Composting Model with The Reuse of Organic Waste in Rural Schools

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Abstract

School institutions become producers of organic waste as a result of the daily consumption of school meals offered to students during the school year. An alternative, so that this material is not incorrectly released into the environment, is the implementation of a composting model that will reuse organic waste, generating humus, which will serve as fertilizer for the implementation of a vegetable garden in the school in the rural area. This work aims to propose a composter model in a School in the Rural Area of Manaus for the reuse of organic waste, to develop a prototype of composter for the production of humic substances and mineral nutrients for the creation of gardens, to prepare the manual with guidelines for the correct and sustainable management of the composting plant and the school garden and implementing the garden system through the composting process using school organic waste. The work is a case study that proposes to implement a prototype of compost for the production of humic substances and mineral nutrients for the construction of a school garden. It is intended that the proposal raises the awareness of the school community for the correct management and reuse of solid waste generated by the school and arouse in students and teachers the interest in environmental education and behavior change for the preservation of the environment in which they live.

Keywords: Organic waste; Reuse; Compost; School garden.

1. INTRODUCTION

Population growth has generated a daily increase in the production of organic waste and many times these tailings are not reused. According to Rodrigues (2017), Brazilians produce about 1 kg of garbage per day, half of which is of organic origin that could be used to manufacture fertilizers. Organic waste includes seeds, leaves, food scraps, among other waste.

An alternative so that this organic material is not wasted is the practice of composting, which can physically, biologically and chemically modify the remains of organic waste, transforming this organic matter into fertilizer, an excellent product for use in vegetable gardens. The organic matter in the compost is transformed through a process resulting in an ideal product to be used in agriculture without causing environmental damage (SOUZA ET AL, 2001). Therefore, it becomes an important alternative for the disposal of this organic matter.

The creation of a composter and the use of the fertilizer produced through it, in gardens implemented in the school environment, will sensitize the school community and its surroundings to a sustainable posture and will result in the consumption of more nutritious and healthier products.

2. THEORETICAL REFERENCE

According to Silva and Carneiro (2017), the emergence of Environmental Education dates back to the 60s and 70s in an attempt, by environmentalists and ecologists, to awaken the interest of the population and the scientific community for the environmental problems generated by the uncontrolled consumption of forests, their destruction and use of natural resources.

In 1975, an important period for the premises of the environment, an event called the International Meeting on Environmental Education took place, bringing together sixty-five countries in the city of Belgrade, Yugoslavia. About this event, the creation of a 1966 World Environmental Education Program registered through the Belgrade Charter stands out.

In 1977, the International Congress on Education took place in the Georgian capital, Tbilisi, in the United States. It was the first congress aimed at addressing the issue for society, becoming a milestone in the quest to establish the principles of Environmental Education, as well as its objectives and action strategies.

According to Favaro (2019), the emergence of the term Environmental Education is recent, and aims to involve the various areas of knowledge, in an interdisciplinary perspective, such as: education and other environmental areas, in addition to being related to various social movements for ecological preservation, arising from the spread of the idea of preserving nature, and warning of the excessive and unprecedented consumption of humanity.

In 1992, ECO 92, United Nations Conference on Environment and Development, in Rio de Janeiro, Brazil, and in the following years other congresses and conferences also stood out: the South American Congress Eco/92, in Argentina in 1993; the Human Rights Conference in Vienna, Austria still in 1993; the World Population Conference in Cairo, Egypt in 1994; the Conference for Social Development in China in 1995; the World Climate Conference, in Berlin, Germany, in 1995; the Habitat II Conference in Istanbul, Turkey in 1996); the II Ibero-American Congress on Environmental Education in Guadalajara, Mexico in 1997 and the Conference on Environmental Education in New Delhi.

In 2012, Rio+20, the United Nations Conference on Sustainable Development, was held, marking the twenty years since the United Nations Conference on Environment and Development (Rio-92), with a view to contributing to the elaboration of the development agenda sustainable for the coming decades.

Thus, it is understood the importance of Environmental Education and conferences as a milestone that provided humanity's reflection on the global scenario that the environment was.

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2.1 Environmental Education in Brazil and Amazonas

Environmental education has undergone extensive formal institutionalization in recent years. Even with the National Environmental Policy (BRASIL, 1981) and the Federal Constitution (BRASIL, 1988) that

promulgated the National Environment System and the National Environment Council, environmental problems have always existed.

The National Policy on Environmental Education (PNEA) emerged in 1999, meeting the requirements set out by Rio 92, proposing norms, guidelines, principles and goals aimed at increasing the strategies of the new Brazilian political system for environmental education.

Law No. 6,938, of August 31, 1981, amended by Law No. 7,804, of July 18, 1989, based on items VI and VII of art. 23 and in art. 235 of the Constitution, establishes the National Environmental Policy, its purposes and formulation and application mechanisms, constitutes the National Environment System (SISNAMA) and institutes the Environmental Defense Registry.

In Art. 6 in item II, the National Council for the Environment (CONAMA) must "advise, study and propose to the Government Council, guidelines for government policies for the environment and natural resources and deliberate, within the scope of its competence, about norms and standards compatible with an ecologically balanced environment and essential to a healthy quality of life." (CONAMA, 1981, p.3)

According to Article 6, all competent bodies must protect and defend environmental issues established by the National Environment System – SISNAMA. (CONAMA, 1981).

According to Andrade (2017), taking care of nature in such complex contexts, with regard to the Amazon, becomes important, however it is necessary to understand the complexity that involves the Amazon environment.

Law No. 3222 provides for the Environmental Education policy in the State of Amazonas and was formulated by the bodies that make up the commission.

The Interinstitutional Commission for Environmental Education of the State of Amazonas (CIEA/AM) created on 06/02/2005, by Decree 25.043, amended on 09/24/2012, by Decree 32,836 has among its partner institutions the Institute for Environmental Protection of Amazonas - IPAAM. The commission is responsible for advising the environmental and education bodies and its proposal is to prepare and evaluate all projects and programs related to Environmental Education.

