Sustainable vegetable garden in the school environment: A STS approach in elementary school

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ABSTRACT

We will present here the results of a research that aimed to ascertain the pedagogical potential of an educational product linked to the construction of a sustainable vegetable garden with students of the 5th year of Elementary School. This educational product was structured from a STS (Science, Technology and Society) approach in order to develop learning and skills capable of expanding the students' repertoires about Science, Technology and, mainly, about its implications in our society and environment. Our study is qualitative and as a data collection instrument we used a field diary. The data revealed that pedagogical actions – such as those of school gardens – supported by a STS approach contribute to the formation of students who are more critical about food and healthy processes related to human health.

Keywords: Organic Food, Science, Technology and Society, Elementary School of the Early Years, School Garden.

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INTRODUCTION

Throughout history, science and technology have become essential to human development; both are present in all spaces of life and are part of people's coexistence (Leal, 2010). Technology has been latent since the Prehistoric periods, in which the individual sought to settle in certain places to manually build his first vegetable gardens to acquire food. Thus, we observe that from a very early age the individual had the need to operationalize certain knowledge/knowledge (science[4]), build data artifacts (technologies) and, thus, promote better conditions of adaptability for their existence; In this process of increase, agriculture proved to be a technological construct full of scientific knowledge undertaken by the subjects so that they could meet their food and nutritional needs, thus helping them to move away from nomadic life, predatory-extractive harvesting and hunting as exclusive food sources. In view of this, we can emphasize that individuals at that time were already developing scientific and technological knowledge to support their own livelihood.

In modern times, scientific and technological knowledge has increasingly undergone innovations in society and one of them, to stay in the field of the food issue, was the replacement of manual work for mechanical work, seeking to meet the demand for food productivity, due to population growth. With this and as an alternative to the expansion of agricultural production, we had an excessive increase in the use of pesticides in the search for greater productivity and profitability of food production. Thus, with the indiscriminate use of pesticides by farmers, we have (1) a vertiginous increase in health problems in living beings and (2) the environment increasingly impacted.

In this context, the STS (Science, Technology and Society) approach has been inserted in school and educational spaces with the intention of provoking in individuals, in a critical way, the development of knowledge that questions this socio-environmental panorama correlated to the processes of transformation given by Science and Technology in humanity. Thus, one of the ways to provide the STS approach in school is through the insertion of new pedagogical approaches, thus providing students with a more critical look at the technological and environmental issues of their reality. In view of this approach, it made possible, through scientific and technological knowledge,

[4]Here, we assume a broader notion of science, such as that described by the authors Felipe Fontana and André da Paixão Gomes, in the article entitled "Black culture and African scientific legacy for a more dynamic teaching of the natural sciences"; For them: "[...] Scientific thought and science are commonly regarded as incontestable and irrefutable truths, a type of systematic knowledge – built through a rigorous and tested method of investigation and analysis – aimed at understanding the reality that surrounds individuals in order to promote their transformation and a consequent greater adaptation of them to their environment. Now, if we use this metric as an interpretative lens and observe other societies, we will notice that numerous social and human groupings – alien to the Eurocentric and Western axis of humanity – produce a relevant scientific thought that, in turn, is full of specificities, contributions and meanings. In other words, considering this view, we observe that Humanity has not produced a single legitimate scientific thought – as educational institutions would have us believe – but rather an amplified and polyphonic set of ideas that have attempted to transform the world and promote a greater adaptation of individuals to their environments" (Fontana, 2018, p. 7).

the implementation of an organic-school garden at the Nilza de Oliveira Pipino Municipal School, located in the municipality of Formosa do Oeste-PR.

Through partnerships made with the City Hall and the Department of Education and Culture of Formosa do Oeste-PR, we raised the subsidies for the implementation of an organic garden. In this direction and assisted by technicians specialized in each function, we provide opportunities – with the construction of flowerbeds, with the fertilization of the land, with the installation of the rainwater harvesting system and with the installation of sprinklers for irrigation – the possibility of promoting in the students, in a dialogical and operationalized way, the latent link between scientific knowledge, technological artifacts and the imperative of food subsidies necessary for the existence of the subjects of our society.

The research underlying[5] this article was based on the action research methodology, safeguarding a qualitative approach. According to Gil (2016), action research is characterized by its flexibility and involves the action of the researcher and groups of interested parties in the most diverse moments of pedagogical action. There is a constant back and forth between the phases, which is determined by the dynamics of the relationship between the researchers and the researched situation. Among this approach, the research aimed to investigate the pedagogical potential of an educational product for the construction of a sustainable garden in a class of the 5th year of Elementary School. To make this possible, we listed specific objective data, such as: 1) building a school garden; 2) implement the rainwater harvesting system; 3) make a composter; 4) provide students with the practice of planting in the school garden; 5) subsidize students through lectures with professionals, Emater technicians and Nutritionists; 6) address content related to healthy foods, through a STS approach; 7) sensitize students and the school community about maintaining healthy habits.

THEORETICAL FOUNDATION

THE STS APPROACH IN SCIENCE TEACHING

According to Bonfim and Guimarães (2015), the purpose of the STS approach in the teaching of Science is to provide a scientific view through Science and Technology, allowing the teacher to develop content in a way that can contribute to the formation of the student for the exercise of citizenship. In this reality, the school has an important role in disseminating knowledge and seeking to sensitize students to environmental issues with pedagogical activities that are included in the

[5] The aforementioned work is called "SUSTAINABLE VEGETABLE GARDEN IN THE SCHOOL ENVIRONMENT: A CTS APPROACH IN ELEMENTARY EDUCATION". This research linked to the Graduate Program in the National Network for the Teaching of Environmental Sciences (PROFCIAMB-Associada UEM) is available at: <https://dci.uem.br/profciamb/publicacoes/dissertacoes>. Accessed on: 08/16/2024.

school curriculum, working with the transversality between disciplines directed to environmental issues (Silva, 2017).

