988). The collection instruments used were semi-structured interviews and Logbook. The subjects studied are 14 students, children of family farmers, in the sixth year of a municipal school located in the semi-arid region of southwest Bahia. The analysis took place with data collected at three different moments of the research. The transcripts of the subjects' verbal formulations and the Logbook reflections were framed in different levels of representation, in the light of Genetic Epistemology.

The theoretical framework is the awareness present in Jean Piaget's Genetic Epistemology approach. Awareness raising leads us to an active appropriation of concepts, implying a slow and laborious process of conceptualization (reflection), presupposing a true construction of the subject, and not an elaboration of a totalitarian consciousness, but of its different levels, with systems of implications that range from the simplest to the most complex. (ANDRADE et al, 2016).

The results presented here refer to the second and third moments of the research, where, based on the subjects' prior knowledge, an intervention process began, which culminated in different levels and sub-levels

of representation on syntropic agriculture (GOTSCH, 2017).

In view of the above considerations, this work had as general objective to analyze the construction of the concept of syntropic agriculture (awareness), during a participant research, with children of family farmers in the semiarid region. The specific objectives were: a) how are the representations made by students during the intervention different? b) how to intervene in order to favor imbalances in the conceptualization processes? For this, a pedagogical proposal was developed to measure and monitor the subjects' learning about syntropic agriculture.

METHODOLOGY

It is a qualitative research (DEMO, 2000; LÜDKE, 1988) of the participant type (TRIVINOS, 1987; BRANDÃO, 1988). The planning of activities, in line with the pedagogical proposal, aimed to produce changes (action) and understanding (reflection), configuring itself as a social intervention, with an empirical and participatory basis.

The orientation and planning of the activities were carried out by the researcher, with the cooperation of teachers, during the research activities in the project entitled: The awareness of students and teachers of public schools, in the municipality of Jequié in Bahia, during the experimental activities. The data of this work emerged from experimental activities (garden construction, exploratory walks, construction of schemes) carried out by the subjects. For this intervention, the researcher joined the school's Teaching Table, working together with the teachers. To this end, a schedule of activities, teaching strategies and objectives was built, illustrated in Table 1.

Data collection took place at three different moments (Table 1), during the development of the work. The subjects of this research consisted of fourteen students, children of family farmers, in the sixth year of a municipal school located in the semi-arid region of southwest Bahia.

The collection instruments were: semi-structured interviews and Logbook. In this type of interview, the interviewer has a set of predefined questions, but is free to ask others, if interest arises during the course of the interviews. The predefined questions are a guideline, but they do not dictate how the interviews will take place, as the questions must not be asked in a certain order, nor in exactly the same way as they were initially defined (DEMO, 2000; MINAYO, 1996).).

The basic questions must be organized as a starting point, for the emergence of new questions. This type of interview can make information appear more freely, unlinked from alternatives that may be suggested by the basic questions used, allowing respondents to be more spontaneous (MANZINI, 2017).

After collecting the material and reading the records, which express the interaction between empirical data and Genetic Epistemology, the analysis process began. The verbal formulations that emerged from the semi-structured interviews and the Logbook descriptions were analyzed based on the awareness of Genetic Epistemology. In order to do so, we list three categories: 1) Pre-conceptual representation – Level I: almost null knowledge - the subjects' responses about syntropic agriculture are superficial, confusing and contradictory; 2) Conceptual representation - Level II: partial knowledge - Level achieved by subjects who demonstrate a more elaborate knowledge about the concept of syntropic agriculture, presenting more coherent answers; 3) Scientific representation - Level III: adequate and broad knowledge - Level of subjects who present more complete answers, revealing a

RESEARCH MOMENTS	ACTIVITIES THAT WILL BE DEVELOPED AND TEACHING STRATEGY	GOALS	COLLECTION INSTRUMENTS
I Moment	→ Construction of schemes that represent a syntropic (organic) x conventional agriculture.	→Identify the representations of the subjects about the concept of syntropic agriculture.	→Application of semi-structured interview and Logbook.
II Moment	→Exploratory walk to a vegetable garden and a vegetable garden. →Organic planting activity (building a vegetable garden). Pesticides and chemical fertilization. → Production and use of school waste. →Construction of schemes that represent conventional agriculture and syntropic (organic) agriculture and their differentiations.	→ Identify the characteristics of polyculture and monoculture. → Recognize the difference between chemical and natural fertilizer. →Recognize the difference between chemical and natural pesticides. →Distinguish the similarities and differences between syntropic and conventional agriculture.	→ Application of semi-structured interview and Logbook.
III Momento	→Caminhada exploratória a um horto e a uma horta. →Visitação a uma fazenda de gado e de pequenos animais. →Caminhada exploratória nas diversas paisagens do entorno da escola. →Construção de esquemas que representem uma agricultura sintrópica. →Comparar a construção, produção e condição da horta escolar com hortas do entorno. →Programa Globo Rural sobre agricultura sintrópica.	→Distinguish the similarities and differences between syntropic and conventional agriculture. →Reflect on actions that could harm soils and the survival of animals. →Discuss the importance of the practice of syntropic agriculture for the balance and preservation of biodiversity.	→Interview application semi-structured and logbook.

Table 1: Schedule of activities that were developed, didactic strategies, objectives and research collection instruments.

Source: prepared by the authors.

higher level of knowledge about syntropic agriculture.

Based on the analyses, we framed the subjects' verbal formulations, supported by the representative schemes of the Logbook, in levels and sub-levels of understanding. Then, they were classified by the type of representation that characterized their level of understanding about syntropic agriculture.

RESULTS AND DISCUSSION

I MOMENT:

The results referring to the first moment of the research were published in the V CONEDU, under the title of: Pre-conceptual representation of children of family farmers in the semiarid region, on the concept of syntropic agriculture. In summary, the subjects' levels of understanding are summarized in Table 1.