Studying and reflecting on environmental policies, projects, programs and laws arouse in the reader the interest in understanding the dynamics established in the relationship between society, culture and the environment.

2.2 Historical, Social and Cultural Context of the Environment

Thinking about issues involving the Environment is thinking about how much Culture and Society has a strong influence on the dynamics that involve the manifestation of human behavior in face of global issues.

The 1972 Stockholm Conference became the first to discuss and make the world turn its gaze to issues involving environmental degradation: "the Stockholm Conference addressed issues mainly related to air and natural resource pollution. The discussions were attended by heads of 113 countries, and more than 400 governmental and non-governmental institutions". (Stockholm Conference 1972).

In 1987, the BRUNDTLAND Report presented the concept of sustainable development that respects the needs of human beings in the present without giving up thinking about the environment that will be inherited by future generations. The 1987 BRUNDTLAND Report emphasizes that "A safe environment is a fundamental right, constitutionally guaranteed, of trans-individual ownership, that is, indivisible and

belonging to the entire community. It is a good that is unavailable and imprescriptible and, therefore, it is up to everyone, citizens and Public Authorities, to join efforts for its protection" (JAPIASSU; GUERRA, 2017).

At the beginning of ECO 92, he highlighted that: "human beings are at the center of concerns about sustainable development. They are entitled to a healthy and productive life, in harmony with nature". (RAMID; RIBEIRO, 1992).

Between 1995 and 2018, several conventions called the Conference of the Parties were held, which had among the main commitments: stabilizing the concentration of GHG; establish the Clean Development Mechanism (CDM).

Amazonas has an extension, according to IBGE 2020 data, of 1,559,167,878 km². The Amazon biome is characterized by forests, animals, rivers, soils and flora. The vegetation of the Amazon is composed of forests of dry land, meadow and stream, each with its own private nuances.

The Amazon is rich in its cultural diversity arising from traditions that were incorporated by its inhabitants in the diverse representations that are manifested through the close relationship with the nature that surrounds it.

Environmental education enters into this scenario providing students with a look of care and zeal for the forest, fauna and flora. Concrete actions that involve students help them to perceive themselves as part of and responsible for keeping their habitat intact, preserved and supervised.

2.3 Environmental Education and Interdisciplinarity

The school, through socio-educational and environmental programs and projects, will be able to help students understand the importance of the environment for their lives and for society.

The participation of teachers and students in the proposed project will arouse interest, involvement and commitment during its execution, as well as the maintenance and continuity of the project suggested for the school.

It is in this context that the interdisciplinary perspective is anchored, when those involved in the project, the technical, administrative and pedagogical team perceive themselves as "[...] the subject of their own action, revealing aspects of themselves that even to themselves were unknown" (FAZENDA, 2013), the implementation of the proposed model will tend to achieve its goals.

Japiassu (1976) emphasizes that the characteristic of interdisciplinarity "consists in the fact that it incorporates the results of all disciplines, borrowing conceptual analysis schemes from them in order to make them integrate, after having compared and judged them. ".

It is important to understand that the involvement of school teachers and students is necessary for the proposal of an interdisciplinary perspective, as a determining factor in the search for the meaning of research-based teaching and taking into account the specific knowledge that will act as a driving force in the consolidation of science-based environmental education in the act of teaching in the classroom. (BARSOSA; BEZERRA, 2014).

2.4 Organic Waste

2.4.1 Contextualization and Conceptualization

In Brazil, Law no. 12,305/10 of the National Solid Waste Policy (PNRS) regulates how the country should store and handle garbage. It also requires that the public and private sectors use correct means to dispose of material from solid waste. Also, according to the PNRS, art. 3 – XV, Chapter II, Tailings are solid wastes that do not present any other possibility than an environmentally adequate final disposal, when all possibilities for treatment and recovery are exhausted (PNRS, 2010).

Every segment of society must take into account the protection of public health, implement the 3Rs policy (Reduce, Reuse, Recycle), adopt a sustainable internal policy for the production and consumption of its products, propose actions for the proper reuse of waste and , finally, encourage the creation of a recycling industry.

When proposing projects that enable the correct management and disposal of waste, every segment of society that generates waste on a small and large scale must be taken into account "[...] conditions and standards established by Organs competent bodies of SISNAMA and, if applicable, SNVS and SUASA". (PNRS, 2010).

Thus, we believe that the proposal for the reuse of organic solid waste through the Compost Model is in line with the guidelines of the PNRS, which seeks to minimize environmental impacts and sensitize society to the correct, adequate and sustainable management of waste from all organic material produced and consumed by the Brazilian population, especially those attending, teachers and students, of the municipal school in the rural area under study and research, who daily consume organic products in the meals provided by the school.

2.4.2 Classification of Solid Waste

The National Policy defines waste as any material, or substance, or object resulting from activities, which are used by society and which can be discarded into the environment. Solid residues called garbage by the population are usually packaged in a certain type of material and collected by public cleaning agencies for disposal in previously defined areas. These solid wastes are normally generated by homes, companies, organizations, industries and other segments of society. They are any and all material that will not be used and is in its solid state. ABNT NBR 10004:2004 presents the following waste classification:

Figure 1. Solid Waste Classification
Source: Authors, (2021).

Residues have a pattern and classification criteria. According to NBR 1004 of 20024, waste is classified as Class I Waste - Hazardous Waste that presents hazardous; Class II Waste - Non-hazardous, is subdivided into Class II A Waste - Non-inert, those that do not fit into the classification of Class I - Hazardous or Class II waste. Class II A – Non-inert waste may have properties such as: biodegradability, combustibility or solubility in water. They can also be classified as Class II B Waste - Inert Any waste that, when sampled in a representative way.

Residues classified as II A (non-inert) are those that are characterized as non-flammable, corrosive, toxic, pathogenic and are not prone to chemical reactions. Some examples are: organic waste from the food industry (food waste); wood scraps; textile materials; glass fibers; sludge coming from filters; iron filings and mud from water treatment systems.