Pinheiro, Silveira and Bazzo (2007) mention that the STS approach began around the 1970s as a result of great economic and technological development, evidencing its insertion in school curricula in several countries, with the aim of developing scientific-technological literacy in citizens. The same authors also state that the STS approach inserted in education aims to provide students with a critical view and a questioning posture in the face of the existing problems of their reality. Thus, teaching is promoted capable of developing students' interest in the search for subsidies aimed at solving problems intrinsic to their daily lives.

Miranda (2013) points out that the STS approach is based on the Industrial Revolution. During this period, society understood that technology controlled people's lives and also believed that to have a better quality of life it would have to depend exclusively on it. According to Santos and Mortimer (2002), the STS approach can also be worked with several disciplines, especially in multidisciplinary activities, enabling the student to better understand and, through more complex analyses, seek solutions to environmental problems. Bazzo (2010) adds that there is a correlation between the knowledge of Science and Technology with the practice of citizenship, thus encouraging students to be more participative in the occurrence of eventual changes in the technological process. In Brazil, the National Curriculum Parameters (PCN) were elaborated, which, in turn, bring a STS approach; According to this document, we see that in the context of general pedagogy:

> [...] the discussions about the relations between education and society are decisive for the emergence of progressive tendencies, which in Brazil were organized into important currents, such as Liberating Education and the Critical-Social Pedagogy of Contents. These were currents that influenced the teaching of Science in parallel with the STS trend. A common feature of these tendencies was the importance given to socially relevant content and to the processes of group discussion. If, on the one hand, there was a renewal of the criteria for choosing content, it was not verified in relation to the teaching/learning methods, as the belief in the method of rediscovery that characterized the area since the 60s still persisted (Brasil, 1997, p. 20).

The PCN suggest that teachers work on pedagogical content, such as teamwork, the insertion of scientific research and the elaboration of hypotheses in the Natural Sciences related to STS; making the student have an approximation and involvement with scientific and technological knowledge in their learning process. The PCN also mention that from the 1970s onwards, due to the various questions coming from the population about science and technology, it is recommended to insert content related to the STS approach in various teaching disciplines:

> This model has deserved criticism that points to the need to reorient investigations beyond the students' preconceptions. It does not take into account that the construction of scientific knowledge has demands related to human values, to the construction of a vision of Science

> and its relations with Technology and Society, and to the role of the methods of the different sciences (Brasil, 1997, p. 21).

By studying aspects of the STS approach, students can understand the importance of viewing specific content in its multiple dimensions, which facilitates the formation of a participatory citizen in society, improving their decision-making capacity. Would it be convenient to explain the concept of food, without addressing the damage to health and the environment? And what about the political aspects involved in food production, without questioning the exaggerated consumption of ultra-processed foods? We believe that, for both questions, the answer is no. Herein lies the defense we make of the STS approach.

THE SCHOOL AS A SPACE FOR HEALTH PROMOTION

Insufficient consumption of fruits and vegetables increases the risk of chronic non-communicable diseases, such as cardiovascular diseases and some types of cancer (which are among the ten risk factors that cause the most deaths and diseases worldwide (WHO, 2002). The consumption of healthy foods is essential in the school environment. According to Kassaoka and Raimundo (2017), acquiring healthy habits in childhood and adolescence offers good foundations for maintaining these habits in adult life. For Bodah, healthy eating is a growing one:

> [...] concern because the world population continues to grow and demand more quality food, through effective and sustainable methods. Thus, agroecology comes in as a very important alternative in organic and sustainable food production, mainly due to the fact that it is devoid of the use of pesticides or agricultural chemicals (Bodah, 2010, p. 43).

In this context, the school has a primary role in disseminating knowledge linked to the formation of citizens with healthy eating practices (Freitas, 2007). In this way, in the school environment, students are encouraged to acquire healthy habits in their diet (introducing a greater amount of fruits and vegetables in lunches, for example). In this sense, school meals are essential during the school period and must be well planned, using nutritious and diverse foods in their preparation; each stage of their development is carefully done so that students receive a healthy, balanced and adequate diet (Basaglia; Marques; Benatti, 2015). Kassaoka and Raimundo (2017) report that one of the ideal ways to ensure healthy eating at school is through lunches, which should be composed of organic foods and avoiding processed foods.

ORGANIC-SCHOOL GARDENS IN PEDAGOGICAL ACTIVITIES IN THE TEACHING OF SCIENCE IN THE EARLY YEARS OF ELEMENTARY SCHOOL

The consumption of organic food is one of the bases for a healthy diet. Knowing this, it is essential that the teacher develops didactic activities addressing content about the importance of

organic food for health and the environment, thus enabling the improvement of knowledge. For Veiga (1994), pedagogical practice is related to social practice; They are guided by objectives, purposes and knowledge that enable the teacher to work on content that involves theory and practice – inside and outside the classroom – associating the subject with the real context of the student. Thus, the didactic-pedagogical practices for Science Teaching achieve didactic content, thus enabling students and teachers to actually interact in the construction of concepts and skills.

A study developed at the Padre Mario Castagna School in Porto Velho-RO led to the implementation of a vegetable garden and the application of didactic-pedagogical activities, in which the consumption of pesticide-free food produced in the school garden was associated with the health benefits of the students, obtained through a healthy diet (Eno; Luna; Lima, 2015). Fernandes, *et al.* (2013) in Uberlândia-MG, developed the implementation of a school garden for Early Childhood Education students. Cypriano, *et al.* (2013), at the Cônego José Ermelino de Souza State School in Araponga-MG, implemented a vegetable garden that was used as a tool for the development of pedagogical activities. In this way, the pedagogical actions worked by the teacher in the school environment provided students with mastery in the execution of the proposed didactic activities, in an interactive, participatory way, valuing the students' knowledge effectively in the performance of their teaching profession (Silva; Oliveira, 2009).

METHODOLOGY

LOCUS OF RESEARCH AND ITS SUBJECTS

The study linked to this article was developed in the urban area of Formosa do Oeste-PR, which, in turn, is located in the West of Paraná (IPARDES, 2018). In the area of Education in 2015, students in the initial years of Elementary School in the Public Network of the Municipality of Formosa do Oeste obtained an average score of 5.8 in the IDEB. For students in the final years, this score was 4.8 (IBGE, 2017). In the city, we established a partnership with the Nilza de Oliveira Pipino Municipal School to consolidate the development of our work. The subjects participating in this study were twenty-four (24) students from the 5th year of Elementary School of the aforementioned school with the age group between ten (10) and eleven (11) years. Of this total number of students, eighteen (18) students were from the urban area and six (06) students from the rural area.