Finally, in the analysis of the interviews and Logbook, in the first moment of the research, we were able to evidence:

> [..] *that all subjects have preconceptual representations about the concept of syntropic (organic) agriculture. The prefix "pre" before the word "concept" indicates that the reasoning of these students is neither inductive nor deductive, but transductive, starting from a particular situation and moving to another particular one, without reaching generalizations. On the other hand, we found more advanced students, because their practical experiences in everyday life, as they are children of rural farmers, allow the ongoing conceptualization to improve the elaboration of their narrative, which gives their thinking an intuitive character, being intermediate between a preconceptual representation and a conceptual representation. (SOBRINHO et all, 2018, p.10).*

II MOMENT:

The results presented here refer to the second moment of the research, in which the verbal formulations of the subjects are analyzed, in the semi-structured interviews and the researcher's notes in the Logbook.

In the verbal formulations of subjects A3ED2 and A10ED2 (Interview 1), we observed an awareness that in conventional agriculture we have a monoculture, that is, a dense plantation of the same species. In syntropic (organic) agriculture, we have

SUBJECTS/ LEVELS.	SYNTROPIC AGRICULTURE REPRESENTATION (Organic)
Level I **A1ED1; A2ED1; A3ED1; A4ED1; A5ED1; A6ED1; A8ED1; A9ED1; A10ED1; A12ED1; A13ED1.**	→ They relate conventional agriculture to that which uses poison and chemical fertilizer. Syntropic (organic) agriculture, on the other hand, is agriculture that does not use poison and uses natural fertilizer (cow poop, goat poop). But there is an indifferentiation between fertilizer, chemical pesticide, poison and natural pesticide: natural pesticide is called natural poison, 10/10 fertilizer is called chemical pesticide. Natural fertilizer has no poison and chemical fertilizer has. →Simple dissociation of the word polyculture and monoculture. It is evident that this relationship is not understood. →There is a back-and-forth (instability) in thinking when relating polyculture and monoculture with conventional agriculture and syntropic agriculture (organic).
INTERMEDIARY **A7ED1; A11ED1; A14ED1.**	There is an advance in relation to the previous subjects, in the following aspects: → Monoculture is represented with several plants of a single species (like a canary seed plantation) and polyculture is represented by different plants (but still with few specimens of each). The subjects coherently relate syntropic (organic) and conventional agriculture. → There is greater stability in thinking, when relating monoculture and polyculture with conventional agriculture and syntropic (organic) agriculture, respectively.

Table 1: Levels of understanding of the subject, at the first moment of the research, about syntropic agriculture.

Source: SOBRINHO, et all 2018, p10.

polyculture, and this is not a consortium system, but a densification of different species. Let's see the speech of A3ED2 and A10ED2 (Interview 1), faced with the question: "Q: If I plant mango and guava, do I have a polyculture? A3ED2: No, because to be polyculture, I have to have several types of plants, not one or two plants. A10ED2: There would have to be many plants". These results also appear in the representative schemes of these subjects. (Table 1 – comments A and C).

> **INTERVIEW 1: Q: What is a monoculture for you?** A3ED2: It is a plantation with many cacao trees (points to the poster).
>
> **P: Because there are a lot of cocoa plants, are you sure it's a monoculture?** A3ED2: Yes, because it's a lot of one thing. A10ED2: Because I have a single species in the plantation, which is the cocoa tree **P: And polyculture, what would it be?** A3ED2: It is a plantation of various types of plants such as cocoa, coffee, mango, guava, orange (points to the poster). **P: Are you sure?** A3ED2: Yes, I am.
>
> **P: At that moment I pick up several pens of different colors and suggest, in an imaginary way, that each pen represents cocoa, coffee, mango, orange guava. If I plant mango and guava do I have a polyculture?** A3ED2: No, because to be polyculture, I have to have several species, not one or two. A10ED2: I would have to have all of them. **P: Monoculture is used in which agriculture?** A3ED2 and A10ED2: Traditional. **P: Isit policulture?** A3ED2 and A10ED2: Syntropic (organic).

These results could also be observed in the representative schemes constructed by subjects A4ED2 and A1ED2 (Table 2 – comment A). In conventional agriculture, we found a process of awareness, where a coconut monoculture was represented by several specimens, different from the first moment where the monoculture was represented by a single papaya tree. Also in the representative schemes constructed by subjects A7ED2, A11ED2 and A14ED2 (Table 3 – comment A), they become aware that in conventional agriculture we have a monoculture and that we can have a dense plantation of the same species. They represented a dense tomato crop (see Table 3 – Comment A). In syntropic (organic) we have polyculture and this is not a consortium system, but a densification of species (see Table 3 - comment C).

There is also greater stability in thinking, when relating monoculture and polyculture with conventional agriculture and syntropic (organic) agriculture, unlike the first moment, in which the subjects changed their opinion, presenting themselves insecure, confused and contradictory, in the face of questions - such as A2ED2, which uses verbal phrases such as: "I think mono is in syntropic (organic) and polyculture in conventional". Q: Why? S2ED2: "laughter" S2ED2: emphasizes: "So it's the other way around? laughter".

Continuing our analysis of the verbal formulations of subjects A4ED2 and A1ED2 (Interview 2), we could see an awareness when subjects associate conventional agriculture with the use of chemical fertilizer (10/10) and chemical pesticides (Semirex and Randap); associate syntropic (organic) agriculture with the use of natural fertilizers, such as cow and goat dung, and natural pesticides, such as rope tobacco. We also observed an awareness of the place of application: the use of chemical pesticides applied to the leaves and chemical fertilizer on the root part of the plants. This is an advance in relation to the first moment, when they considered chemical pesticides and chemical fertilizers as synonyms.

