# Frei Pacífico Primary School Sustainable Project

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ABSTRACT: The building design for the Frei Pacífico Public School responds to urgent needs from the district of Itapuã, municipality of Viamão, for a new school. Approved by the community´s Participatory Budget, the process of the new school design was based on sustainability principles. The design strategies incorporates several “more sustainable” technologies and seeks minimizing environmental impact materials, in harmony with the environmentally preserved area nearby, and promoting the valuation of the cultural local values which re-engages the community with its traditions and conveys the importance of natural environmental preservation. The project was developed to fulfill the needs of the school community in a more sustainable way. The design faced the challenge of putting together environmental technology, social participation and socio-cultural values with a lower budget compared to the conventional public schools of the city. This was possible using local “soft” techniques and materials of low environmental impact and encouraging the participation of the local community in the construction. The insertion of “more sustainable” principles was contemplated in the phases of design and construction. Recomendations for its future use were included for subsequent operation of the school.

Keywords: school building; sustainability; environmental education; bioclimatic design; low impact; participatory design.

## 1. INTRODUCTION

The present article aims to describe the design of a the new building for Frei Pacífico Public School, developed in 2004, by NORIE (Núcleo Orientado para a Inovação da Edificação), to the Secretary of Education of the Municipality of Viamão, State of Rio Grande do Sul, in the south of Brazil.. This paper presents the concepts, characteristics, materials and the procedures that were used in this design project. It is worth mentioning that the design of a sustainable school, in the context where it occurs, is an innovation that tries toqualify the concept and the pattern of the public schools in the region. It will be the first school of the municipality - and perhaps a unique example in the State - to be implemented with sustainability concepts being used didactically.

The design project of Frei Pacífico Public School is an answer to the requests of the local community and was approved in their Municipal Participatory Budget, for a new school building, as the existing one was lacking appropriate services and physical space. The municipality requested a "differentiated" school design in the new area, that as well as the previous one, is to be located in the proximities of Itapuã State Park, a Conservation Unit belonging to the State network of Parks. Since the beginning of the design there was a close contact with the school community, aiming at understanding their expectations and making clear to them the characteristics of a more sustainable school.

This project demonstrates the advantages of applying sustainability criteria and creating a more adequate atmosphere for environmental education in the school. It was expected that this would allow the transfer of technology to other municipalities, making clearer the sustainability principles. The proposal also tries to harmonize the school with the Park of Itapuã and may constitute another attraction to the area, transferring sustainable technologies to the community and visitors. It is a public school open to the students of the neighborhood, so that the project aims to integrate the whole community, proposing not only an universal accessibility, but also cultural activities, opportunities for practising sports and environmental education, to the whole of the local community. The environmental design and the vegetable garden will be implemented by the school community, as forms of participatory intervention and environmental education.

The sustainable strategies used in the design were: use of low impact and recycled materials, bioclimatic design (solar orientation and natural ventilation), green roof, wastewater biological

treatment, rain water collection, local production of food, composting of organic residues, preservation existing and introduction of new specimens of vegetation, soft intervention in the soil, and water use reduction. In the same way, other more sustainable strategies were use, such as the ban on toxic products demonstrating a committment with the health of all involved in the production processes; the type of implementation and use of the school; the use of recycled materials, such as the eco-wood, preserving the durability of the product and caring for the workers' health, all show a new local approach to a school design.

1.1 Concepts and Guidelines

*1.1.1 Culture and Architecture*

The school design makes an attempt to create its link with the previous local indigenous culture occupation, recognizing it as an example of a healthy relationship with the environment, showing principles to be rescued. The careful attitude of the natives is a testimony that it is possible the man's harmonious life with nature. The design incorporates this attitude through the rational use of the available resources, intelligent preservation of the existent vegetation, cultivation of ecological vegetable gardens, floors and fountain expressed as artistic elements and of the respectful relationship with the flora and the fauna. The use of local materials, the simplification of forms and constructive techniques; the use of bio-climatic strategies (solar orientation and natural ventilation); the peripheral disposition of the buildings on a center of collective conviviality (looking for inspiration in the form of the indigenous village), were also design tools. Another local reference is the Portuguese Architecture, also present in the neighborhood – with its “door and window” houses covered with mud tiles – which was considered more appropriated for the forms and materials inspiration of the school blocks.