METHODOLOGICAL ASPECTS

The research was based on the methodology called *action research* (qualitative approach). Our methodological aspects related to action research are based on the studies developed by Thiollent (1986), Fonseca (2002), Tripp (2005), Baldissera (2001) and Engel (2000). In a

representative way, Thiollent (1986) states that *action research* is characterized by the actions of the researcher and the people involved in the face of the object studied, thus seeking possible solutions to mitigate situational problems. It proposes a collective and participatory work during the development of each stage, allowing for a visible interaction between the members of the research in the midst of the investigated situation. Furthermore, he describes that this methodology can be seen as a research method or strategy, which provides those involved with the insertion of practical-collective activities based on "techniques of recording, processing and exposure of results".

DATA COLLECTION INSTRUMENTS

The data collected in the study were obtained during its development through theoretical approaches in the classroom, through interviews, field diary (daily notes of activities with students at the end of class), video recording and texts written by the students. Also, through practical classes developed in the school organic garden. We emphasize that the records referred to the observations made by the researchers during the process of developing the pedagogical actions. Thus, the research was duly approved by the "Ethics Committee" for its implementation (mediated by Informed Consent Forms for Minors).

RESEARCH ACTIONS AND DATA COLLECTION

The research was developed in three stages: In the first we sought partnerships, through a meeting, with the mayor of the municipality and with the municipal secretary of education and culture to request financial support for the implementation of a school garden. At this stage, we also made contact with the principal and the pedagogical coordinator of the selected school in order to define the place where we would implement the garden. In the second stage, we started the construction of the school garden in which the City Hall supported us financially. The land where the garden was implanted had a steep slope, and there was a need for grounding to minimize it. In the garden, paths were implemented on the sidewalks with concrete blocks around the flowerbeds and black "shading" screens were placed. In the construction of the rainwater harvesting system, it was necessary to acquire a 2000-liter water tank, PVC pipes, zinc gutters, sphere register to control the flow of water, sprinklers for irrigation in the garden (inputs that were already in the school to adapt the system). A compost bin was made, digging a rectangular hole in the ground near the vegetable garden. To obtain organic compost, we use leaves, grasses, sawdust and raw food scraps covered with umbrellas or tarpaulins to prevent the proliferation of insects.

In the third stage, weekly meetings were held for the implementation of pedagogical actions with the 5th grade "A" class in the classroom with the morning Science teacher. These actions were divided into ten (10) meetings, described in Table 01.

Table 01. Pedagogical actions at school.

MEETING	PEDAGOGICAL ACTION	H. CLASS	DESCRIPTION
First	Development of practical activities under the guidance of Emater's technician.	02	Discussion about organic planting, rainwater harvesting system and composting in the garden with the Emater technician; then, planting of vegetable seedlings under the guidance of the Emater technician. In fertilizing the beds, we use dry animal fertilizers.
2nd	Emater Lecture: "Types of gardens, care and benefits to obtain organic food".	02	Lecture entitled "Organic home garden", given by the technician from Emater.
Third	Lecture with a nutritionist on "Organic food and its benefits".	02	Lecture "Organic Food" with a nutritionist from the City Hall.
4th	Visit to an organic food producer in the municipality.	03	Formulation of three questions about organic cultivation to be asked during the visit to the rural organic producer in the Santa Terezinha Community of Formosa do Oeste. Afterwards, we went towards the rural producer's property. During the visit, she guided the students by showing her organic garden and the types of plants there. At this point, the students asked the questions formulated before.
5th	Class: composting, "Preparation and its benefits for the environment".	01	Science class on the theme "Composting".
6th	Preparation of organic fertilizer by the students.	02	Practical class "Demonstration of how to make an organic compost in a composter".
7th	Application of the didactic game "Food Bingo".	02	Didactic game "Food Bingo" (process no. 4422/2008-DEX).
8th	On-site visit to Sanepar to learn about the treatment process and the physical-chemical controls and the logistics of water distribution.	03	Practical class with the theme "Water". Then, under the guidance of the Science teacher, we went to the Paraná Sanitation Company in the municipality of Formosa do Oeste-PR. On the occasion, the Sanepar technician began with a lecture in the courtyard of the place. The students observed, at Sanepar, all the water treatment processes and their physical-chemical controls performed by the technician in charge. Later, we returned to the classroom and the researcher requested the elaboration of a text reporting the visit made.
9th	Definition and distribution of didactic activities to be developed by groups of students.	02	Practical contact of students with different vegetables, herbs and greens. The class was divided into groups and, in the computer room, each group researched the plant selected by him. Then, a debate was held to choose the name of the garden entitled "Green Space".
10th	Harvest and presentation in the schoolyard about "organic food" to the school community and the parents of the students.	03	Writing an essay about the activities carried out to build the garden. Then, we harvest and exhibit the harvested vegetables, herbs and vegetables. At the end, we presented it in the courtyard and to the whole school – with multimedia – the process of implementing the garden.

Source: authorship.

Our pedagogical actions employed procedures closely linked to the methodological assumptions of "action research". In this process, we observed the development of sustainable

attitudes and behaviors to the exercise of citizenship, to Environmental Education, as well as the development of critical thinking and the understanding of aspects that encompass many environmental issues. We'll see this better in our results.

Image 01. Photographic records that identify the pedagogical actions described in "Table 01" – we have in the assembly: 1) the school garden built and its cistern installed; 2) students eating vegetables from the garden; 3) exhibition of the plants collide in the garden for the school community; 4) technical visit to the organic garden of the Santa Terezinha Community; 5) construction of the composter; 6) observation and research on vegetables, herbs and greens; 7) lectures with the Emater technician; 8) harvest in the "Green Space" school garden.



Source: authorship.