> **Interview 2: Q: Here in this garden, what kind of fertilizer is used?** All students answered that organic fertilizer is used, since during the visit, several animal manures were seen on the plantations.
>
> **P: During the visit to the garden, I asked: if the ants arrived here to cut these seedlings, what would farmers in the region normally**

LOGBOOK:

II Moment

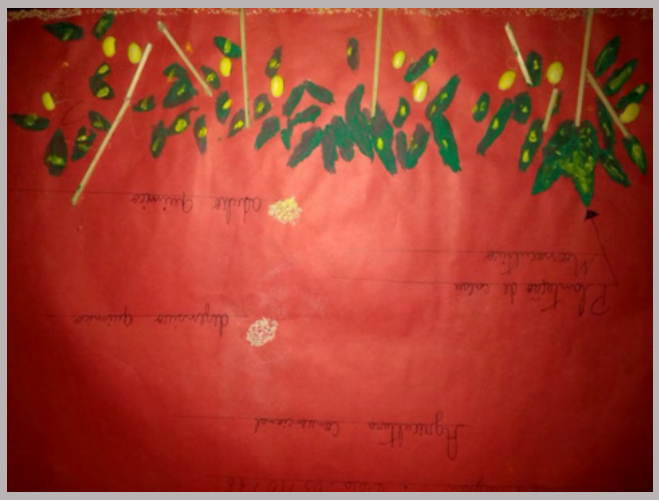


Figure 1 – Representation on conventional agriculture

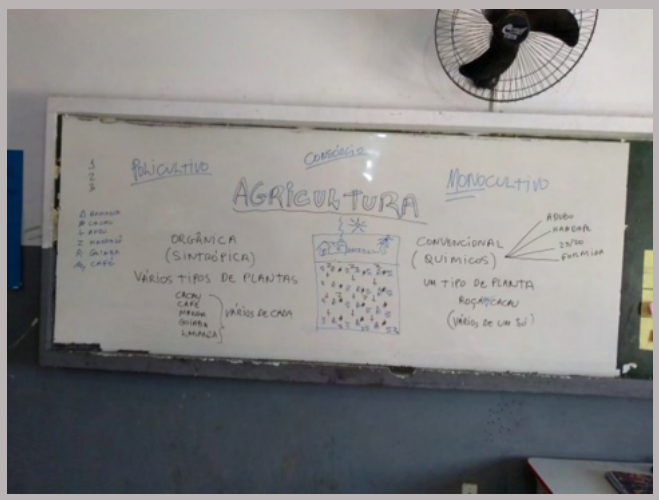


Figure 2 – Comparative representation of agriculture conventional and syntropic (organic).

Comment A (figure 1): In this scheme, subjects represented conventional agriculture as a cocoa monoculture.

Comment B (figure 2): Syntropic (organic) agriculture is represented without the use of chemical fertilization. Conventional agriculture has been described with the use of agrochemicals (chemical fertilizer, herbicide and insecticide). The use of chemical pesticides on the leaves and the use of chemical fertilizer on the root part of the plants were observed. If we compare with the representation of the I moment, we can observe two processes of awareness, namely: a) the first, the association of conventional agriculture with the use of chemical fertilizers and poisons: insecticide (SEMIREX) and herbicide (RANDAP); b) in the second, there is also awareness of the place of application (the use of chemical pesticides applied to the leaves and the use of chemical fertilizer on the root part of the plants).

Comment C (figure 2): In this scheme, we observed that the subjects described syntropic agriculture (organic) as a dense polyculture (cocoa, coffee, mango, guava, orange, etc.). (Different from the 1st moment, where polyculture was associated with a consortium of beans and rice).

Table 1: Description of an excerpt from the Logbook, in the second moment. Representative scheme built by the subjects (A3ED2 and A10ED2) on conventional agriculture / syntropic agriculture (organic).

Source: Logbook elaborated by the author.

LOGBOOK:

II Moment

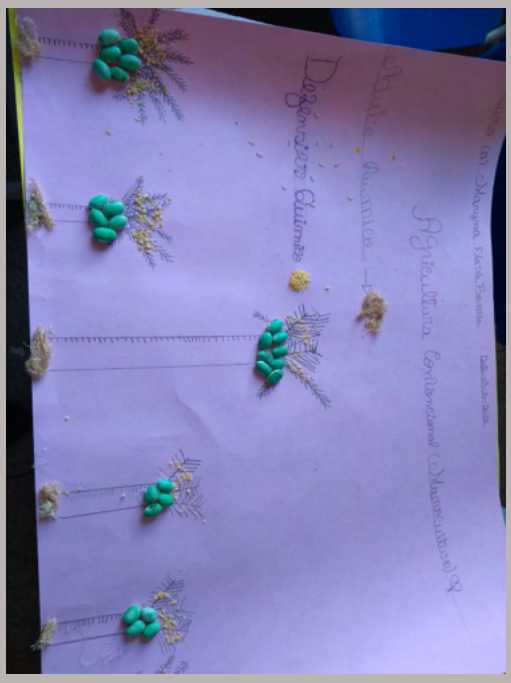


Figure 3 – Representation on agriculture conventional.

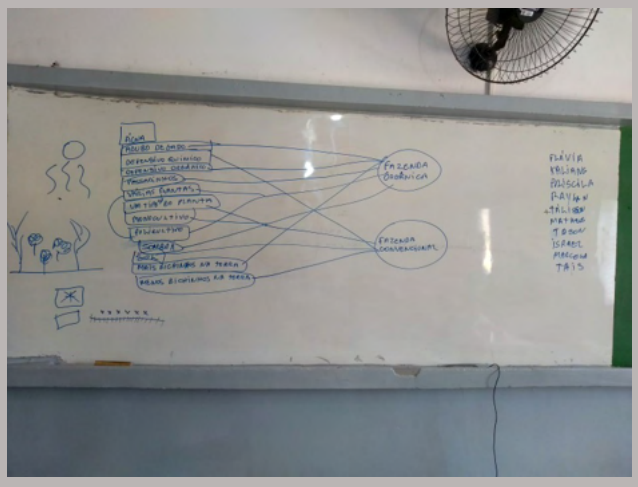


Figure 4 - Comparative representation of agriculture syntropic (organic) and conventional.

Comment A (figure 3): In conventional agriculture, we found a process of awareness, where a coconut monoculture was represented, with several specimens. Different from the first moment, when monoculture was represented by a single papaya tree.

Comment B (figuras 3 and 4): We also found a process of awareness, when the subjects differentiate between fertilizer and chemical defensive. Different from the first moment, where they consider chemical pesticides and chemical fertilizers as synonyms. It is observed that the use of chemical pesticides is applied to all the leaves of the plantation.