*1.1.2 Sustainability and Architecture*

The insertion of concepts of environmental education in the design emphasizes the human being's relationship with nature in a sustainable way, providing the users an experience throughout space, as a form of comprehension and respect for the world that surrounds them. In this way, educational solutions appeared in the project directly related with the eco-literacy concept, so relevant, mainly for a school that is located close to an ecological sanctuary. The proposal of sustainability for the school is made present in the respect for the environmental characteristics of the plot (prevailing winds, available solar radiation, topography and existing vegetation), by the possibility of use of natural resources (local materials, rainwater and local production of food) and by the inclusion in the design of cyclic flows of existing energy and materials (wastewater biological treatment and composting of organic residues). With this aim – a sustainable approach – the design proposal tried to implement **technologies** that take sustainability into account, with strong emphasis on environment and social inclusion, so to make them adequate and accessible to the school efficiency, as a whole:

a) exploration of solar radiation as source of energy and climatic conditioning;

b) exploration of natural ventilation, for a better habitability;

c) use of local constructive materials: granite stone, ceramic brick, eucalyptus wood;

d) organic forms conjugated with orthogonal forms, making possible the diversity;

e) use of recycled materials;

f) use of the thermal inertia in the construction, g) appropriate space disposition of the construction in relation to the existent vegetation and topography;

h) use of rain water as a resource

i) separation of the black and gray waters, with their polishing in a pondthrough biological treatment, after preliminary filtering;

j) composting of the organic residues, improving the characteristics of the soil, in vegetable gardens and orchards.

Besides the internal space of the Classrooms and Laboratories, the students will be in direct and permanent contact with environmental education, through the exhibition of techniques of clean and efficient strategies for production , as well as the best use of the natural resources and the sustainable management of the generated residues.

*1.1.3 Amusement and Architecture*

With this guideline the conception of spaces aimed at allowing, and stimulating, the creativity to flow and the enabling student's learning in different ways, not only in the classrooms, as in the leisure and conviviality spaces. The use of different materials, the use of color and the integration of architecture and landscape elements, as well as the production of food in the vegetable gardens, handled by all users of the school, are instruments used in the materialization of this principle.

## 2. OBJECTIVE

As the existent school building was in a precarious state, suffering frequent floodings and presenting functional weaknesses a new physical space was devised, that also would fulfil the dreams and initiatives of the local (rural) community. As an answer, a design that suplies these demands satisfactorily was developed, making possible an environmental education close to nature and to the construction itself. The design also allows the community's integration through the creation of spaces for events, the valuation of architecture and arts, spaces for the practice of sports and for developing the necessary sensitivity that enables a balanced relationship of the human being with nature.

## 3. METHODOLOGY

The project was developed in a participatory way, that breaks up with the conventional way of designing, for involving the school community, supplying the specific demands of final users (students and teachers) and contractiors (Secretary of Education). It began with the municipality people´s participation in the municipal budget, and its inclusion among the priorities to be achieved. Meetings and interviews were accomplished with the school

community (parents, students, teachers and employees) to present the principles of a more ecologically sustainable project and to know their expectations regarding the new school. The insertion of sustainability principles was contemplated in the design and construction phases, and were added to the recommendations for the subsequent operation of the school. A new ethical approach was adopted - the concern with all of the children, of all species, for the whole time [1].

## 4. SITE DESCRIPTION

The new building of the school will be iconstructed in an area supplied by the State Government. The site counts with a main access road, in addition to a secondary one, to be built on the site . The area has approximately one hectare, with a quadrilateral format having sides of 100 m of extension, whose angles face the cardinal points. The land is relatively levelled, containing a natural drain running in the northwest-southeast direction.

## 5. RESULTS

The design of the school building is integrated into the local environment, contemplating in its operation the natural and cyclical processes. The school is alive: it breathes pure air (opened to the healthy and comfortable summer winds from the east), it consumes a well´s local water (in addition to the water of the rain), it produces food ecologically (for the student´s refectory) and re-incorporates the residues into the earth (composting of organic residues, treatment of wastewater), recycling them into food (vegetable garden and orchard), in a cyclical process. For the reduction of consumption of water, toilets employ water saving strategies. There's the expectation of implementation of a set of demonstration set of photovoltaic panels.


**Figure 1:** net of organic exchanges

**Low impact materials** were proposed for the construction, as stone (extracted by a granite craftman´s cooperative in the neighborhood), clay bricks, eucalyptus wood (reforested) with ecological treatment (non-toxic) protected from the weather by specific design, eco-wood beams (material produced from recycled plastic mixed with organic fibres, water resistent) and internal floors made of ceramic tiles and external ones, of local stone.

