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# Installation of Vegetable Based Roof Gardens in Schools From Recyclable Materials: A Study

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## Abstract

The study aimed to reflect on the socio-environmental issues and the action of the gardens in urban/school spaces, considering garden as a methodological instrument for the interdisciplinary activities related to family farming, using the descriptive methodology and study of literary review with proposals of gardens using recyclable materials depicted through images created using the software AutoCAD. Through the study, it was possible to plan gardens using recyclable materials in environments of small spaces. The crops employed will be vegetables for school meals. The activities carried out in the garden contribute to the change in the habits and attitudes of students regarding the perception they possess of nature, the formation of awareness of respect and care, the need to conserve the environment and stimulate the pursuit of improvement of quality of life in other ways of seeing the activities performed by their own parents in the field.

**Keywords:** sustainability, waste, agriculture

## 1. Introduction

In view of the constant evolutions that technology imposes on agriculture and food production, especially in family farming associated with climatic phenomena, the uncertainties of an economically, socially, politically and technologically correct agriculture, as well as the absence of agricultural practices in the experience of young people in rural communities, raises a concern on the future of world agriculture and food production [1], with similar concerns occurring in Brazil.

In Nigeria, the idea that agricultural activity, especially in rural areas, is undervalued and provides few benefits for its practitioners [2], prevails on the part of young people.

Anjos and Caldas [3] cite that there is a very negative view populating the imagery of rural youths, a fact that, ultimately, reproduces the dominant stigma that rural spaces represent the place of “non-development”, of the archaic, of the traditional.

According to Guthman [4] for the production of food, students, in the exercise of citizenship or as future agricultural workers, will be better able to understand the debates and controversies that underlie the production, creation and marketing of agricultural products, recognizing the limits and possibilities of models, both of intensive production and alternative models, these little valued and disseminated (family farming, agroforestry production, etc.), as well as recognizing the various aspects (environmental, scientific, political, economic, cultural, etc.) present in the different models of food production and understand the different tools of flexible teaching and learning, based on permaculture, that the gardens School (Gardens) can offer.

One of the alternatives to raise the perception about activities in the agricultural environment and the care of the environment is the use of a school garden, which can serve as a source of food and didactic activities, offering advantages to the communities involved, such as obtaining quality food at low cost and involvement in food and health programs developed by schools [5], contributing also to the knowledge of the 3 R's (reduce, reuse and recycle), integration of the community school in the performance of socio-environmental activities, encouraging the consumption of organic foods, providing students with experiences of agroecological practices for food production, so that they can be transmitted to their relatives and, consequently, apply them to home or community gardens [6].

In this context, the research aims to reflect on the environmental issues and the action of the gardens in urban/school spaces, taking allowance from the garden as a methodological instrument the interdisciplinary practices of activities related to agriculture family.

## **2. Materials and methods**

The literature review presented below contains a synthesis of the latest studies on the production of vegetable gardens in urban areas, highlighting the production of vegetable gardens in schools. The methods used were studies of free area in school spaces of three schools of early childhood education, investigation of the needs and desires of the school community and researches on types and forms for plant production in urban areas and employability of recyclable materials in its construction. The software Auto Card, a tool for architectural drawings, enabling the creation of gardens for each space studied was used.

For the preparation of the gardens passive recycling materials may be used, through characterization of solid residues, materials that has been discarded by the local population, without appropriate destination for the environment, for example,

- Tires: used in the garden site
- Pet bottles: it is used to demarcate the Mandala (vegetable garden en circle) garden site and store rainwater for irrigation through the drip.
- Paper: fertilizer and base of the flowerbeds.
- Organic residues of food production in school: fertilizer.
- Gray water from the production of school feeding: irrigation and fertilization.
- Demolition wood: to assemble the structure of the vegetable gardens.

## 2.1 Results and discussions

### 2.1.1 Urban agriculture

Urban agriculture is an activity that has been growing in Brazil and worldwide, according to FAO—Food and Agriculture Organization of the United Nations. This activity refers to the use of surfaces located in urban areas or in their respective peripheries for agricultural production and the creation of small animals intended for own consumption or for sale in local markets.