Comment C (figure 4): In this scheme, we observed that the subjects associated a conventional farm with chemical pesticides, one type of plant (monoculture) and fewer animais on the ground and intense sun. The syntropic farm (organic), as a space with more water, more animals on the ground, birds, plants (polyculture) and shade, in addition to the use of fertilizer and organic pesticides.

Table 2: Description of an excerpt from the Logbook in the second moment, built by the subjects (A1ED2 and A4ED2) on conventional agriculture / syntropic agriculture.

Source: logbook elaborated by the author.

use? A1ED2: Buy medicine and and take it. **P: What remedy is this?** A4ED2 and A1ED2: SEMIREX.

P: It is placed where? A 4ED2: In the house and on the roads. A3ED2: In the house and on the tracks. **P: If I had organic farming, could I use poison to kill ants and caterpillars?** A4ED2 and A1ED2: No.

P: Could I fertilize with 10\10? A4ED2 and A1ED2: No. **P: Why not?** A1ED2: Why would conventional agriculture be? **P: In syntropic (organic) agriculture can I use RANDAP (herbicide), SEMIREX (insecticide) and use 10\10 (chemical fertilizer)?** A11ED2, A7ED2, A14ED2: No.

P: Why not? A11ED2: Because otherwise it would be conventional agriculture. **P: RANDAP and 10\10 are the same thing?** A 4ED2: No, RANDAP is used to kill weeds in the plantation and 10\10 is used to fertilize the plantation. **P:Where can it be applied?** A4ED2: 10\10 in the root, to fertilize and RANDAP, in the leaves.

P: And in syntropic (organic) agriculture, what type of pesticide and what type of fertilizer are used? A4ED2: Ox, cow shit. A1ED2: Goat shit. **P: And what kind of defensive is used?** A4ED2: Rope smoke. My mother uses a tobacco preparation in the garden at the back of the house.

Similar answers were obs in the interviews of subjects A7ED2, A11ED2 and A14 ED2 (Interview 3).

Interview 3: Q: If I am working on my land and I call my agriculture syntropic (organic), what fertilizer do I use? A7ED2, A11ED2 and A14 ED2: Organic.

P: Why organic? A7ED2: Because it's natural and it doesn't hurt. A11ED2: Because it's not bad for those who eat. A14 ED2: Because it is good for health. **P: Give an example of organic fertilizer.** A7ED2: Ox dung, goat dung. A14 ED2: Eggshell, vegetable shell. A11ED2: Cow and ox dung.

P: In conventional agriculture, which type of fertilizer is used? A7ED2, A11ED2 and A14 ED2: Chemical. **P: Give an example of chemical fertilizer.** A7ED2: 10\10. A11ED2: 10/10 and urea.

P: Chemical pesticides are used in which agriculture? A7ED2:In conventional agriculture. A11ED2: Everything chemical is conventional agriculture.

These results could also be observed in the representative schemes constructed by subjects A4ED2 and A1ED2 and described in the logbook (Table 2 – comments B and C). Also in the representative schemes constructed by subjects A7ED2, A11ED2 and A14ED2 (Table 3 – comment B), a differentiation between natural and chemical fertilizers can be seen. Chemical fertilizer and chemical pesticide are not the same thing, unlike the first moment, where these concepts are undifferentiated.

We could observe that subjects A1ED2 and A4ED2 (Interview 4) showed an early recognition that in a syntropic-organic agriculture system there is more biodiversity when compared to a conventional agriculture system. Also, in the representative schemes (Table 2 - comment C) constructed, we observed that they associated a conventional farm with a chemical pesticide, a type of plant (monoculture), fewer animals on the ground and intense sun. The syntropic farm (organic) was represented as a space with more water, more animals on the ground, birds, plants (polyculture) and shade, in addition to the use of fertilizer and organic pesticides.

Interview 4: Q: What chemical pesticides do your parents use in agriculture? A14 ED2: RANDAP. A7ED2: My father uses herbicide to kill the weeds, but he also kills the soil bugs, so it's a poison. A14 DI2: RANDAP. A7ED2: Herbicide is used at home to kill the weeds. He also uses insecticides to kill the insects that eat the crop.

P: And when we eat the plant, which he sprayed with insecticide, can it be harmful? A14 ED2: Of course it's because

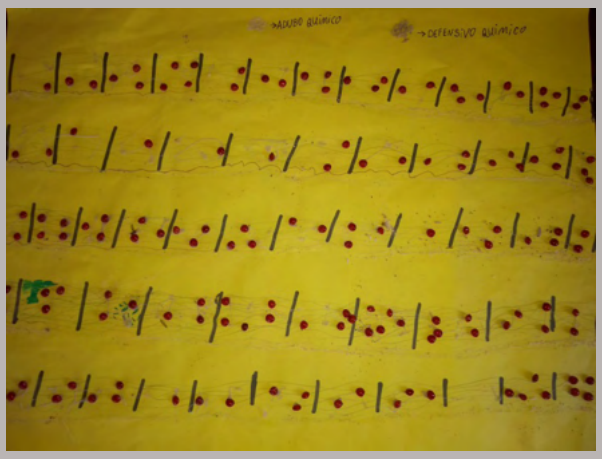
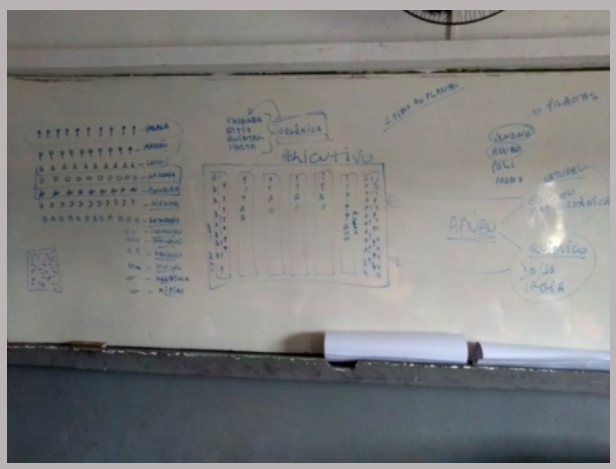
LOGBOOK:	
II Moment  F.  Figure 6 – Representation on syntropic agriculture (organic).	**Comment A (figure 5):** In conventional agriculture, a dense tomato plantation (monoculture) was represented. **Comment B (figuras 5 and 6):** The subjects differentiate between chemical fertilizer (10\10 and urea) and natural fertilizer (organic matter and manure). Chemical fertilizer is used in conventional agriculture and natural fertilizer and natural defensive, in syntropic (organic). A differentiation is noticed: chemical fertilizer and chemical defensive are not the same thing, different from the first moment, where these concepts are undifferentiated. **Comment C (figure 6):** The team represented syntropic agriculture much more diverse and dense, when compared to the representation of the first moment.