Residues classified as II B (inert) are those that do not decompose or undergo changes in their composition over time. They are those who do not suffer a reaction. Examples are: paper, cardboard, packaging of various types, glass etc.

Considering that the Composter Model proposal is intended to reuse waste, which is generated by school meals, and according to the concept, they are within the organic waste category. Organic residues are classified by their chemical composition. The food waste generated by the school fits into this classification and its correct destination and correct disposal may contribute to the preservation of the environment in the rural area, in which the Municipal School of the Rural Zone of Manaus is located.

In order to understand the composting model proposed in the master's dissertation project, a chapter is needed that can conceptualize, contextualize, describe the types of composting, the process of building a composter, as well as the importance of humus for teachers and students can create the vegetable garden, which will provide vegetables to complement the school meal.

2.5 Composting Process In School Garden

2.5.1 Contextualization and Conceptualization of Composting

Urban Solid Waste (RSU) is subdivided into household waste, commercial and service waste and pruning and sweeping waste from public cleaning according to Brasil (2010).

It should be noted that not all portions of organic waste can be composted, such as: treated wood, rubber and leather, for example. Only the compostable portion should be used in fertilizer generation.

We found several concepts of composting, among which we highlight the definition that composting is a biological oxidation process that occurs when microorganisms are in the process of degrading the organic compounds that make up the degraded materials, thus releasing water vapor and CO_2.

Certainly, composting is generated from the biological decomposition of organic substrates through the action of saprophytic microorganisms, which, upon reaching favorable conditions, result from the biological production of heat, called thermophilic development.

However, this biological process of decomposition can occur with or without the presence of oxygen (aerobic and anaerobic), being the aerobic form the most common.

In accordance with Law 12,305/2010), the PNRS aims to establish the way in which solid waste is managed in Brazil. (BRASIL, 2010b).

There are many challenges and barriers faced to implement the norms of the National Solid Waste Policy, in particular the obligation of the Municipalities, in the correct disposal of organic waste, as well as the strategies adopted to send all material for the process of recycling and reuse in composting.

The proper place to deposit waste becomes a challenge for public agencies. Difficulties in defining the most suitable sanitary landfills, without harming the environment, became a concern for municipal governments. The PNRS establishes that all possibilities of treatment and reuse of tailings having been exhausted and having no other alternative, they must have their final destination in accordance with the previously defined location and taking into account the environment. (BRASIL, 2010b).

The PNRS uses as an initial proposal the reduction of 25% by 2015, of the organic portion disposed in landfills for the Southeast region of the country (BRASIL, 2012) and encourages the creation of composting units that can be monitored as a priority, the selective collection organic waste, thus taking advantage of the composting plants installed in landfills.

To assist in the process of decentralizing composting in landfills, the encouragement and creation of composting houses and earthworms would also stimulate the development of school gardens, community gardens and the like, through the exchange of experiences on composting of Urban Solid Waste (USW).

Understanding that these processes would collaborate with local economic growth and consequently with the reduction of environmental impacts, programs, projects and municipal actions are necessary.

Siqueira (2015) reinforces that incentives from private companies, non-governmental organizations, community managers and social entrepreneurs would facilitate the use of organic waste for agroecosystems.

2.5.2 The general composting process: Mesophilic, Thermophilic and Maturation

The composting process is not only determined by the insertion and mixing of organic matter stacked in piles, it also involves the use of the appropriate materials, the selection of the best composting system for the type of soil and location that the composter will be created, in addition to access available material to complete all steps. (KIEHL, 1998).

The author also describes that it is possible to divide the steps into three phases. Initially, there is a faster phase where a raw or immature compound (phytotoxicity) is presented. This phase, called mesophilic, lasts for approximately 15 days and occurs when fungi and mesophilic bacteria proliferate as the organic matter is agglomerated. They are very important for the decomposition of organic waste and are responsible for metabolizing nutrients.

The next phase takes place through bio stabilization, which is characterized by the reduction in the temperature of the organic mass that occurs after having reached temperatures of up to 65°C. This phase can last about 2 months, depending on the subject. In this process, fungi and bacteria known as thermophilic or thermophilic are found, which survive temperatures between 65°C and 70°C. The most complex molecules are degraded and, because of the high temperatures, the pathological agents are eliminated. Subsequently, the third stage is reached, humification, accompanied by the mineralization process, a stage called maturation. The final product, resulting from this entire process, is called organic compost, which is a material rich in mineral nutrients and ready to be used as organic fertilizer.

As they are organic residues, their compounds undergo chemical metabolic changes that are associated with soil and air moisture, the process of water in the soil and its absorption and the action of saprophytic microorganisms responsible for the decomposition of organic matter.

Other organisms also participate in the process, such as algae, insects, etc. Thus, after chemical reactions, the components become available to plants, the producers of the food chain, which is known as the mineralization process, since microorganisms return the energy, obtained from decomposition, to the soil.

The saprophytic microorganisms that act in the decomposition of this matter are responsible for the absorption of carbon (C) and nitrogen (N). Kiehl (1985) states that these beings carry out decomposition and subsequent mineralization within a given period and it is generated by the relationship between the chemical reactions that occur between C and N in the raw material. According to the author, the N content of residues that are in decomposition should theoretically reach a percentage of 1.7%. to be bigger.

For this process of temperature variation to become crucial, the action of the four temperature phases is necessary. According to Bernal et al, the first phase is called Mesophilic. In its moderate temperatures prevail, up to around 40 ºC, which may last on average from two to five days. Then, the second stage begins, the thermophilic phase, in which the material reaches its maximum temperature (> 40 °C) and is degraded more quickly and can last from a few days to several months, according to the characteristics of the material being composted. In the third phase, cooling occurs, through the drop in temperature to ambient temperature values. In the fourth and last phase, the process is completed with maturation, where the stabilization period produces a matured compound, highly stabilized and humified, free from toxicity.

After explaining the general composting process, we will present the types of composters that can be prepared in the most differentiated spaces in a sustainable way and preserving the environment.