RESULTS AND DISCUSSIONS

PARTNERSHIPS FOR THE IMPLEMENTATION OF THE GARDEN

In the meeting held with the Municipal Mayor of Formosa do Oeste-PR, it was agreed to his partnership with the project to implement an organic garden in the school space. The mayor was responsible for the financial resources and the manpower necessary for the execution of the project (construction of the vegetable garden, rainwater harvesting and other materials). It was also agreed with the Municipal Department of Education and Culture of Formosa do Oeste-PR the location of the implementation of the school garden and the permission for the development of a didactic-pedagogical-environmental project with the class of the 5th grade "A" of the Elementary School of the Municipal School Nilza de Oliveira Pipino. The vegetable garden was built behind the school in a total area of 77.0 m2, containing five (05) beds of 8.0 m2/each and a sidewalk with blocks around them to enable people's mobility. Sprinklers were installed to irrigate the plants and shade screens to

protect the plants from the most intense sun rays. The contents addressed with the students were taught according to the curricular programmatic needs, which are: 1) food; 2) food production and its technologies; and 3) environment (BNCC 2017, Early Years of Elementary School, Science subject).

EVALUATION OF PEDAGOGICAL ACTIONS WITH A CTS APPROACH

First meeting

In the first meeting, at the beginning of the class, the students participated in a discussion in the school court, next to the vegetable garden, with the technician of the Technical Assistance and Rural Extension Company of the State of Paraná – Emater-PR. At this time, the following contents were developed with the students: 1) organic garden at school; 2) the generation of organic waste and alternatives to composting; 3) the rainwater harvesting system and water saving; 4) vegetable planting techniques. Then, the students planted their own vegetable seedling and had direct contact with the soil, thus assimilating techniques for preparing the holes with correct spacing between the seedlings. Within the Teaching of Natural Sciences, we know how important it is to link the practical dimension to the teaching and learning process in the search for a greater educational use of students about the specific knowledge offered to them[6]. In this sense, the content previously conveyed by the Emater professional gained greater dialogue, fixation and representativeness. Thus, the BNCC (2017) proposes to the early years of Elementary School, through the Teaching of Natural Sciences, that students can arouse a greater interest in understanding the "natural and technological world", allowing the student to build knowledge that allows them to distinguish and also to understand the events of their reality (simple and complex).

The students were participative and attentive in all stages of the planting process; showing a lot of enthusiasm for being a different class and for providing a correlation between theory and practice. This enthusiasm is interesting, after all, it shows a pleasure in relation to the learning process[7]; added to this, the fact that the students understood how certain "more specific knowledge", in this case organized within the Natural Sciences, is converted into techniques and technologies linked to the transformation of human life, giving individuals greater food adaptability and preservation of natural resources.

We verified recurrent interactivity among students and a lot of emotion in the development of the activity. During the execution of the planting, some comments emerged, such as: 1) "I am enjoying planting the vegetable seedlings"; 2) "I had never planted a vegetable"; 3) "I don't want to stop planting anymore"; and 4) "I'm enjoying it a lot". Observing students in a position of subjects of

[6]In the study by Costa and Batista (2017), it was found that practical activities, in addition to being educational, stimulate the student's creativity in their learning. In addition, the teacher becomes a stimulator and participant in this process, thus making the student's teaching and learning more effective.

[7] Fonseca (2008) mentions that, for the student to achieve success in his learning, there needs to be this interaction between the teacher and the student at school, thus providing a bond of affection.

research and knowledge is important, as it annuls in them the position of passivity intrinsic to the traditional educational process with which the school system is too accustomed (and the school public as well). Far from it, they cease to behave as univocal receptacles of knowledge; that is, as blank slates that only receive information and have the obligation to retain it. On the contrary, in this modulation of teaching and learning, they are actors in the process and, by participating in a practical and dynamic way, they assume a posture of researchers and, consequently, of builders of knowledge: "Action research is a valuable instrument that teachers can use to improve the teaching-learning process, at least in the environment in which they work directly" (Rocha, 2012).

Second meeting

In the second meeting, the Emater technician taught content linked to organic planting and its advantages for health and the environment. In this second activity, the following contents were published: 1) what is an organic garden; 2) where can we build a domestic, business and/or institutional organic garden; 3) what are the types of chemical and organic fertilizers; and 4) what are the benefits of implementing an organic garden. In this sense, the BNCC (2017) suggests that scientific knowledge be conveyed to students in the teaching of Natural Sciences and provides opportunities for the development of the awakening of curiosity, observation and logical reasoning.

It was reported that the planting of organic fertilizers can be done in any space, using organic fertilizers and without pesticides. In this activity, the students interacted with the speaker, participating intensely with questions about their daily food, as well as being very interested in building a home garden and knowing the advantages of producing pesticide-free food. They also understood the benefits of these foods for human health, as well as questioned about which organic edible plants could be planted and purchased in the local markets of the municipality for a healthier diet. In general, we found that the students had an apprehension of the knowledge addressed, an indication of this were the questions they raised. Below, we list some of them: (i) "How do I build a vegetable garden in my house?"; (ii) "What types of organic fertilizers can I use in my garden?"; (iii) "What types of plants (vegetables) can I plant in my garden?"; (iv) "What organic plants can I buy at the market for me to eat?"; (v) "Will the planting of vegetables from the garden be for school?".

All these questions, recorded in our field diary, aroused a lot of enthusiasm in us, after all, they show how comfortable the students felt to carry out questions, which, in turn, is the driving force for the construction of a teaching and learning process anchored in the constitution of criticality and autonomy.

It was observed in the lecture that the students paid close attention to the content spoken by the Emater technician and showed interest in acquiring new technological and scientific knowledge related to organic planting. This action allowed the students to build a broad view of the contents

learned and, more than that – as we can see in the questions asked – the need to link them to their daily lives and their realities. Linking technical and scientific knowledge in a critical way to the lives of individuals is one of the mottos of the STS approach that, in this action, we had the opportunity to make available. In agreement with Oliveira and Messeder (2017, p. 22), we note that: "Bringing a STS approach to the daily lives of children in the early years of Elementary School, in the context of the school garden, means valuing human aspects".