Table 3: Description of an excerpt from the logbook in the second moment. Schemes constructed by the subjects (A7ED2, A11ED2 and A14ED2) on conventional agriculture / syntropic agriculture.

Source: logbook elaborated by the author.

> we end up contaminating ourselves with the poison. For animals too, I've seen a dead bird in a plantation that was used poison.
>
> **P: Where are more living beings: in syntropic or conventional agriculture?** A 7ED2: In syntropic agriculture, because if there is no poison, there are more animals.

Finally, from the analysis carried out in this second moment, we were able to observe the advances of the subjects (A1ED2, A4ED2, A3ED2, A10ED2, A7ED2, A11ED2 and A14ED2) in understanding the concept of syntropic agriculture, which allows us to classify them into a Level II (subLevel IIA) of comprehension. These advances occurred under the following aspects: a) everyone became aware (there is a stability of thought) that monoculture is associated with conventional agriculture and is represented by several plants of a single species; polyculture is associated with syntropic (organic) agriculture and is represented by several plants of different species, that is, a much more diversified and dense crop (cocoa, coffee, mango, guava, orange, etc.), and not just a system consortium; b) stability in thinking, by relating polyculture to syntropic (organic) agriculture and monoculture to conventional agriculture; c) The association of conventional agriculture with the use of chemical fertilizer and poisons: insecticide (Semirex) and herbicide (Randap), and regarding the place of application (the chemical pesticide is applied to the leaves and the chemical fertilizer, to the root part of the plants) ; d) More diversity and quantity of cultivars in polyculture agriculture.

On the other hand, the subjects (A4ED2 and A1ED2) advance even more in understanding, when they present a beginning of recognition that in a syntropic-organic agriculture system there is more biodiversity, when compared to a conventional agriculture system, which allows us to classify them in a subLevel IIB.

III MOMENT:

The results presented here refer to the third moment of the research, when the verbal formulations of the subjects are analyzed, in the semi-structured interviews and the researcher's notes in the logbook.

In the verbal formulations of subjects A3ED3 and A10ED3 (Interviews 5 and 6) and in the logbook (Table 4 – comment A), we could verify an expansion of the understanding of the concept of syntropic agriculture, as the subjects verbalize and represent (Table 4 – Figure 7) highly productive areas rich in ecosystem services.

> **Interview 5: Q- Tell me a little more about your poster (syntropic agriculture).** A3ED3 - (pointing to the poster). Here is a plantation of many things. Here you have the grasshopper that feeds on the leaves, the birds that feed on the locusts, the hawk that feeds on the birds, various things. **P - And how many things are these?** A 3ED3- Acerola, watermelon, avocado, many things. **P- And when you have many things, a plantation of many things like that, what do you call it?** A 3ED3-
>
> Polyculture. **P –– And is polyculture a characteristic of syntropic/organic or conventional agriculture?** A 3ED3 and A10ED3- Syntropic agriculture. **P- continue your explanation**. A3ED3- (pointing to the poster) Here I made the earth animals. **P- What if I hit poison here? Or if I used a chemical fertilizer here, what would happen to these little animals?** A 3ED3 and A10ED3- They would die.
>
> **P- When it comes to syntropic/organic agriculture, do these little animals stay alive or die?** A3ED3- Alive. **P- In conventional agriculture, what would happen to them?** A3ED3- The animals would die from the poison. A10ED3: The poison would kill many of them.
>
> **Interview 6: Q- In terms of animals, is conventional agriculture poorer?** A 3ED3: Yes. A10ED3 – Yes, because the poison kills many living things. **P- But would it have**

animals anyway? A3ED3- A little.

P- What is the most balanced system? Syntropic or conventional?A3ED3:The syntropic. **P- Why do you think that?**A3ED3- The food chain, the natural fertilization of plants, the animals..

P- What is a food chain? A3ED3- The hawk feeds on the bird, the bird feeds on the grasshopper, the grasshopper feeds on the plants. **P- Which is more like nature, syntropic or conventional agriculture?** A 3ED3 and A10ED3- Syntropic agriculture. **P- Why?** A3ED3- Because it's more organic, more natural.

For example, in the verbal formulations of subjects A3ED3 and A10ED3 (Interviews 5 and 6) and logbook (see Table 4 – Figure 7), we observed an establishment of coordination between organic fertilization (cattle dung), polyculture (cassava planting, avocado, strawberry, guava, acerola, etc.), animals (birds, insects, land animals), poison, conventional agriculture, monoculture, polyculture. This expansion in the understanding of each concept builds an interconnected system. This produces inferences, generating more comprehensive and generalizing ways of thinking.

We could also see that this awareness raising process leads to awareness of the impacts that poisons can bring to the environment. Let's look at the verbal formulations of A3ED3 and A10DE3. A3ED3: "The poison in the earth kills the animals, the animals, harms nature". Also A10ED3: "People who work in the fields must take better care of the animals and also take care of the soil and water". This sensitization process was only possible thanks to the construction of interconnected relationships, one of which is the recognition that in a syntropic (organic) agriculture system there is more biodiversity, when compared to a conventional agriculture system (Interview 6). The awareness-raising processes must be based on the development of attitudes, sensitizing the subjects so that they can develop attitudinal changes, on their interpersonal relationships and with the environment (ANDRADE, 2013).