2.5.3 Types of Composters

In 2010, the Ministry of the Environment - MMA, published the manual with explanations on the techniques and types of composters, for their implementation and selective collection for the public system. It presents three basic types of composting: composting by natural aeration; of forced aeration and that obtained through biological reactors.

In natural aeration, waste is disposed in windrows. Controlling these factors in the compost windrow allows the microorganisms to work effectively for their transformation. (EMBRAPA, 2009).

Composting with forced aeration, according to the method, is seen as an alternative to the traditional method of turning over the groves. In it, the organic material is placed under perforated tubes through which air is forced to circulate, through mechanical pumping. This pumping serves as an accelerator and significantly improves fermentation. However, it becomes financially disadvantageous, due to the high amount spent to assemble its mechanism (turbines, tubes, grids), essential in the forced aeration process.

In the third and last method, the compound is inserted in biological reactors (closed systems), in these reactors, oxygenation occurs without external interference.

Kiehl (1985) also classified composting systems in a simpler way: slow or accelerated processes. It is noteworthy that many handcrafted creations have been used in communities, as a way to generate fertilizer for home gardens, and especially for schools, proposed in this study. Thus, the choice of method is made for two main reasons, the amount of material to be used in the composters and the financial availability for

its creation.

Next, we will present the appropriate materials that can be used during the composting process.

2.5.4 Main materials used in a composter

The composter has some characteristics that become pertinent to be highlighted and presented, among them, it is highlighted that the materials of vegetal origin, in in natura stage tend to be richer in nitrogen.

It is known that the green color of vegetables is a result of chlorophyll, on the other hand, the brown color indicates its absence in the most varied types of vegetables.

It is noteworthy that the yellowish color of the leaves, scientifically called senescence, indicates the degradation of chlorophyll and is directly associated with the concentration of nitrogen that changes from the leaves to other parts of the plant.

Considering that the proposal is composting, we emphasize that the materials that can be used are divided into two classes: those with material rich in carbon and rich in nitrogen.

Among the materials rich in carbon stand out: tree bark, wood scraps, all material from garden pruning, leaves and tree branches, among others. Among the materials rich in nitrogen, we highlight green leaves, animal manure, among others.

It is worth emphasizing the care that must be taken when separating the material that will be used in the composting process. The selection procedure must separate any and all materials that originate from glass, plastics, paints, oils, metals and stones. Fats, for example, release fatty acids that slow down the composting process.

Considering that the proposed composting model will be implemented in the Municipal School of the Rural Area of Manaus, meat waste must be avoided to avoid the presence of animals that can lead to danger and insecurity in the school environment.

Another material that can be used is paper, but it should not exceed the 10% limit of the pulp. Some papers should be avoided, such as: waxed paper, which is composed of fibrous material of vegetable origin.

That said, we will present below the process of building a composter so that students and teachers can understand the importance of reusing organic waste generated by school meals.

2.5.5 Construction Process of a Composter

The research project proposes a model of compost to be applied in the Escola da Zona Rural de Manaus. Therefore, in addition to the socio-educational lecture that will be held and which aims to contribute to the environmental education of students and offer theoretical and technical information so that teachers can continue the project, it is necessary to prepare a Manual that presents it in detail and didactically how the composter construction process takes place.

The proposed Manual aims to demonstrate the stages of construction of the composter, as well as the material that will be used, always aiming at the reuse of organic material that fall within the waste classified as II B (inert) and that can be found and in an unused status by school, family, rural community center, thrown into the environment, such as: drums, drums, barrel, canister, 50 liter milk containers, containers, buckets, all made of plastic and with lids that can be adapted to the structure of a composter .

The process of building a composter is simple and dynamic. The proposal is to use a creative, active and

participatory methodology. The methodology used will raise interest and involvement in the student during the manufacture of composter. When demonstrated in a dynamic and playful way, it can facilitate the students' learning process so that they can carry out the construction steps.

When play is used in the teaching and learning process, the act of learning tends to be more effective when faced with a concept, topic, subject or practical activity that one intends to develop. Geane Farias emphasizes that: “playfulness, as the foundation of childhood cultures, comprises playing, an activity that children practice continuously and selflessly, [...]. Playing has an interactive nature, therefore, it is fundamental for the child's learning and socialization.” (2017, p. 46).

In this play, students and teachers interact, strengthening the socio-affective relationship, which becomes an indispensable tool for the teaching and learning process.

The project among its objectives will propose the implementation of the garden system through the composting process using school organic waste. In order for students and teachers to understand the entire process that begins with the collection of organic waste, including the assembly of the composter, construction of the vegetable garden using the humus that will be originated from the decomposition of the waste, we will present below the importance of humus in the preparation of the fertilizer in preparation for planting vegetable seeds in the school garden.

2.6 The importance of Humus in a School Garden

Humus has its etymology of Latin origin, humus and means organic matter originated by the composition of animals, plants, leaves, etc. According to the Portuguese language dictionary, humus is an "organic and black substance, resulting from the partial decomposition of plants or animals, which accumulates on the soil or mixes with it." (FERREIRA, 2021, p.487)

The humus becomes a fertilizer rich in organic matter and can be mixed with black or brown earth, which originates in soil that has forests and woods in its composition. This mixture will become an ideal fertilizer for the school garden. It is noteworthy that the school, being in a rural area, will have this facilitator so that students and teachers can remove this raw material from nature itself without harming the environment.

The school vegetable garden plays an important role in boosting the supply of schools in rural areas of Manaus. With the production of vegetables, the school will be able to reinforce the meals of its students and teachers, and if the production is on a large scale, it will be able to sell at cost price to the families and parents of students, raising funds to carry out improvements in the school.

There are several types of gardens: traditional, which features the planting of various vegetables; domestic plants that are grown indoors, in backyards, in pots; mini gardens, are suitable for small spaces and widely used in apartments; organic, is similar to the conventional vegetable garden, distinguishing itself from this by the non-use of the industrialized product; suspended, are those that the planting carried out at a height above the ground.

