

Education for sustainability in The Botanic Garden of the University of Coimbra: 10 years of experience

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INTRODUCTION

Education is a key component in any project that intends to inform and allow people to improve their quality of life. In the decade of Education for Sustainability (2005-2014), declared by the United Nations, being the "Preservation and Protection of the Environment" one of the main themes, the Botanical Gardens (BGs) are determinants agents in the contemporary societies for education, teaching and divulgation of the Sciences of Nature. The BGs have fundamental elements to equate chief issues that threaten the world at a global scale representing privileged opportunities to alert to a conscious and tolerant behaviour. The BGs singularity can thus provide stimulant programs, with valuable training and skills, for the "environment" to be integrated by the educative departments in the formal scholar *curricula*, allowing opportunities based on knowledge that links the social, political and economical issues to the natural systems (Hawkins 2008, Waylen 2006, Willison 2004).

The Botanic Garden of the University of Coimbra (BGUC), an historical and classic garden founded in 1772 for the cultivation and knowledge of the aromatic plants and acclimatization of the "new" plants from the "new" world, initiated an educative program in 1997 from which same activities will be presented (Almeida & Tavares 1996, Tavares 2007a, 2007b, <http://www.uc.pt/jardimbotanico>).

The vast living patrimonial of the BGUC inspired the willingness to teach. Using a diversity of resources it was possible to promote experimental teaching and to develop the interest for scientific learning. Applying the fundamental principles for the environmental education (Willison 2004) and through an enjoyable approach, the activities involve the participants that more easily assimilate the concepts and use them in practice actions. We have the collaboration and devotion of a group of about 10 volunteer's high school students from different Coimbra University courses like Biology, Pharmacy, Anthropology, Geography, History, Erasmus programs. They are annually trained and they have an excellent and devoted performance allowing the enlargement and enrichment of BGUC' Educative Service. Throughout the year, guided visits under different themes are prepared for school groups according to their *curricula* and also for general public: "**Biodiversity, Extinction and Sustainability**"; "**Evolution and Characterization of the Main Plants Groups**"; "**Aromatic and medicinal**

plants"; "**The Botanic Families**"; "**The Garden's History**"; "**Discovering the Plant's World**"; "**Records' Plants in the Garden**". Periodically, there are also specific **activities for each season** that will be briefly described:

Spring

"**Let's hug the trees?!...!**": to understand biodiversity and the importance of plants for Life in Earth, nothing better than learning through senses and sensations and so.. Let's hug the trees: to feel the texture of the trunks, to taste some fruit, to understand what we hear near by, to smell some fragrant leaves and to see how they are all different and so discover the characteristics and curiosities of trees from all over the world, present in a Botanical Garden!.. There are 8 and different species to discover with an orientation pamphlet: *Platanus x hispanica* Mill ex Munch, *Ginkgo biloba* L., *Sequoia sempervirens* (D.Don) Endl., *Cedrus deodara* (D.Don) G. Don, *Araucaria bidwillii* Hook.f., *Tilia x vulgaris* Hayne, *Eucalytus citriodora* Hook. and *Ficus macrophylla* Desf. ex Pers.; after the "hug", observing attentively and registering notes, we collect leaves, flowers, fruits, cones to make an *herbarium* (8 individual files: with photographs, scientific name, common name, family (basic concepts), geographical origin, morphological characteristics...) (Huxley & Griffiths 1992, Tabares 2007c).

"**A different present for my father**": in the unique space of the bamboo plantation, surrounded and involved by an exotic environment that takes us to distant oriental regions, the thematic is the bamboo (and the panda...), remaining in our memory the unusual space and the acquired knowledge about it... in our hand a botanical present for the father: a pencil box, a decorated bamboo (Pascoal & Tabares 2007).

"**A different present for my mother**": Mother, May, flowers... the variety of colours, shapes and sizes that the garden offers and the theme is now the flower. In ateliê, we are going to embellish a "botanical present" that we materialize from a plastic bottle, an example of recycling and reutilization of materials, that with imagination and a little of skill is transformed in a beautiful "bouquet" for a mother's gift (Pascoal & Tabares 2007).

"**Looking for the lost book near the plants records of the garden**": celebrating the 21st March (Tree's day and Poetry's day), visitors are invited to discover the records

plants (the ancient living-fossil species; the tallest species of the world; the species with the greatest ovules of the Plant kingdom; the species with the most primitive flower and fruit; the species presenting more longevity; the species with largest trunk...); with an illustrated pamphlet throughout the garden, when reaching the records plants, visitors will also find a book, a gift for the winners (Huxley & Griffiths 1992, Tabares 2007a)!

“In Children’s day the guide is a child”: a lovely way for celebrating the 1st of June: an excellent citizen’ example promising a “greener” future...! Children are the “roots” of the future!