Continuing our analysis, similar responses were also observed in the verbal formulations of subjects A1ED3 and A4ED3 (Interview 7) and in the schematic representations taken from the logbook (Table 5 – comment A). We could also verify an expansion of the understanding of the concept of syntropic agriculture, as the subjects verbalize and represent (Table 5 – Figure 7) highly productive areas rich in ecosystem services.

Interview 7: Q- What did you represent in this poster? A4ED3- Syntropic agriculture. **P- Why did you represent this amount of animals?** Silence. **P- If it were conventional agriculture? Would there be so many animals?** A 1ED3 and A4ED3: There wouldn't be many animals.

P- What if poison was thrown? Could this poison kill the grasshopper? A4ED3 and A1ED3- It could kill the locust and whoever eats the locust. **P- Could the bird die?** A1ED3- The bird was going to die of poison.

P- Explain there, what did you plant? What are these animals for? A4ED3- Plants feed butterflies, grasshoppers too, there's also the spider, which the birds eat. Bee too. **P: What do bees feed on?** A1ED3- Of the flowers. **P- Does mango plant produce flowers?** A1ED3 e A4ED3: Yes.

P- So can the bee come to feed on the mango tree (pointing to the poster)?A1ED3 e A4ED3: Yes. **P- What does Ant eat?**

A1ED3 and A4ED3: Leaves. **P- Ants eat leaves, but who eats ants?**A1ED3- The birds. (Here begins the making, by the subjects, of the schema (via arrows), of links in the food chain, heron that eats fish, a caterpillar that eats a leaf, that turns into a butterfly, that is eaten by birds, etc.) **P- Do you think that in syntropic agriculture**

LOGBOOK:

III MOMENT

Figure 7 - Representation of syntropic agriculture (organic).

Comment A (figure 7): This representative scheme excels in richness of detail. There is the representation of several concepts that make up syntropic agriculture, namely: dense polyculture, interactions between fauna and flora, food chain and organic fertilization. It is also possible to notice a much larger number of animals, when compared to the representative schemes of the second moment. There is an understanding that the non-use of poison in syntropic agriculture implies greater biodiversity.

Table 4: Description of an excerpt from the logbook in the third moment. Representative scheme built by the subjects (A3ED3 and A10ED3) on organic agriculture.

LOGBOOK:

III Moment

Figure 8 - Representation of agriculture syntropic (organic).

Comment A (figure 8): This representative schema is rich in detail. There is dense polyculture, interactions between fauna and flora, food chain and organic fertilization. These are all concepts of syntropic agriculture. Awareness of these concepts is perceived when the team manages to establish several ecosystem relationships in the representation.

Table 5: Description of an excerpt from the logbook in the third moment. representative scheme construído pelos sujeitos (A4ED3; A1ED3) sobre agricultura convencional / agricultura sintrópica.

there are more or less animals than in chemical agriculture?A1ED3 and A4ED3: More.

P- And why is there more? A1ED3 Because in chemical agriculture, poison is used, which kills the animals, and in organic agriculture, everything is natural. **P- Is syntropic agriculture more balanced than conventional agriculture?** A1ED3 and A4ED3: Yes.

In the verbal formulations (Interview 8) and in the logbook (Table 5 - Figure 8), the subjects (A7ED3, A11ED3 and A14ED3) become aware of the concept of syntropic agriculture, in three aspects: a) representation of the diversity of cultivars - ten cultivars (rice, beans, andu, watermelon, papaya, beetroot, mangalo, coconut, apple and corn); b) recognition that in a syntropic-organic agriculture system there is more biodiversity, when compared to a conventional agriculture system, and c) understanding of the webs of relationships between syntropic (organic) and conventional agriculture and their impacts on the environment. However, they still do not represent a desired densification seen in syntropic agriculture.

Interview 8: Q- Is there any kind of poison in syntropic agriculture? A7ED3- No kind of poison. A11ED3: There is not poison. A14ED3: Without poison. **P- And if in your scheme, I put poison, would it be a syntropic/organic farming scheme?** A7ED3- No. A11ED3: No.

P- For it to be organic, can it have poison? A7ED3- No. **P- You are saying that in a syntropic agriculture there is no poison at all. That's it?** A7ED3- That's it. **P- Where are more animals? Syntropic or traditional?** A7ED3- In the syntropic. **P- You put a caterpillar here. What does she eat?** A7ED3 and A11ED3- The leaves of plants.

P- Who eats the caterpillar? A7ED3 - The birds. **P- And who eats the birds?**A7ED3- The hawk. **P- What would happen to a bird if it ate a caterpillar that had been feeding on a poisonous leaf?**A7ED3 and A11ED3- He was going to die.**P- Do you think that in syntropic farming it is easier to gather animals?** A7ED3- Yes. I think so. A14ED3: Yes.

P- And those earth animals that you put on the poster? Can you explain them?A7ED3: Silence. **P- Where are the most animals on earth? In chemical or syntropic agriculture? And birds?** A7ED3, A11ED3 and A14ED3- In the syntropi.

Finally, from the analysis carried out in this third moment, we could observe that all subjects (A1ED3, A3ED3, A4ED3, A7ED3; A10ED3, A11ED3; A14ED3) advance in understanding the concept of syntropic agriculture, which allows us to classify them in the IIC subLevel of comprehension. These advances occurred under the following aspects: a) they advance in the representation of cultivar diversity, but still do not represent a desired densification; b) recognition that in a syntropic-organic agriculture system there is more biodiversity when compared to a conventional agriculture system; C) understanding of the webs of relationships between syntropic (organic) and conventional agriculture and their impacts on the environment.

On the other hand, subjects A1ED3, A3ED3, A4ED3, A10ED3, advance further in their understanding of the following aspects: a) In addition to the diversification of cultivars, they represent a desired density in a syntropic agriculture; b) Broadening the understanding of the webs of relationships between syntropic (organic) and conventional agriculture and their impacts on the environment; c) Awareness of environmental issues. These advancements allow us to classify them into a subLevel IID.