Third meeting

In the third meeting, with the knowledge already obtained previously – which facilitated the approach of new information about organic – we received a nutritionist who, in turn, made a presentation related to the advantages of consuming food without pesticides and that use organic fertilization for the best development of the crop, thus providing food with high nutritional value, after all, they were produced in a rich and balanced soil. At this time, the following contents were addressed: 1) organic foods; 2) health benefits of organic food; 3) food more contaminated by pesticides according to Anvisa; 4) the possible diseases that can occur with conventional food. In this way, according to the nutritionist, the consumption of organic products avoids health problems. Based on data studies, she said that research has shown that the toxic residues that remain in the food ordinarily planted by most farmers can cause various diseases, such as: 1) allergic and respiratory reactions; 2) hormonal disorders; 3) neurological problems; and 4) cancer. These diseases could arise when consuming conventional foods with an excess of pesticides and, in relation to this, students should be careful. We can notice that the students showed a strong apprehension and great interest in the knowledge acquired, according to the questions formulated by one of them, which we list below: a) "Which foods contain the highest amounts of pesticides?"; b) "What type of disease is most frequent when we eat food with pesticides?". Nutritionist's answer: "The foods that contain the highest amounts of pesticides are: peppers, tomatoes and strawberries, according to Anvisa's research. And the main most frequent disease, when we consume foods with pesticides excessively, is cancer. In fact, many farmers who have direct contact with pesticides end up being affected by some oncological disease".

Then, the nutritionist started a discussion with the students about the harm that foods with pesticides cause to people's health, of which one of the alternatives to alleviate this disease is the consumption of organic foods in our meals. These questions demonstrate the concern of the participating student in identifying and consuming foods that have lower amounts of pesticides, thus avoiding future diseases.

Fourth meeting

In the fourth meeting, the students were enthusiastic about the visit made to a rural producer, after all, they could see that they do not need to go far from school to verify that there were people/farmers in the community who produced good quality food, without pesticides and with environmental responsibility, thus preserving the environment. Added to this, the fact that leaving school and getting to know the surroundings of the city was a totally different and enriching experience for most of the participating students. In this action, we found that the farmer transmitted, to the student, the following contents**:** 1) organic planting; 2) preparation of seedlings for planting; 3) how the seedlings are transplanted in beds; and 4) Sprinkler irrigation and the number of times they are turned on per day. In general terms, we realized that the students were unaware that there were people who grew organic food in the rural area of the municipality. In addition to getting to know the dynamics of an organic garden in practice, they were able to feel nature more closely and how much it was possible to grow food in a natural way, without synthetic pesticides. The students checked "how much experience" the producer had accumulated with the cultivation of her organic garden. They also explored the garden, observing the types of plants that were being grown. In this exploration, they learned to identify which plants could not be used as food – "bush" –; however, they were informed that they had an often positive purpose in the organic garden (scaring away diseases, pests and insects, for example, to the detriment of the use of pesticides and chemical-inorganic pesticides).

The students had the opportunity to verify in person what an extensive organic garden built on a flat land was, and, consequently, with resources used for its maintenance. In the process, they were surprised by the presence of a huge amphibian, which was inside the seedling nursery. They were able to visualize their physical and motor characteristics. According to Silva (2016), the importance of developing didactic activities outside the classroom is linked to the possibility of undertaking new interactions between the content studied and its reality, thus being able to contribute in a significant – and in this case surprising – way to the teaching and learning process of the student.

In this activity, it provided an opportunity for the students to integrate with a relevant and necessary economic-social process on which we are currently very dependent: the production of food on a large scale for human consumption. Now, with this visit, the students saw how scientific knowledge was used by individuals in the forging of new technologies linked to their adaptability to the world (use of scientific-technological knowledge for the production of a larger quantity of food, specifically here, the making of vegetable gardens is configured as an example of this). In this case, they saw that not all scientific knowledge – converted into technologies that cause changes in nature in order to promote greater adaptation of human beings – is harmful; on the contrary, after all, in the garden visited, nature is explored and, at the same time, its preservation is carried out. It was explicit

to the students that the problem is not scientific knowledge and the new technologies that emerge from it, but rather the way in which individuals direct their efforts to promote the adaptability of human beings. The questions prepared in advance by the students in the classroom were used to interview the producer during the visit. Eight questions were selected to be asked: (i) "What kind of vegetables do you grow"?; (ii) "Is it necessary to water with the irrigator?"; (iii) "How many times do you have to throw water on lettuce?"; (iv) "How long does it take to grow lettuce?"; (v) "What plants do you recommend planting in backyards?"; (vi) "What poisons are applied to plants in the garden?"; (vii) "What kind of fertilizer do you use?"; (viii) "What is your greatest difficulty in your plantation?"

In this meeting, we noticed that the students had a different contact with large-scale organic production. In this way, they were able to learn about other types of organic food and the irrigation system – made by larger sprinklers. Unlike the school garden, the plantation visited was irrigated through a water collection system from a spring on the property. We also observed that the students were able to visualize other spaces for growing organic gardens and, as a result, there was a greater contact with organic food in different environments. Added to this, the ratification of the importance, for human health, of consuming food free of pesticides. For Terso and Leite (2013), the organic garden is linked to the construction and maintenance of sustainable development, without aggression to the environment and, at the same time, providing a better quality of life resulting from the consumption of products that act in the prevention of diseases.

Fifth meeting

A class on composting was given. In this action, we convey the following contents: 1) what composting is; 2) what types of composting and how to prepare a composter; 3) benefits of composting; and 4) care with the composting process. Related to this, our BNCC (2017) highlights that it is necessary to encourage educational alternatives engaged in the acquisition of scientific knowledge that allow for awareness, providing a more harmonious environment. The teacher began the meeting by mentioning the importance of students knowing the composting process, its maintenance, the transformation of waste deposited there into organic fertilizers and its benefits for the environment. After the lecture, some comments from the students were raised: 1) "I didn't know that the remains of fruits and vegetables could become organic fertilizer"; 2) "Now I know how many meters I can make the compost bin in the soil"; 3) "I'm going to ask my parents to make a composter at home"; 4) "When I make the compost I will cut the bigger husks"; 5) "I'm going to separate fruit and vegetable peels at home". The composting process acts on the recovery of nutrients through organic waste in the soil, which, in turn, is transformed into organic compounds and is used as

fertilizers. This is one of the ways to contribute to the environment, recycling organic waste that was previously discarded (Terso; Leite, 2013).