In the process of assembling gardens, raw materials that could be discarded into the environment in an inappropriate and incorrect manner can be used. Several materials that are used in daily life and that after a period of use will be discarded, can be used as tools in gardens, among which we can highlight: plant vases, pet bottles, buckets, wooden and plastic crates, metal and plastic gutters. plastic, wooden pallets, aluminum cans, MDF structures among other materials that can be reused.

To set up the garden at the school, we will sensitize students and teachers through a lecture that will be entitled, Reuse, Reuse and Recycle: taking advantage of all disposable materials at home, school and the environment. The lecture aims to make students and teachers collect all material that is not used and become raw material for the construction of the school garden.

Students and teachers will be able to become multipliers in their rural community, encouraging their families, neighbors and friends to make their own home garden. This socio-environmental attitude may be reflected in a significant reduction in the disposal of organic waste in nature, contributing to the environmental re-education of residents who live in the vicinity of the school.

The figure below shows the models of gardens that can be built, which will help to preserve the environment and contribute to the school and family economy.

Figure 2. Garden Models

Source: Authors, (2021).

Figure 2 shows the models of gardens that can be built, which will help to preserve the environment and contribute to the school and family economy.

3. MATERIALS AND METHODS

Luiz Fonseca (2010) defines Methodology as: “technical procedures, the modalities of activities, the methods that will be used in the research. And he adds: [...] it will depend on the nature of the work, the type of research and the proposed objectives.

Proposing a research methodology through a composting model that reuses organic waste, which is generated by the subjects involved in the case study in question, teachers and students, in a Rural School in the City of Manaus, becomes a possibility for exercising citizenship through environmental education and changes in behavior in the current scenario, World and National, which involve environmental issues.

The incorrect disposal of solid waste in the environment causes serious environmental damage, in addition to promoting the proliferation of contagious infectious diseases, originating from the most diverse species of insects and animals.

In order to understand the researcher's interest in the proposed theme, a brief explanation of the area chosen for the implementation of the composter Model is necessary.

3.1 Materials

The School previously selected for the research was founded on 05/19/2014, with registration number: 20.405.799/0001-03 (HEADQUARTERS), business name: CONSELHO SCHOOL OF THE MUNICIPAL SCHOOL OF MANAUS RURAL AREA, title of the establishment (trade name): Municipal CE of the Rural Area of Manaus. Description of the main economic activity: 94.30-8-00 - Activities of Associations for the Defense of Social Rights, description of secondary economic activities: 94.99-5-00 - Unspecified Association Activities, Description of the legal nature: 399-9 - Private Association, located on highway BR 174, Km 41, S/N, RURAL AREA, CEP: 69.048-990, Neighborhood: village Nova Canaã, Municipality: Manaus, UF: AM, registered with INEP under. No. 13098675.

The School has in its structure: five classrooms, cafeteria, a kitchen, leisure area for Physical Education practices, board room, secretariat, 2 bathrooms (female and male). It has in its registry 166 students duly enrolled, distributed as: 13 students in Maternal, 16 years in the 1st period, 07 students in the 2nd period A, 14 students in the 2nd period B, 22 students in the 1st year, 23 students in the 2nd year, 23 students in the 3rd year, 23 students in the 4th year and 25 students in the 5th year. It has in its staff: 06 teachers and the following subjects are taught: Portuguese Language, Mathematics, Science, Geography, History, Arts, Religious Education and Physical Education.

Aiming at optimizing the implementation process, a Manual will be created with guidelines and information with the stages of construction of the composter and vegetable garden model. Seeking to sensitize the research subjects and contribute to the teaching and learning process, the Booklet will present playful activities through QUIZ, word searches, mazes, crosswords, among other learning strategies.

3.2 Research Methods

To endorse the importance and relevance of the proposal for a model of composting with the reuse of organic waste, it conducted research on specialized sites: Scientific Electronic Library Online (SciELO), CAPES Journal Portal, Digital Library of Theses and Dissertations (BDTD), Science.gov, Dot.Lib, ACADEMIC GOOGLEO. To carry out the selection process, the year of publication was considered, with emphasis on publications between the period 2016 to 2021.

Table 3.1 presents the process of research on specialized websites and selection of articles according to the descriptors that are included in the theme proposed in the Professional Master's Degree Project in Engineering, Process Management, Systems and Environment, in the Energy and Environment research line Environment.

Table 1. Bibliometric Analysis from 2016 to 2021.

SPECIALIZED WEBSITE	DESCRIPTOR(S)	SURVEYED	SELECTED
SciELO	Environmental education; Education and Interdisciplinarity; Composter; Organic Waste; School Garden.	32	16
Academic Google	Environmental education; Education and Interdisciplinarity; Composter; Organic Waste; School Garden.	27	10
Dot.Lib	Environmental education; Education and Interdisciplinarity; Composter; Organic Waste; School Garden.	16	8

Source: Authors, 2021.

Figure 3 shows the amount of scientific production published on the Scielo, Google Academic, Dot.Lib and ITEGAM websites, corresponding to a total of 75 publications. For reading according to the descriptors: Environmental Education; Education and Interdisciplinarity; Composter; Organic Waste; School Garden a total of 34 publications were selected for reading and contribution to the writing of the dissertation.

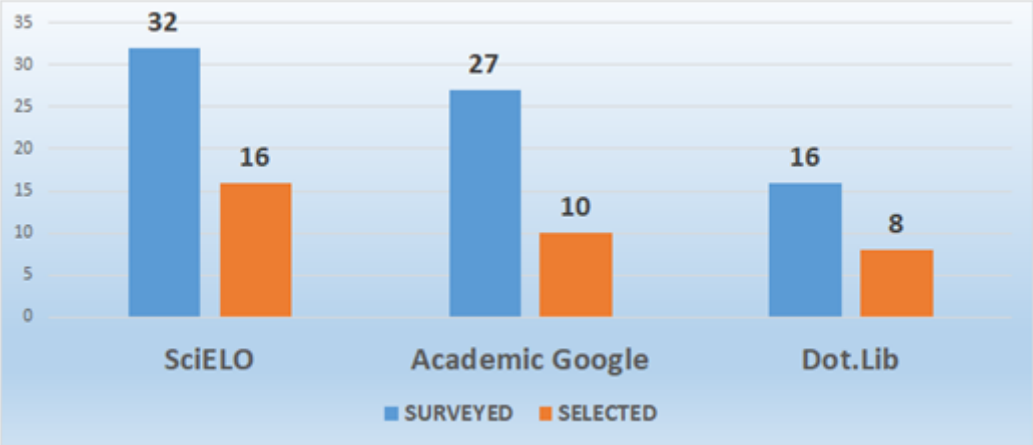

Figure 3. Sites Searched from 2016 to 2021
Source: Authors, 2021.