The buildings benefit from bio-climatic strategies: **efficient ventilation** - closed to the winter winds and opened to the summer's; **"light shelves"** - diffusing solar light inside the classrooms; **"chimney effect"** - increasing crossed ventilation; **solar devices for shading** - by means of horizontal elements and deciduous vegetation; and **thermal mass** - created with the help of the stone walls. There are also green roofs in the whole extension of the covered

circulation, with benefits to temperature and humidity; reduction of paved areas, for better drainage; as well as for the cleaning of the air; temperature reduction of the roof, besides aesthetic benefits. The rainwater is collected by the green roofs and feeds a fountain, from where is directed to a small pond (final stage of wastewater treatment) in the school's access.

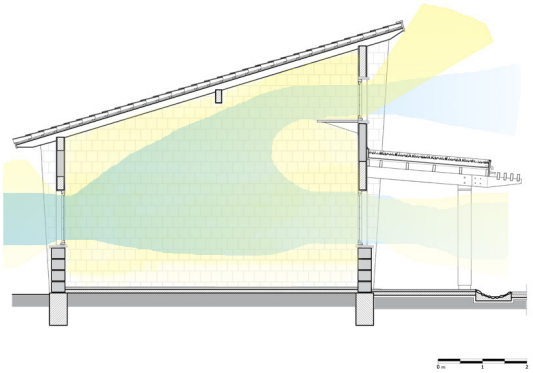

**Figure 2:** bioclimatic desing

Several actions oriented the proposal of environmental education, such as the low intervention in the soil and the reduced parking area, that maintain the permeable soil, the productive landscaping and the planting of native species, besides the preservation of the existent arboreal species. A proposed path, surrounds the plot limits, passing by the vegetable gardens and the other elements already mentioned, configuring a **trail with five stop points** (the sensory trail) that stimulates the senses: the first one is the **palate stop**, that is close to the vegetable gardens and is surrounded by a bamboo structure with fruit creepers; the second is the **vision stop**, that receives creepers of beautiful colored flowers, being the main focus for looking at the surrounding scenery; the next one is the **smell stop**, that is surrounded by aromatic herbs; the last two stop points are located in the existent eucalyptus wood , being the **touch sense** stimulated by species of different textures, while the **audition stop** is stimulated by the eucalyptus leaves that dance and sing with the wind.

5.1 Physical Description

The land where the school will be implemented is accessed through the northeast side, entering a small eucalyptus wood. The constructions were located in the subsequent part of the plot, to guarantee early access to the sun, avoiding the shadow of the trees Their buildings design is such to orient towards the north and the east, being the west façades protected by the heavy stone walls. The main access to the school is near the access road, where there's a lodge projected with the same materials and environmental strategies used in the main buildings. The access path from the lodge to the first block of the school buildings is decorated with productive landscaping and a pond (final stage of the wastewater biological treatment), and leads to the main building, and gives access to the pathway in a gallery that connects all the blocks. At one side of the plot a new passage for vehicles was opened, constituting a secondary access, that serves the service areas and makes possible a future public road.