Sixth meeting

We discuss the procedures for preparing a home composter. Thus, we showed that this process involved choosing an appropriate type of material (raw vegetable remains, fruit peels, sawdust and grasses) for its deposition in an appropriate container. We also inform the necessary care to carry out this process, such as: 1) the periodic turning of solid waste, seeking to provide aeration; 2) periodicity for obtaining it; and 3) guidance regarding the use of organic compost. Thus, the contents taught were: i) how to prepare organic compost; ii) which organic waste is suitable for the decomposition process; iii) how to do the daily maintenance of the composter; and iv) presentation of the preparation of the compost in the plastic box in the classroom. The presentation of the procedures for the preparation of the composter was made in an expository way; In this way, we present the organic compost in different stages of decomposition, highlighting its characteristics and the care for its maintenance.

We also highlight the environmental benefits of this practice. Subsequently, the students took the remains of raw organic food to the composter in the soil of the garden. Santos, *et al.* (2014) emphasize the importance of the composting process for the construction of more interdisciplinary knowledge offered to students, enabling them to acquire new meanings in relation to sustainable practices – in the school environment and outside it. It was noted – in our field diary – that the students participated in all the moments intrinsic to this pedagogical action: from the construction and maintenance of the organic compost in the composter, to its transformation into a sustainable fertilizer for the school garden.

Seventh meeting

In the seventh meeting, the students participated in the didactic game "Food Bingo". Each student received a card along with the E.V.A. markers. Soon after, we drew a number where there was a question that was addressed to the student of the time. This action made it possible – playfully and playfully – for the students to come into contact with theoretical knowledge related to the nutritional values present in various foods. Silva *et al.* (2013) mention that the realization of didactic games in the school environment – especially with those related to the content "food" – encourages the student to have a healthy diet, thus providing several benefits in the choice of more nutritious foods. The students participated in the game with great intensity: they gave their opinions, debated and argued about the theme. For Cabrera and Salvi (2005), the didactic game is very useful to complement, pleasurably, the student's learning. The fact of learning and teaching through play

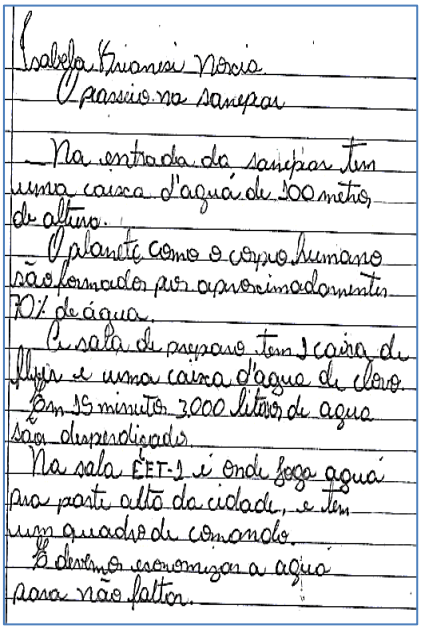
enriches worldviews and the possibilities of relationships, companionship, socialization, competitiveness and exchange of experiences. According to Oliveira, Costa and Takahama (2013), the game brings numerous contributions to learning, after all, the child learns in a more natural way.

Eighth meeting

In the eighth meeting, the students visited the Sanitation Company of Paraná – SANEPAR of Formosa do Oeste-PR. There, they learned about the water treatment process. There was student participation at all times of the visit; Most of them were surprised, after all, they did not know the operating process of a distributor of this size and, consequently, the sanitation and water treatment consumed daily by them. Thus, they had the opportunity to question the technical speaker about the performance of daily physical-chemical analyses and the maintenance of the machines. During the visit, the students positioned themselves as active and critical subjects in the face of the scientific and technological knowledge acquired at the site, which, in turn, were: 1) the conscious consumption of water; 2) demonstration of the steps and procedures of water analysis in the laboratory; 3) rainwater harvesting; and 4) visitation in the engine room, where students observed and received explanations of the pumping process of water distribution in the municipality.

In the classroom, the students were able to report the knowledge obtained at SANEPAR in an essay requested by the educator; They were very confident in the elaboration of the texts. As an example, we noticed in the text of Figure 01 that the students paid significant attention to the actions related to the visit to SANEPAR. Thus, the students' reports show that the activity was positive, motivating and allowed the understanding of theoretical and practical concepts involved in the process of water treatment and supply, and which are in situations present in the municipality. Freitas and Nuances (2015) emphasize that educational practices carried out with the participation of students outside schools are of great importance in the development of sustainable activities, allowing them to become aware of the local reality that surrounds them, thus forging attitudes aimed at the "rational use of water", for example, in their municipality of origin.

Figure 01. Text written by a student about the visit to SANEPAR.[8]


Isabela Krianesi Norcia
O passeio na sanepar
Na entrada da sanepar tem uma caixa d'aguá de 100 metros de altura.
O planeta como o corpo humano são formados por aproximadamente 70% de água.
A sala de preparo tem 1 caixa de flujer e uma caixa d'agua de cloro.
Em 15 minutos 3000 litros de agua são desperdiçados.
Na sala EET-1 é onde joga aguá pra parte alta da cidade, e tem um quadro de comando.
E devemos economizar a aguá para não faltar.

Source: authorship.