Summer

“80 Minutes Tour Around the World”: during 80 minutes the visitors can enjoy and appreciate the differences ambiances and flora of the world, since the Equator, with the “queen” of water-lily, *Victoria amazonica* Orb., living in the Amazonas river and present in a Coimbra greenhouse’ lake (Tabares 2003); then they will see tropical plants as coffee, orchids,...; afterwards they will enter the template greenhouse where live pitcher-plants from different continents.. the journey ending in the cold greenhouse, a refreshing ambiance surrounded by tree-ferns and musci...

“Fruit salad and gelatin”: specially designed for pre-schooler children (2-5 years old), an invitation to recognize and discover the plants of the fruit-salad (banana, sugar-cane, vanilla, mango-tree...) and that the gelatine is made from red algae; afterwards they will be delighted when eating the fruit salad and gelatine, a light afternoon snack under the refreshing trees’ shadow.

“Games for All children”, “Painting in All ages” and **“Theatre in the garden”** are outside activities, prepared for all publics, including the one needing special care.

Autumn

“Tea & teas”: a particular trial through the aromatic and medicinal plants of the Medical School (Almeida & Tabares 1996, Hawkins 2008, Huxley & Griffiths 1992.), specially focused in the plants used for tea, including the truly tea-plant *Camellia sinensis* L. characteristics and fitoterapeutical properties, followed by a restful hot tea in a winter afternoon.

“Nuts from here and there”: ... what part of the fruit do we eat in a nut? Is it a seed, a fruit, the tegument or not all a fruit? Do you really know what is a fruit? A trial through the nuts from here (Portuguese plants) and there (exotic plants): several examples to demonstrate the different types and parts of fruits, that later will be tasted.

“Let’s make fossils”: approaching the immense biodiversity that characterises the garden in the different seasons of

the year and colours’ changes (concepts of evergreen and deciduous plants) collecting leaves to serve as a “mould” in the elaboration of a fossil with clay, the best way to understand the natural fossilation process (Pascoal & Tabares 2007).

Winter

“The pitcher-plants guard the botanic crib”: with parts of plants, pines, leaves, branches, fruits and some imagination, a botanic crib is made by children and their parents and some figures will be under the guard of the pitcher-plants (Tabares 2004), in the greenhouse for a Christmas exhibition.

“DNA: Dentro Nasce A-vida (life is born inside)”: the code of the cells is the basis for the biodiversity walking through the garden to recognize and understand the differences of the leaving beings from the macro to the microscopic observations: isolate DNA from onion cells and afterwards make a puzzle, a drawing of a cell with its organelles.

“Carnival masks in the garden”: what are the parts of a plant? Some have cones, other have flowers. Learning about them and please think: could there be both cones and flowers in a tree? well let’s make carnival-masks recycling all the diverse collected materials and identifying them!

“Ecomata”: an ecological circuit using a pamphlet and the plants of the BG as living models to introduce the main notions in Ecology. Next to the *Tilia x vulgaris* the question was: is a tree part of an ecosystem or is it itself an ecosystem? Here the exploration of concepts such as individual, population, community, ecosystem. Next, *Erythrina crista-galli* allowed us to explore the influence of the abiotic factors and the existence of relations of symbiosis, commensalism and competition between different species in the tree. The cooperation between individuals of different species was exemplified by the sparrows that use the seeds of the fruits of the *Liquidambar styraciflua*. In the *Ficus macrophylla*, the visitors confirm the competition between this plant and its neighbours, the palm-trees. Questioned about the existence of “predators plants”, someone answered: “Yes, the carnivorous plants!” and it was confirmed observing *Dionaea muscipula*. In the *Arboretum*, the *Quercus cerris* was victim of a pathogenic fungus (parasitism) and the bamboo plantation (*Phyllostachys bambusoides*) was an example of intraspecific competition. Is there cooperation between plants? Then the pupils selected two sampling areas in the *Arboretum* for the study of a terrestrial ecosystem using the squares’ method. After laboratory experiences, analysis and discussion of data, this formative action as “scientist-pupils” was completed and it was enhanced that any scientific study must be much

more comprising, demanding the repetition of procedures, seasonal monitoring and laboratorial experimentation (Costa & al. 2007, Huxley & Griffiths 1992).

CONCLUTIONS

The fulfilment of the space and live resources of the garden is attempted with these activities by the interaction of the affective (“heart-on”), physical (“hands-on”) and cognitive (“head-on”) aspects (Gomes Da Silva 2003, Willison 2007). By involving the participants they can develop skills and learn the Natural Science concepts, applying them in the construction of the future memory of the Garden experiences. This program was initiated at the BGUC in 1997, reaching 15.000 guided visitors in 2003 and near 10.000/year in the last years; the educative actions have been enriched since then and it is now possible to present a **seasonal calendar of activities**, besides the **thematic visits during all the year**.

Although produced mostly for school-children, these are educative models adjustable for **all the publics** and represent well succeeded and gratifying examples of Education for Sustainability in 10 years of emotion and affection in the BGUC.

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Recibido: 15 de abril de 2009.

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