Figure 4 highlights the publications that were searched from 2016 to 2021. The selection took into account publications related to the theme proposed by the Research Project and described in the dissertation of the Professional Master's Degree in Engineering. ITEGAM's Process, Systems and Environmental Management.

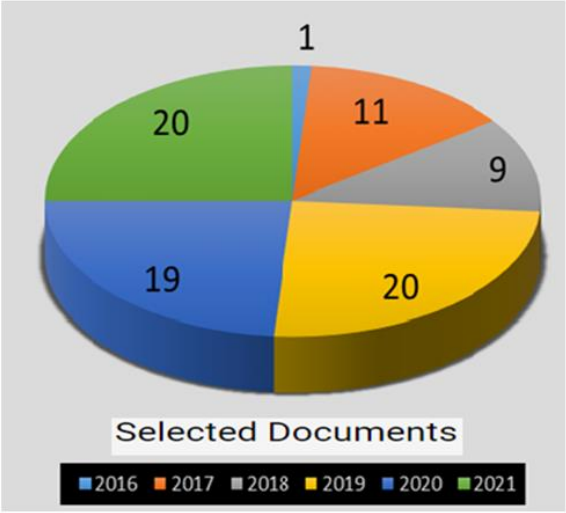

Figure 4. Publications: Descriptors Researched from 2016 to 2021.
Source: Authors, 2021.

In order to enable the process of implementing the composter Model and the creation of a vegetable garden at the school, an on-site visit was carried out, after the proper authorization of the School Manager, so that the geographic area could be known, aiming at the photographic record, analysis and definition of the location, in agreement with the Director, for the implementation of composter and the school garden.
Figure 5 shows the flowchart of the steps that were taken so that we could have theoretical and technical basis on the proposal for the Implementation of the Compost Model, as well as the on-site visit so that the School Manager could participate and define the most appropriate space for the installation of composter and Horta, present the Dissertation for Qualification, publish the Scientific Article and carry out the Defense.

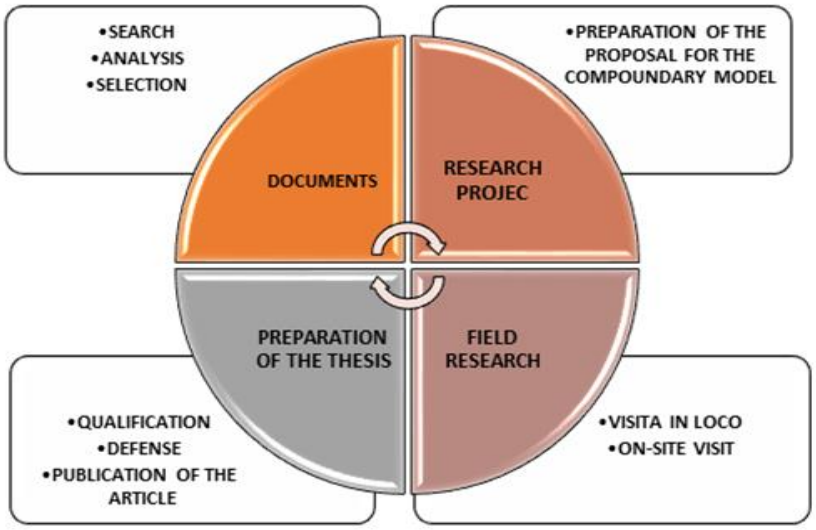

Figure 5. Flowchart of the Master's Thesis Project Steps
Source: Authors, 2021

In order to enable the process of implementing the composter Model and the creation of a vegetable garden at the school, an on-site visit was carried out, after the proper authorization of the School

Manager, so that the geographic area could be known, aiming at the photographic record, analysis and definition of the location, in agreement with the Manager, for the implementation of composter and the school garden.

It is noteworthy that as a result of the COVID 19 PANDEMIC, started in March 2020, the on-site visit was only possible with the proper authorization of the manager, respecting the distance and care measures with the use of mask and alcohol gel. It is noteworthy that the School was under State and Municipal decree with school activities suspended and only remote classes were held.

The School is under renovation and below we will present images of the current physical structure of the school, as well as the location that was defined, with the consent of the Manager, for the implementation of composter and the School Garden.

The photos below show images of the School: location in the Rural Zone, classrooms, cafeteria, technical-administrative and pedagogical staff rooms, where the composter and the school garden will be implemented.

Figures 6 to 9 show images of the site for the implementation of the composter Model and School Garden Proposal

Figure 6. E.M of the Manaus Rural Area
Source: Authors, 2021

Figure 7. Classroom
Source: Authors, 2021

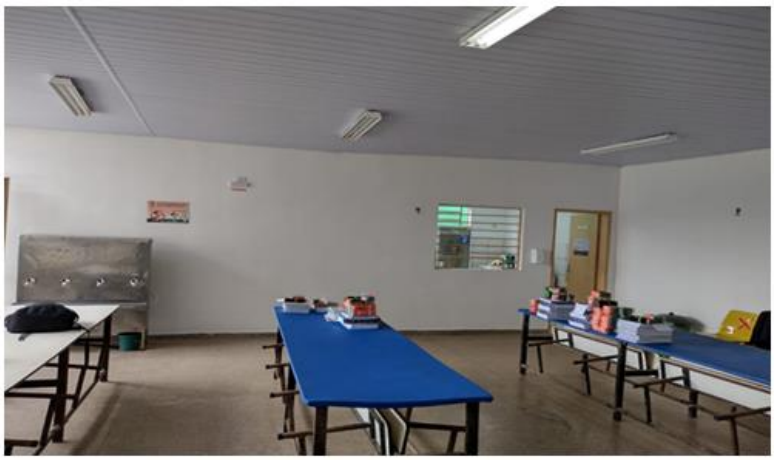

Figure 8. Refectory
Source: Authors, 2021

Figure 9. Place for Implementation of the Compost and School Garden Model
Source: Authors, 2021

The theme proposed for the study leads us to qualitative research. We understand that the proposal is

presented as necessary and urgent, given the phenomenon that reveals itself in its subjective aspect, highlighting the consequences that manifested themselves in the social, in our case in the school environment. It is noteworthy "that in the social sphere there are different problems, issues and restrictions that cannot be explained or understood in their entirety only from a quantitative approach". (GONZAGA, 2005).