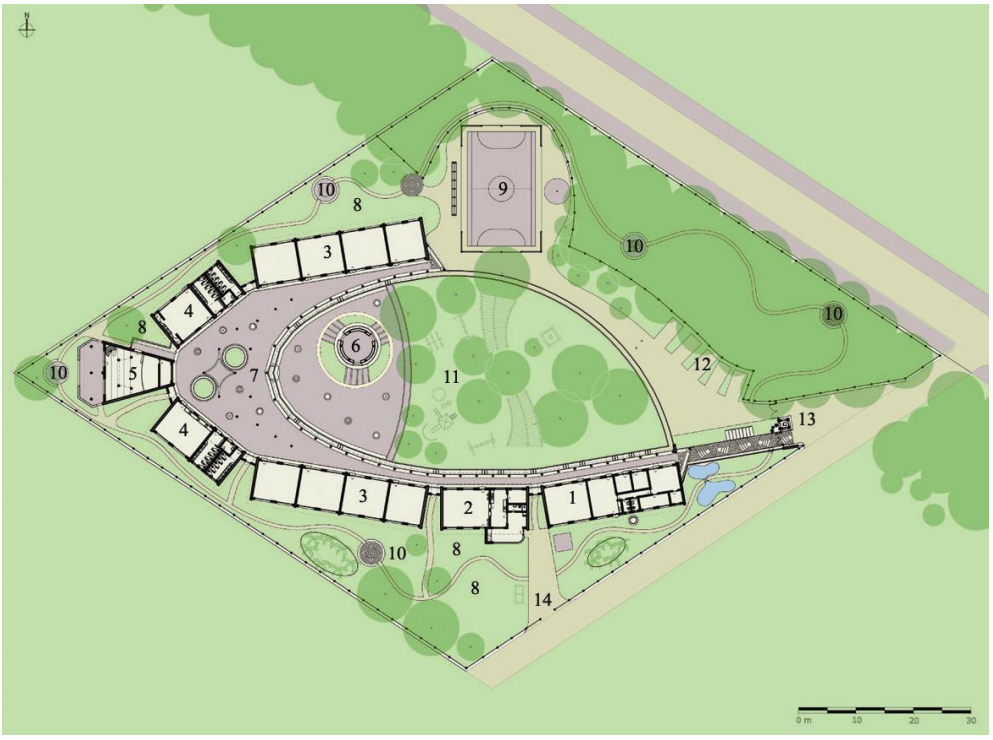


**Figure 3:** 1 - administration; 2 - refectory; 3 - classrooms; 4 – bathrooms and laboratory; 5 - auditorium; 6 - bandstand; 7 - covered recreation; 8 - vegetable gardens; 9 – sports' court; 10 - stop points; 11 - open recreation / playground; 12 - restricted parking; 13 - lodge of main access; 14 - service access.

Arriving to the complex of buildings from the main access, the visitor is received by a tip-shaped stone porch that symbolizes the denomination of this district: **Itapuã**, that means “tip of the stone” in the Guarani native language. For a long time this area has being occupied by this ethnic group that until today remains in the neighborhood of the park, their old homeland. When passing the access porch, the visitor enters in the gallery that conducts to the different blocks of the school, from where is possible to have a general view and to notice the disposition of the constructions as a semi-ellipse, reminding an South American indian village, where the main space is the centrally located and designed to be used for recreation (near the fruit trees), whose focus is the bandstand, designed for presentations of the school band (of which the community is very proud of).

The band is very symbolic for the school community, because it is an opportunity for children to give wings to their artistic creativity. The school community is proud of this group and its presentations constitute very important events, so that the bandstand was designed at a place that made possible the a community meeting . If in an indigenous village we imagine the fire as the central element; in this school this place belongs to the bandstand.

The building complex is opened to the east (to the desirable summer wind) , and gives its back to the west, protecting the interior from the cold winter winds that comes from this direction. The construction in curve creates two sides in the land: inwardly, a place of collective conviviality is configured, embracing the bandstand for presentations and a big recreation area (playground), enclosed by a green rooffed gallery; outwardly there is the path of environmental sensitization, with productive vegetation and some service areas.

The gallery has a green flat roof that unites all blocks in a smooth curve. The rainwater are driven through a system of drains, gargoyles and a gutter perforated that distributes the water to the internal perimeter of the covering, creating a curtain of water in the extension of the gallery, being collected by a stone gutter at the level of the ground. This gutter surrounds the whole place, addressing the flow to the pond located in the lower part of the plot. Part of the rainwater collected by the green roof is driven to a fountain and, soon afterwards, also collected in the stone gutter. This whole system brings the water cycle in nature to the daily conviviality of the school community, being part of the strategy of environmental sensitization.