Some of the concepts about urban agriculture in general address their relationship with localization. For Dimoud and Nikolopoulou [7], the definition of urban agriculture refers to the location of the spaces within and around cities or urban areas. Therefore, the intra area refers to all spaces within cities that may have some type of agricultural activity, which can be individual or collective, in addition to being located in private or public areas such as squares or idle areas.

Wong [8] stated that the concept of urban agriculture goes beyond what is defined by the area of localization, which is therefore an interaction between the ecological and urban economic system, not being reduced only to the urban location.

Dimoud and Nikolopoulou [7] stated that this integration is made possible by the fact that urban agriculture has a set of activities (cultivation, breeding, fishing, etc.) that develop in the interior (Intraurban) or in the periphery (periurban) of the cities.

The development of urban or periurban agriculture is directly linked to the demographic and economic growth of cities, contributing to the reconfiguration of urban spaces through land use, population structures, social practices, among other factors.

The advantages of urban agriculture, includes the local development through the rational use of spaces, food security, formation of microclimates, maintenance of biodiversity, water drainage, harvesting of rain water, decreased temperature and income generation. Most common examples of urban agriculture are the community gardens that are most often installed in urban idle areas, which may be public or private, intended for cultivations of vegetables, medicinal plants, legumes, fruits and other foods, providing food for families living near these areas, or seedling production [9].

Urban gardens have differentiated configurations, where they almost always correspond to the boundary of the area where you want to deploy it.

One of the configurations observed in the use of urban gardens is the greenhouses. These are protected agricultural environments where the plastics are used as cladding materials for covering the greenhouse framework, used in the protection of crops, facing the climatic adversities. Agricultural greenhouses are used to create climatic environments suitable for plants, protecting them from poor environmental conditions such as frost, hail, and other weather. They are used for food production, cultivation of ornamental plants, flowers and medicinal plants [10].

Rosenzweig et al. [11] stated that the cultivation in protected environment brings with it numerous advantages such as: harvest in the periods between harvest, faster production cycle due to favorable environment conditions, increase in production, control of the environment promoting the development and production of plants, greater control of pests and diseases that may occur in the protected environment, better use of available resources, reduced risks and increased market competitiveness by the producer.

According to Wong [8], besides urban gardens, vertical farms have numerous advantages such as production of several crops throughout the year, zero loss of

crops related to possible adverse weather conditions, reduction of transaction costs, production without pesticide use, herbicides and fertilizers, optimization of water resources, greater control of food security and social and esthetic gain in large urban centers.

### 2.1.2 Gardens in the school space

In the educational context, adopting other forms of production and consumption that is more sustainable is fundamental to resignify time, space and social relations of the students.

It is noteworthy that for school garden its size is not important, but the diversity of plants used matters. The main idea is to manage, in a balanced way, the soil and other natural resources through a work harmonized with nature and, as the garden will be located in the premises of a school, the construction and management can be used as an activity of enrichment of classroom learning [12].

The study proposes the elaboration for the construction of school gardens that meet children and adolescents for the experience of agricultural and environmental practices for plant and animal production. Vegetable gardens, vertical gardens in pet bottles and gardens in ceilings with the use of pallets are preferred in which vegetables and fruits adapted to the region, are to be cultivated. Proper management options are required, besides use of constructive materials of low cost. Community and rural producers in the region may supply the seedlings and may be involved in the production system.

There are enormous benefits of composting in the school community, and most important among them is the possibility of students to start administering and using the leftover food produced in their family environment. In addition are the inevitable learning process related to ethics, personal responsibility and environmental citizenship, giving them a specific action to help their local community and society as a whole. The landscape effect that the materials recyclable and plants can provide, has been shown in **Figure 1**.

With the short space, it was proposed to build units of vertical vegetable gardens using pet bottles that can be collected by students at their homes, vegetable gardens



**Figure 1.**  
*Proposal of an agropedagogical space of recyclable materials.*



with tires and a central site that is already existing in space. For the cultivation of species that do not have good productive results receiving solar incidence, a recycle wood pergola of solid waste from civil construction—RSC, was designed where vines will be cultivated, for example, passion fruit.

Vegetable gardens serve as pedagogical space for teaching learning, almost all care is performed by the students, as seen in **Figures 2** and **3**.