Ninth Enagainst

On this occasion, we defined teams and each one of them was responsible for researching the chosen vegetable and/or greenery to then plant it. During this action, we carried out research on each selected vegetable and/or vegetable, among them, we had chicory, tomato, lettuce, cabbage, radish, parsley and chives. The students were enthusiastic and interested in carrying out these activities. The linked contents were: 1) variety of vegetables; 2) characteristics of vegetables; 3) nutritional values present in vegetables; and 4) benefits of eating vegetables. Barbosa *et al.* (2016) emphasize that the acquisition of food-nutritional knowledge by the student is necessary; in addition, this process must occur in order to give rise to possible changes in their nutritional behavior, thus enabling the prevention of certain diseases considered chronic. After this first stage of research, we planted the respective seedlings in recyclable milk carton models. According to Silva and Muniz (2012), by producing models in schools, we can stimulate students to better learning (a positive way of understanding the sociocultural, environmental, spatial and geographical context in which they are inserted). In addition, encouraging group work allows students levels of interaction between them; in an enriching way for their learning, they jointly seek knowledge for the development of their study, in which everyone learns and teaches at the same time (Riess, 2010).

[8] It is important to highlight that, in the dissertation already referenced that served as a subsidy to this article, we have a greater and more detailed number of images, figures, reports, transcriptions, comments and productions resulting from the research process presented in this article.

Tenth meeting

At the beginning of this meeting, the students placed the sign with the name – collectively chosen – of the garden: "Green Space". As it is a collective moment of evaluation, new specific content was not necessarily broadcast. Thus, we seek to apprehend and evaluate the knowledge acquired/assimilated so far by the students in the midst of the nine activities previously developed. Then, and once again, the students prepared a brief essay on the construction trajectory of the "Green Space" hour, thus demonstrating an understanding of (i) the educational process carried out and (ii) the interventions made – planting in the garden, the visit to the organic producer, the lectures on the garden, nutrition and composting, the visits to SANEPAR, internet searches, etc. This evaluative methodology, of a more traditional nature – textual production to measure assimilated knowledge – was employed without constraints, after all, until that moment, we prioritized practical, playful and enjoyable teaching and learning processes far removed from traditional models (in fact, as we know, students need to come into contact holistically with different forms, methodologies and approaches to teaching and learning). With this way of measuring knowledge – textual production – in addition to the need to evaluate their knowledge related to our actions, we also stimulate important dimensions in students, such as: 1) writing skills, textual form and Portuguese language; 2) concentration; 3) organization of ideas; and 4) ability to synthesize. Considering that the LDB of 1996 and the BNCC for Science Teaching of 2017 require greater diversification in the forms Evaluating is a complex and difficult process; in this sense, Silva, Matos and Almeida (2014) present some considerations about evaluation by stating that educators are the main mediators in the elaboration of the concept of evaluation in the minds of students, also including society as a whole. Next, we selected four (4) transcriptions of texts produced by the students:

> Student 1: "Our garden is homemade and is made in a well-kept garden at the school made by our own manure known as fertilizer it helps the vegetables grow beautiful, healthy and faster. I learned that in a bed several vegetables or fruits are planted and my teacher taught me how to make fertilizer. And the waters that water the vegetables, fruits, etc. The box has to have about 2 liters of water and that's what I learned."[9]
>
> Student 2: "Green space is the name we gave to the fifth grade garden There in the garden we planted lettuce, chicory, and the teacher planted chives, tomatoes, pumpkins, cucumbers,

[9] This student ratified in his speech the importance of collecting rainwater to irrigate the vegetable garden and also the benefits of organic fertilization. It is noteworthy that he offers information about his participation in the preparation of compost, thus stating that organic fertilizer is important for the maintenance of the plant. This student clearly absorbed certain technical-scientific knowledge for the making of organic gardens and the description he makes of the activities shows this. The use of organic fertilizers, compost and collected water are essential for the construction of this technology (vegetable garden). Having this perception inscribed in the minds of students helps them to compose representations of how what the individual transforms is engendered with knowledge and, through this transformation, he promotes a more comfortable/adapted life (in the case of organic gardens, we promote greater food security, preservation of the environment and quality of life linked to better health). Thus, we can affirm that this way of connecting knowledge, as we have already observed, is a necessity for educators, especially those of Natural Sciences, concerned with promoting a teaching and learning process anchored in the STS perspective: "In this perspective, we consider the importance of teaching Science to make students scientifically and technologically literate, through educational actions planned to achieve this goal" (Bonfim; Guimarães, 2015, p. 3736).

tomatoes, we started the garden on October 9th, from time to time without a country school class we went to see the garden we harvested on November 27th we harvested lettuce, Almeirão, that and the teacher harvested the rest of the vegetables and we did a lecture and each group talked about a vegetable that was in the garden and we made a model and on the last day of school in the field the teacher will have a picnic on the farm".[10]

Student 3: "In our school we have a vegetable garden called Espaço Verde. In it you have: Lettuce, chicory, cabbage, cabbage, parsley, pumpkin, cucumber and chives. It is a project of the School in the countryside. On this day we visited several places such as farms, a visit to Sanepar, our school garden. We students plant the vegetables and then harvest the vegetables. On the first day of the project we had a lecture with Valmir. We also had a lecture with Josiane and then we did a food bingo competing for gifts such as pencils and erasers. When our garden was finished, it became very green and beautiful. The vegetables were very large and ripe, ready to be harvested. We composted with food scraps and saw dust. The beds of our vegetable garden were made with wooden boards. We students made a presentation to the school and family members about the benefits of various types of vegetables. In our classroom we made a model about our 'school garden' and then presented our model to the school. In the Espaço Verde vegetable garden there is a water tank pump that filtered rainwater and irrigated our vegetable garden. We put our compost in the compost bin we made and it is almost ready. In short, our Green Space garden is being a success".[11]

Student 4: "This year the School in the countryside showed us how important it is to grow products in a home garden, such as: lettuce, chicory, pumpkin, cabbage and many other vegetables. The most beautiful products we see in the markets are those that have more pesticides, this is very sad, because it harms people's health, bringing cancer and other diseases. In our school we made a garden to eat products without poison. Our class collaborated with everything. I replanted the lettuce seedling. The flowerbeds were very beautiful. On the day we went to the farm we learned about very cool things like planting seedlings! There were several trays with seeds planted, these seeds stayed in the greenhouse for a few days, then they were planted in the beds with manure and prepared soil. It was an educational and interesting tour. With this project I learned how to grow our own food and take better care of our health. The vegetables were watered at least twice a day. And when they got big, they were sold to be consumed, completely free of poisons."[12]

In general, the texts were produced within the classroom and had exclusive ideas of the students, that is, according to their interpretation of the project. In an evaluative way and considering all the statements analyzed, we found that most of them identified: 1) the difference between organic and conventional products, consequently, the benefits linked to the consumption of organic products to the detriment of foods with pesticides; 2) the saving of water related to the capture made through rain; 3) the potential of making a composter; 4) contact with the environment as something relevant;

[10] Also supported by an essentially descriptive speech, he recalled his participation in all stages of the project and was enthusiastic about making the models and presenting the research on the selected vegetables to the entire school community. As we have already observed, these levels of satisfaction and affectivity linked to the actions developed within the schools are essential for the school success of the students, as it confers pleasure to the teaching and learning process.