It is this gradual effort of the subjects of adaptation in relation to the concepts that allows advances, through awareness, and that constitutes a conceptual system, where its

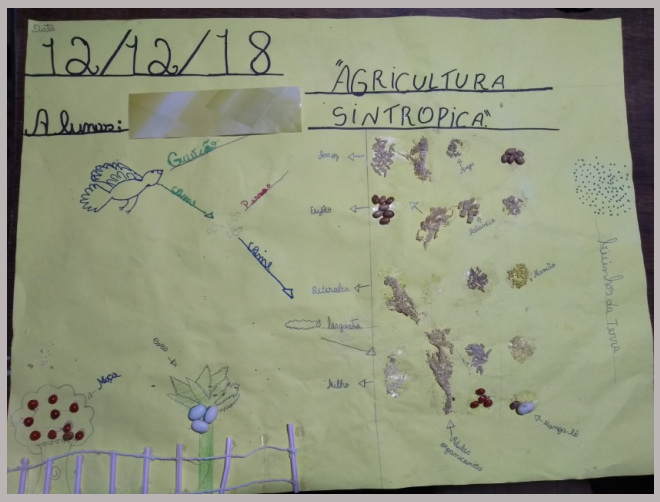
LOGBOOK:	
III Moment  Figure 9 - Representation of agriculture syntropic (organic).	**Comment A:** In this representation there are ten cultivars (rice, beans, andu, watermelon, papaya, beet, mangalo, coconut, apple and corn), but without the density seen in syntropic agriculture. When comparing the III moment with the II moment, we noticed a greater diversification of the cultivars, but still with little densification. There are more animals and the food chain is set with plants-caterpillar-bird-hawks.

Table 6: Description of an excerpt from the logbook in the third moment. Posters built by the subjects (A7ED3, A11ED3 and A14ED3) about syntropic agriculture.

elements inevitably support each other, being at the same time open to all exchanges with others. the exterior, and closed, as a totality. Therefore, it is impossible to characterize a concept without using others, in an eminently dialectical process (ANDRADE, 2016).

In summary, these analyzes made it possible to prove that the researched subjects advanced through processes of successive awareness, at different levels and sub-levels, as characterized in Table 2, where the distribution of subjects by levels and sub-levels also appears, at each moment of the research.

Table 3, below, presents the frequency distribution by categories, levels, sub-levels and moments of the intervention research. In the first moment, we obtained 78.6% of subjects at Level I and 21.4% intermediate (SOBRINHO, et all 2018). In the second moment, 71.4% were classified in subLevel IIA, and 28.6% in subLevel IIB. In the third moment, 42.9% in the subLevel IIC, and 57.1% in the subLevel IID. It must be noted that these differentiations between the sublevels occur in Level of microgenesis.

This way, the transformations that took place in the system of relations of the representative schemas at levels II and sublevels IIA and IIB, described in the logbook and supported by verbal formulations, lead to a better structuring and organization of thought. These are, therefore, implications between statements, where: (a) the affirmation of a class implies the gathering of similarities in a whole A - such as, for example, the increase in the number of relations that characterize each concept (synttropic agriculture, conventional, poison, natural fertilization, polyculture, monoculture). But, on the other

Level and SubLevel	Description	Subjects[1]
II Moment Level II		
SubLevel IIA	→ They become aware (there is a stability of thought) that monoculture is associated with conventional agriculture and is represented by several plants of a single species. On the other hand, polyculture is associated with syntropic (organic) agriculture, and is represented by several plants of different species, that is, a much more diversified and dense crop (cocoa, coffee, mango, guava, orange, etc.) not just a consortium system. → Stability in thinking, when relating polyculture to syntropic (organic) agriculture and monoculture to conventional agriculture. → The association of conventional agriculture with the use of chemical fertilizer and poisons: insecticide (Semirex) and herbicide (Randap), and in terms of the place of application (the chemical pesticide is applied to the leaves, and the chemical fertilizer is applied to the root part of the plants). → More diversity and quantity of cultivars in polyculture agriculture.	A10ED2; A14ED2; A3ED2; A11ED2; A7ED2.
SubLevel IIB	→ Beginning of recognition that in a syntropic-organic agriculture system there is more biodiversity, when compared to a conventional agriculture system.	A1ED2; A4ED2
III Moment Level II		
SubLevel IIC	→ They advance in the representation of cultivar diversity, but still do not represent a desired densification. → Recognition that in a syntropic-organic agriculture system there is more biodiversity when compared to a conventional agriculture system. → Understanding the webs of relationships between syntropic (organic) and conventional agriculture, and their impacts on the environment.	A7ED3; A11ED3; A14ED3
SubLevel IID	→ In addition to the diversification of cultivars, they represent a desired density in syntropic agriculture. → Recognition that in a syntropic-organic agriculture system there is much more biodiversity when compared to a conventional agriculture system. → Broadening the understanding of the webs of relationships between syntropic (organic) and conventional agriculture and their impacts on the environment. → Awareness of environmental issues.	A1ED3; A3ED3, A4ED3, A10ED3
Level III	No student ever made it.	

Table 2: Characterization of the levels and sublevels and classification of the researched subjects, by Level and subLevel, in each moment of the research, on syntropic agriculture.

	I Moment [2]	II Moment [3]	III Moment [4]	
Categories	**Pre-conceptual representation**	**Conceptual representation**	**Conceptual representation**	**Scientific Representation**
Levels/ sub-levels	Level I	Level II	Level II	Level III
Sub-levels	Intermediary	IIA IIB	IIC IID	
Frequency/ subjects	78, 6% 21,4%	71,4% 28,6%	42,9% 57,1%	

Table 3 - Distribution of frequencies by categories and moments of intervention research.

Source: elaborated by the author

1. Students A2ED1, A5ED1, A6ED1, A8ED1, A9ED2 A12ED1 and A13ED1 did not attend classes, so there was no material that would allow them to monitor their awareness processes.

2. The frequency at the first moment was obtained from the fourteen subjects surveyed.

3. The frequency in the second moment was obtained from eight subjects. A2ED2 students; A5ED2; A6ED2, A8ED2, A9ED2 A12ED2; A13ED2 did not attend classes, so there was no material that would allow them to monitor their awareness-raising processes.