Qualitative research allows the researcher to understand how human processes occur and their relationships with the surrounding environment. Being in the space that involves environmental issues configures the necessary involvement of contexts: cultural, social, political, economic and educational.

Some characteristics of qualitative research, such as: "analyzing the experiences of individuals or groups; examining interactions and communications that are developing and investigating documents or similar traces of experiences" (BARBOUR, 2009) become an integral part that guide the research in question.

The researcher, faced with this proposal, must be clear in which context he/she is inserted, which path he/she intends to follow and how to go about it so that he/she can get to where he/she wants to go. (GONZAGA; GONZAGA, 2011).

The qualitative approach permeates the constructions of the social reality in which individuals find themselves. The meaning and understanding they have of their relationships and experiences with the world in order to answer questions that involve their attitudes and attitudes towards environmental phenomena.

Therefore, the research will be anchored in the case study technique, which features the intensive study that will provide an understanding of the research in its entirety. (FACHIN, 2006).

The research was presented as exploratory and descriptive, supported by on-site observation, photographic record, analysis of the appropriate space (CERVO; BERVIAN; DA SILVA, 2007) for the implementation of the composting model that can contribute to minimize environmental impacts and enable the production of vegetables through the creation of the school garden.

It is proposed to hold lectures so that one can talk about environmental issues, explain the stages of construction of the composter and guide for the construction of the school garden.

Seeking to reach the largest number of students and teachers, we will make use of ICTs: Cell Phones, Notebooks, Computers and Smartphones, so that everyone can have access to the Manual with information about the composter Model proposed in the Professional Masters research project.

4. RESULTS AND DISCUSSIONS

Figure 10 presents the proposed flowchart for the Implementation of the Compost Model in the Rural School in the City of Manaus.

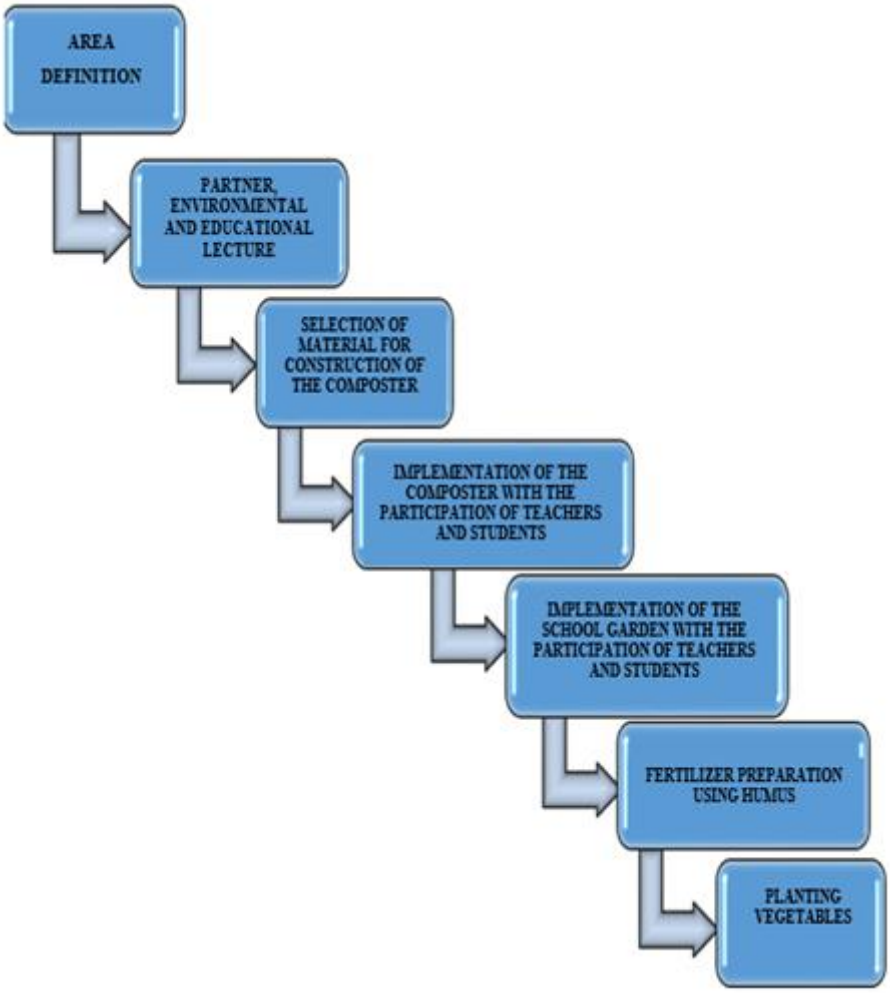

Figure 10. Flowchart of Project Implementation Steps
Source: Authors, 2021

In order for the project to reach its objectives, a Manual will be proposed that will allow students and teachers to understand the stages of assembly of the composter.

The figures below, which are part of the Manual, are being prepared, with information and illustrations about the composter Model, which will be made available to students and teachers.

It will be suggested that teachers and students use ICTs to access the Manual more easily and quickly, without having to use printed material, contributing to environmental preservation, avoiding the use of paper and its disposal in the environment.