**Figure 4:** Main access

**Figure 6:** general perspective of the project

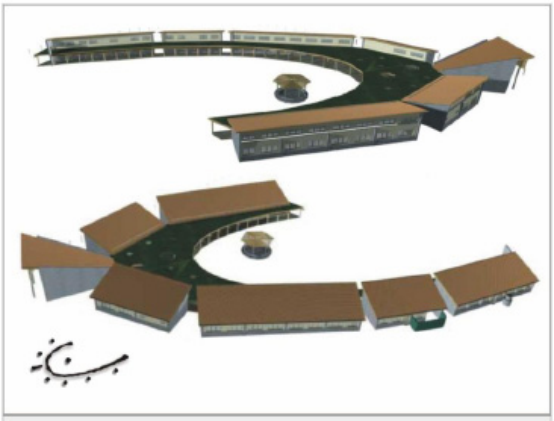

**Figure 5:** materiality and form of the built object

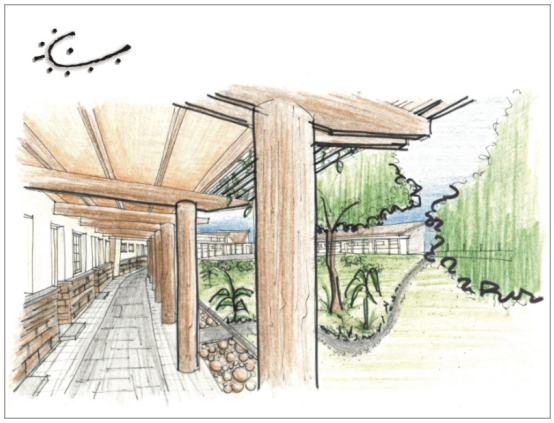

**Figure 7:** gallery of circulation

The school blocks follow a functional sequence: **block 1** congregates the administrative activities and the library, and there occurs the collection of rainwater and close to the system wastewater treatment ((digestor, filter, reedbed and wastewater polishing pond); **block 2** congregates the service areas and the dining hall. Externally are located the vegetable gardens and composting areas, from where begins the Trail of the Senses, that continues along the perimeter of the plot until the eucalyptus wood ; **block 3** gathers four classrooms, in their proximities is the Stop Point of the Palate and a circle of banana trees (indicating the system of wastewater treatment - from the bathrooms); **block 4** constitutes the students' lavatories and the science laboratory ; **block 5** is an auditorium with mezzanine and deposit for the band's instruments. In its exterior there's a balcony for contemplation of the exuberant surrounding view and the Stop Point of the Vision. The green roof is wider in block 5, configuring an area of covered recreation, decorated with flowerpots below a zenithal opening, allowing the flow of natural light and air. In this point the roof makes an accentuated curve, leading to the other blocks.

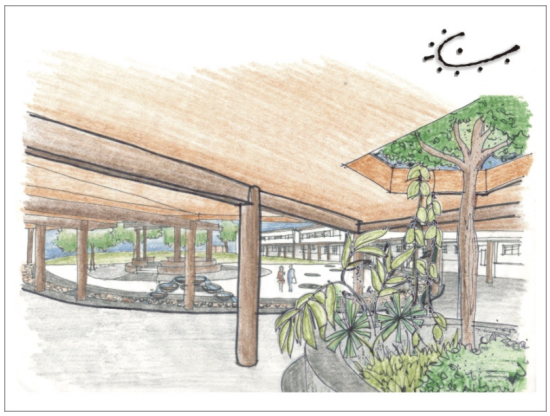

**Figure 8:** recreation area covered with landscaped zenitais and source

**Block 6** is integrated by the library and one more group of lavatories. The external area has a north orientation and has a small playground for the youngest children. **Block 7** is the last of the sequence, gathering more four classrooms. In their exterior there's the Stop Point of the Smell. This block finishes the green roof in the gallery that leads to the sports' court. The path continues until a small car parking in the shadow of the trees, with few vacancies for teachers and employees, what is adjusted to the local reality. Near the access lodge there is also a bicycles parking, the community´s special way of mobility, which is an example of harmony with the environment. In the woods there are other two Stop Points of the Trail of the Senses: the Touch and the Hearing Stop Points.

## 6. CONCLUSION

The project looks for the best use of the land avaliable for its implantation, and tries to convey the several needs of the community, making possible functional cycles (of waters, of food, of people's circulation, etc), educational circuits (trail the senses, vegetable gardens, orchard) and meeting places (bandstand, auditorium, sporting court). Cooperation is the key issue in this project, that contibutes to social dimension of sustainability, as aform of relationship between the school with the community, where some responsibilities are delegated to the school group, as the care with the nature, but always trying to potentiate these relationships through the project, creating several meeting places to be used and administered together.

The project faced the challenge of putting together appropriate environmental technologies, social participation and socio-cultural rescuing, resulting in a smaller budget than those of the conventional schools in the city. This was possible through the use of local techniques and materials of low environmental impact, local production of food, the involvement of the community's in the work, and the support of small local companies.

The close contact of the design team with the school community made possible a project that responded bothto their functional and aesthetical expectations and using local materials and cultural references, it satisfied and increased the community's self-esteem.

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