4. The frequency in the third moment was obtained from eight subjects. Students A2ED3; A5ED3; A6ED3, A8ED3, A9ED3 A12ED3; A13ED3 did not attend classes, so there was no material that would allow them to monitor their awareness-raising processes.

hand, (b) the meeting implies oppositions or differentiations (for example, A is opposed to A') – if A is syntropic agriculture, A' is conventional agriculture, the differences between the two constitute the opposition (one uses natural fertilizer, the other uses chemical fertilizer); (c) the gathering of opposing classes engenders a class of a higher rank: (A.A') → B; (d) in which B→ (A V A'), if A = syntropic agriculture, and A' = conventional agriculture, B = agriculture (e) the relationship implies joint correspondences and differences between n concepts; (f) the differences imply partial correspondences, for example, two sub-concepts (syntropic agriculture and conventional agriculture), of a larger concept (agriculture) are still two concepts; and (g) the similarities imply several increasing degrees up to a limit that is pure identity.

FINAL CONSIDERATIONS

This analysis aimed to answer the following questions: (1) how are the representations made by the subjects during the intervention different; (2) how to intervene in order to favor imbalances in the conceptualization processes? (3) what difficulties were encountered in this intervention process?

Regarding the first question, our analysis allowed us to differentiate two conceptual levels and sub-levels, which were characterized in Table 1 and 2. The description of these conceptualization levels and sub-levels show evidence that the work developed allowed the subject to advance in understanding, through of successive realizations. We can talk about meaningful learning. Thus, the representations of the subjects differed in: (a) a pre-conceptual representation, with a predominance of transductive thinking – the first moment of the research; (b) a conceptual representation (Level II and sub-levels IIA, IIB, IIC and IID), with the understanding of the totality that he came to build – second and third moments of the research.

Regarding the second question, the debates and discussions among students about syntropic agriculture, instigated by the teacher-researcher, generated an imbalance in the subjects' initial convictions and rebalances, when the arguments of some promoted the re-elaboration of the arguments of others. We can highlight moments that were rich in this process: a) creation, in group, of schemes; b) exploratory hikes in monoculture areas; c) visits to animal breeding farms; d) exploratory tour of the Contas River (silting and solid waste); e) implantation of an organic vegetable garden in the school space; f) visits to a garden located close to the school; g) video session concerning the theme.

On the other hand, proposing many practical activities does not guarantee awareness, it is necessary to plan with very well-defined objectives. Being the process of cooperation, in a dialogic instance, fundamental. We must remember that affectivity can accelerate or delay this process. The teacher needs to get involved with the subject and be in a relationship with him. From this interaction emerges the desire, the will to learn (ANDRADE, 2016).

It is important to record the difficulties encountered during the intervention process, which we can divide into three classes. a) structural; b) cognitive and c) resistance to the theme. In a, school transport is the most poignant example. The subjects' delays (and even absences) were common due to the association of the precarious conditions of the roads with the distance from the residences of most students. Another difficulty encountered was the condition of abandonment in the area chosen for the implementation of the school garden: solid

waste of all kinds, hydraulic plumbing with significant leaks and a worrying amount of *Achatina fulica*, that was duly fought. In b, one student (A13) had cognitive impairment, including the school administration informed the researcher about this condition and, in c, five students (A2, A5, A6, A8, A9 and A12) were not conquered by the theme and/or by the researcher. We recorded some statements that attest to the above: "I don't want to know about any of this", "I don't have to work", "I'm already tired. In the morning I help my grandmother at home", "why study these things? ". It is recorded that of these five, only one student remained irregularly attending classes until the end of the school year.

Finally, based on the analysis carried out, we highlight the importance of reflection and awareness of the concepts themselves, so that subjects have a critical training in science. To pursue this objective, we believe in the need to: a) develop programs to improve teachers, both in relation to specific content and in relation to pedagogical theories; b) improvement of the structural and logistical part of rural schools; c) introduce content on syntropic agriculture in the curricula, in addition to producing and improving textbooks and para-didactics, so that they deal with the theme in a simple, clear and identified way with the young audience; d) know and consider the prejudices that students bring to the classroom; e) create interactive spaces, in which the teacher is an instigator, creating situations of contradictions, so that students can overcome resistance and errors.

REFERENCES

ANDRADE, J.A. P de et all. A tomada de consciência da relação entre Organismos Transgênicos e Organismos Geneticamente Modificados: aprendizagem significativa entre estudantes de uma universidade pública no sudoeste da Bahia. **RBPEC**, Porto Alegre, V16, n.1, p. 187 -214. 2016.

BRANDÃO, C. R. **Pesquisa Participante**. 7 ed. São Paulo: Brasiliense, 1988.

DEMO, P. **Pesquisa e Construção do Conhecimento**: metodologia científica no caminho de Habermas. Rio de Janeiro. Tempo Brasileiro, 2000.

GÖTSCH, E. Agricultura Sintrópica. Brasil, 2017. DispoLevel em, <www.agendagotsch.com/pt/syntropy>. Acesso em: 17 de out. 2017.

LÜDKE, Menga. André, Marli E. D. **Abordagem qualitativa**. São Paulo: EPU, 1988 – (temas básicos de educação e ensino)

MANZINI, E.J. **Entrevista Semi-estruturada: Análise de Objetivos e de Roteiros**. Depto de Educação Especial do Programa de Pós-Graduação em Educação, Universidade Estadual São Paulo (UNESP), Marília, SP. 2004. DispoLevel em: [http://www.sepq.org.br/IIsipeq/anais/pdf/gt3/04.pdf]; acesso em 12 de out 2017.

MINAYO, Maria Cecília de S. **O desafio do conhecimento: pesquisa qualitativa em saúde**. 3.ed. São Paulo: Hucitec/Rio de Janeiro: Abrasco, 1996.

ORGANIZAÇÃO DAS NAÇÕES UNIDAS, Brasil, 2017. DispoLevel em < http://www.onu.org.br/ > Acesso em: 17 de out. 2017.

TRIVINOS, A.N.S. **Introdução à pesquisa em ciências sociais: a pesquisa qualitativa em educação**. São Paulo: Atlas, 1987.