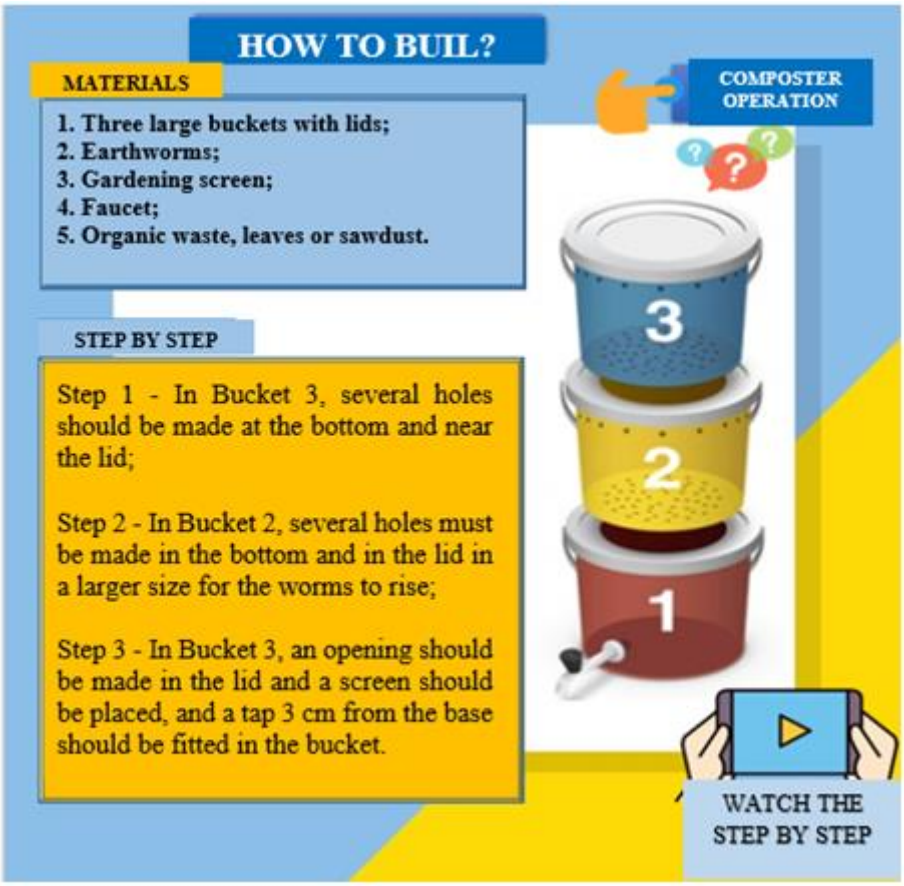

Figure 11. Composter Model
Source: Authors, 2021

Figure 12. Composter Operation
Source: Authors, 2021

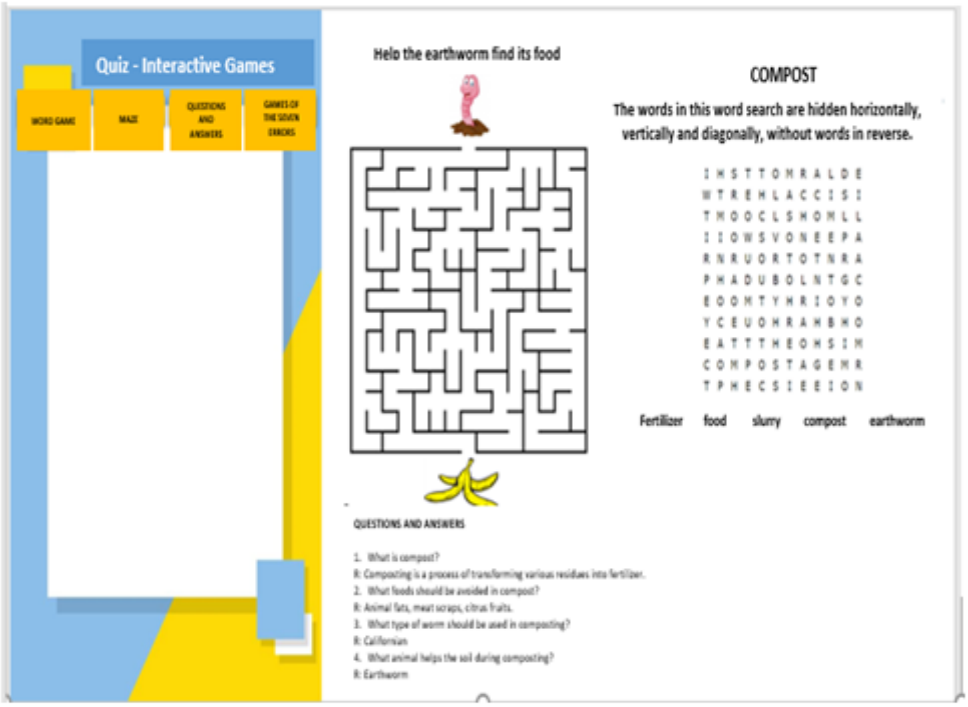

Figure 13. Quiz and Interactive Games
Source: authors, (2018).

The 3Rs policy: Reduce, Reuse and Recycle, sensitized researchers so that they could, through the Master's Project Research proposal, contribute to Environmental Education.
It is noticed that the proposed theme meets the needs of the School, which, being located in the Rural Area of the City of Manaus, faces serious problems for the correct disposal of organic waste, among them, we highlight garbage collection by public agencies State and Municipal.

5. Conclusion

The project to implement the composter model already indicates a significant acceptance and demonstrates the possibility of success, given the interest aroused by the School manager, who made himself available to support the initiative and sensitize his administrative and pedagogical team, stating that he will spare no efforts so that everyone gets involved in the execution of the project.
The statement was made because of the need that the school has to provide the correct disposal of food waste, generated by the daily food provided by the school, and to contribute to reducing financial expenses with the purchase of plastic bags and buckets that serve for its storage, in addition to preventing the proliferation of insects, preventing contamination and proliferation of infectious disease.

6. Acknowledgement

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