[11] Student 3 showed effective participation in all stages of the project and showed great satisfaction with the result in the garden. He showed a broad view of the process linked to the making of the garden, thus evidencing mastery in relation to the knowledge absorbed and its link with the construction of a specific technology, in this case, the garden, which can positively interfere in the existence of individuals. Thus, this student offers us information that supports the perception that the vision expressed in his speech is anchored in a STS perspective linked to the teaching and learning process.

[12] This student demonstrated the importance of growing organic gardens and consuming food without pesticides, emphasizing the benefits they bring to health. He also highlighted the need to work with the land, understanding the difference between growing organic food and conventional food. This type of perception demonstrates that the content has been assimilated by the student, making him consider the consumption of food in a more conscious way. Conscious consumption, as we have already discussed, is also one of the mottos linked to teaching based on a STS perspective that, here, we have already had the opportunity to debate.

5) the handling of tools connected to the treatment of the soil, that is, the use of a set of technologies and techniques linked to the preparation of the school garden; 6) appreciation and affection for the actions developed; 7) the need to preserve the environment; 8) the use of recyclable materials for the production of models; 9) group collaboration for the development of activities; 10) the participation, even if indirect, of the family while they took organic food to their homes; 11) the collaborative work with the Emater technician, the Sanepar professional, the organic farmer and the nutritionist; and 12) the link between a significant range of knowledge and the production of a given technology (the school garden) capable of transforming the reality of individuals, promoting their greater adaptability and quality of life (modulation of teaching and learning linked to the Teaching of Natural Sciences, broadly anchored in the perspective of STS)[13].

FINAL CONSIDERATIONS

Our research was based on the construction of a school garden which, in turn, served as a reference for the elaboration of an educational product[14]. We observed that the pedagogical actions constituted helped, together with the students, in the processes of: 1) assimilation of scientific, technological and sociocultural concepts related to the theme of vegetable gardens, food, human health and organic products; 2) expansion of the autonomy and criticality of the students; 3) approximation and affection of students in relation to the school environment; 4) construction of a feeling of collectivity and group work.

In an interdisciplinary way, the research developed and reported here engendered in its execution different fields of knowledge: i) Portuguese Language (when the students carried out their textual productions); ii) Informatics (in the activities in which the students developed their research on the internet in a way guided by the educator); iii) Environmental Education and/or Environmental Sciences (in different actions in which debates on the environment, environmental issues and environmental preservation were raised); iv) Natural Sciences (throughout the journey taken by us, issues related to human health, water resources, soil chemical processes, planting and plant

[13] We must highlight that the students had the opportunity to taste the vegetables harvested in the school garden in their lunches. The students were excited to consume the very food they had planted and harvested. The joy of consuming vegetables in school lunches as if it were a reward for the work developed was evident. According to Terso and Leite (2013), school meals have made positive advances in relation to the use of organic foods, which were gradually inserted into the students' daily meals with varieties of vegetables and also fruits, seeking to provide a better quality in their school meals.

[14] Our educational product – the manual called "Manual for schools: how to build a sustainable garden" – was developed with the intention of guiding the construction of an organic-sustainable school hour. It has instructions for the implementation of a rainwater harvesting system and the making of a composter in the soil. The basis for the making of this product is anchored in the experience and results reported in this article. This educational construct is available at: <https://oercommons.org/courses/manual-para-as-escolas-como-construir-uma-horta-sustent%C3%A1vel>. And it was accessed on: 08/17/2024.

development emerged); 5) Geography and Art (specifically when the student developed models and, there, spatiality, artistic and geographical knowledge were used).

For us and considering the results exposed, the students were able to perceive themselves as members, interconnected and transforming agents of the environment and the space in which they are inserted. Proof of this was the evidenced knowledge that the students had about the most latent environmental problems; They often knew how to conceptualize and contextualize data terms/concepts articulated with the subject. The theme of organic food inserted in the form of didactic-pedagogical activities in the school can provide students with positive attitudes and consumption habits. In this way, we still believe in the school space as a privileged locus to educate; or rather, to educate themselves environmentally, critically, scientifically, technologically and socially. We cansay that our actions showed satisfactory results in relation to the previously established objectives.

The construction of the school garden proved to be an effective strategy to integrate scientific, technological and social knowledge in the context of Elementary Education in the Early Years and, in this context, the constitution of educational strategies coordinated with action research is indispensable (as we have tried to demonstrate). The pedagogical actions developed contributed significantly to the formation of more aware and critical students, capable of understanding the implications of food production methods for human health and the environment. Through our practical and interdisciplinary activities correlated to the methodology of action research, students have not only acquired technical skills related to organic cultivation and sustainability, but have also developed a sense of scientific-technological, environmental and social responsibility.

The involvement of the school community and the partnerships established reinforced the collective character of the project, promoting collaboration and teamwork (which, as we have seen, also slipped and engendered among the children in the class participating in the research). The results of the research indicate that the school garden, supported by the STS approach, is a powerful tool for the education of students, preparing them to face contemporary challenges related to healthy eating, environmental preservation and the conscious use of given technologies. According to our perception, the reported experience/research evidences the central role of the school in promoting educational practices that dialogue directly with the reality of the students and with the most evident desires for transformation – especially the environmental, food, educational and public health – that we currently need to collectively face and build in our society.

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