Thus, the garden inserted in the school environment can be a living laboratory that enables the development of several pedagogical activities in environmental and food education, uniting theory and practice in a contextualized way, assisting in the teaching process, learning and promoting collective and cooperative work among the social agents involved [5].

It is worth noticing that this space will serve to perform different trainings that may be offered to the community, enabling knowledge about the breeding of birds, including the sanitary management, the preparation of the ration in the property, records and notes, the use of poultry manure for crop fertilization, production of vegetables and legumes and climatic studies, etc.

In the field study, one of the schools had the space in a covered area with roof in slab, and thus pallets were used for the construction of beds, in order to protect the floor of the covering and use a material that would possibly have its destination in the dumps.

Another proposal was on lajeed roofs, and again use of pallets was suggested (**Figure 4**). The pallets may be purchased in trade as recycled material, and used as the basis for transporting construction products, machinery, and other high-weight products.

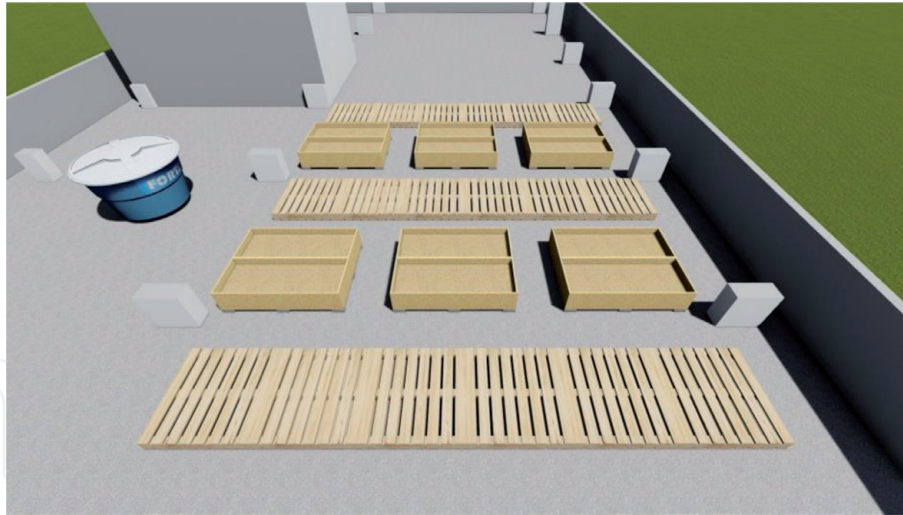
In addition to providing a better nutrition to school students, it also ensured a greater awareness about the natural assets and valorous vision about the



**Figure 2.**  
*Planting with technical guidance.*



**Figure 3.**  
*Vegetable bed with the use of tires.*



**Figure 4.**  
*Gardens on roofs utilizing pallets.*

agricultural activities so present in their midst. The lack of encouragement to the young in the field generates the non-continuity of properties and the growing demographic, economic and cultural emptying of regions of predominance of family farming [3, 13]. According to Adeokun [1], all the efforts of the stakeholders for sustainable child development is valid, and this research continues to be a formidable way to rationalize alternatives and practices of agriculture in the school life.

Projects of this nature are of great relevance to transform some esthetic concepts such as the use of green spaces, actions geared towards environmental education, possibility of exploitation of reusable resources could be debated, used and transformed artistically in a vertical garden, which continues to be cared for by all students and school staff, as documented in the study of Oliveira et al. [6].

With pedagogical practices appropriate to the work, elaboration and development of the school garden in public schools, it is observed that there is also encouragement to the various forms of learning and understanding, enabling the acquisition of new knowledge, where all, through research and practice can exert a dynamic activity, which favors the teaching of science, enabling the encouragement of research and discussion of topics as a food environment, waste, cooperative work, behavior and make possible the development of the teaching-learning method, through practice, in addition to awakening social values such as participation, sense of responsibility, interpersonal relationship and awareness of the metastatic issues in the period in which we live.

### 3. Conclusions

With the study carried out, it was possible to construct different types of gardens for different spaces, bringing to the school spaces the plant production and the productive knowledge for children in urban areas, in the guidelines of (1) sustainability in the ecological, economic, social, cultural, political and ethical dimensions; (2) agricultural production bringing well-being and guaranteeing productivity; (3) construction with low cost and use of recyclable materials and adopting the method in educational spaces.

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