

An experience for learning Andean biodiversity contents in an elementary school curriculum

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SUMMARY

This is the experience of the aromatic and medicinal plants school workshop in Cusco (Peru) for sustainable use of Biodiversity. The aims are: to recover popular wisdom usage of native plants for health care, vegetal coverage, and food supply; to enhance the school curriculum by introducing biodiversity contents (knowledge, attitudes and values) and to promote skills for a future youth productive activity. Native vegetal germoplasm was collected from Kachimayu river watershed and planted on the school terraces (*ex situ* biodiversity conservation). 3rd, 4th and 5th grade students (8 -10 years old) have been using knowledge, skills and attitudes about nature conservancy working on: Seeding, watering, cultivating, harvesting plants, then transforming them on useful long life vegetal products, such as: herbal teas, rubbing creams, medicinal syrups and oily essences. Students recognise vegetation, using their own senses: smelling, touching and studying external features directly, developing affection and feelings for nature as a vital part of their elementary value education. The theoretical classroom concepts are enhanced with practice in natural environment, allowing a close contact to t. This school framework allows to exchange data about plant use from student's relatives and families. All these contents are incorporated into the curriculum after being validated for future replication.

KEYWORDS

Environmental education, schoolkids, biodiversity, Andes, aromatic and medicinal plants, green market, values, attitudes, traditional knowledge

RÉSUMÉ

On présente l'expérience du centre éducatif Pukllasunchis (Cusco-Pérou), dans l'enseignement des contenus de la biodiversité à l'école, à travers de l'atelier productif des plantes aromatiques et médicinales andines. Les objectifs de cette expérience sont : la revalorisation et récupération des savoir et habilités traditionnels sur l'usage de la biodiversité, la recherche des alternatives pour l'usage durable de la biodiversité (aspects relatifs à la santé, couverture végétale, sécurité de la nourriture) et la promotion de l'incorporation de contenus sur la biodiversité local dans le curriculum scolaire. Dans les terrasses cultivées de l'école, située dans le micro bassin de la rivière Kachimayu, on élève *in situ* plusieurs des espèces du germoplasme provenant de cet endroit naturel. Les élèves de 3^{ème}, 4^{ème} et 5^{ème} année de primaire (8 – 10 ans), participent à la culture organique de ces espèces, puis ils récoltent le matériel à utiliser et finalement ils élaborent artisanalement des teintures, des tisanes, des pommades et des huiles essentielles. Les élèves reconnaissent les plants à travers les sens, ainsi, ils exercent des habiletés motrices et affectives. Cet atelier renforce les connaissances acquises en classe et permet l'échange du savoir préexistence des élèves au sujet de l'utilisation des plantes. Il s'agit aussi de promouvoir des espaces (compostera, terrasses, atelier) pour apprendre en dehors de la salle de classe, en contact direct avec l'objet d'étude. Ces contenus s'incorporent au curriculum scolaire dans le thème de la biodiversité dans les écosystèmes andins, et sont développés et évaluent par les professeurs.

MOTS-CLÉS

éducation pour l'environnement , élèves, biodiversité, Andes, plants aromatiques et médicinales, produits BIO, values, attitudes, connaissance traditionnel.

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INTRODUCTION

Consumerism and odd cultural patterns of western society are invading the whole world. External western powerful forces are depleting old traditional wisdom, cultural values and knowledges. A serious damage has been done to education especially in rural areas. However cultural knowledge and traditional wisdom are still available in older generations. The aromatic and medicinal plant school workshop (AMPSW) was born in 1996 and its design has been based on the rich vegetal biodiversity of the high Andes and its inhabitant's traditional knowledge of the environment. Pukllasunchis is a pilot educational non-traditional school that decided to include this productive activity on the school timetable. Pukllasunchis was interested on environmental education since its previous experience working educational, social and intercultural issues. This framework gave to the AMPSW the perfect background for educational purposes. Pukllasunchis' focus is trying to promote a more sustainable value education based on attitudes and skills rather than in memory concepts as old traditional scheme does.

MAIN AIMS

- To recover popular wisdom on usage of native plants for health care, vegetal coverage, and food supply.
- To enhance the school curriculum by introducing biodiversity contents (knowledge, attitudes and values) towards an environmental education curriculum making.
- To promote skills amongst students and teachers for a future productive activity.

CONTEXT

Pukllasunchis School is located in the city of Cusco- Peru, at 3300 m.o.s.l. at San Sebastian District and is geographically located in the middle-low part of the watershed of Kachimayu River. The upper part of this watershed still has native woods and high Andean forest patches. This is the last remaining native flora reserve nearby². A high-density biodiversity distribution area has been located at Kachimayu riverbed for aromatic and medicinal local plants³. There are some local initiatives guided by Pukllasunchis and the Ecology Institute of Medicinal Plants (IEPLAM) to protect legally this area for educational, recreational and ecotourism purposes⁴. Some local rural communities are starting to protect *in situ* local vegetal biodiversity at this watershed in order to avoid erosion process. Native vegetal germoplasm was collected from Kachimayu river watershed and planted on the school terraces as in *situ* biodiversity conservation practice in 1995/6.

MATERIALS AND METHOD

AMPSW was included on the educational program and timetable. Male and female students from 2nd, 3th, 4th and 5th grades applied for this workshop (7 - 11 years old)⁵. Natural and social science's teachers worked together for making contents of this workshop considering the appropriate knowledge, skills, attitudes and value contents for each one of the

² See Erzinger, Florian and Juan Diego López-Giraldo. The Valley of Kachimayu River. Pedagogical Trail and Ecological Reserve Proposal for the city of Cusco in www.audes-conference.ethz.ch/abstracts

³ Justo Mantilla, IEPLAM. Personal communication.

⁴ Erzinger and López-Giraldo. op.cit.

⁵ Nowadays, high school students (16 years old) are applying too. They make oily vegetal essences.

grades on the elementary school curriculum. The school provides a small fund to buy the basic equipment (drying module, electronic weight meter, propane stove, agricultural basic tools, computer and printer) and materials (Kraft paper, scissors, glue, grease, amber-glass pots, plastic lids, funnels, oils, vegetal grease, sugar, glass jars, lab materials, etc.)⁶. The school also provides a minimal laboratory room as physical location for the workshop; however some activities were done outdoors or inside the classrooms. Groups' maximum size of 10 students was allowed amongst each one of the grades. Local literature reviews, school questionnaires and informal interviews with professionals, volunteers, and local elderly people were carried out since 1997 to gather some basic data. Training courses on Andean aromatic and medicinal plants were prepared by IEPLAM biologists for Pukllasunchis teachers and a continuous field research on aromatic plants has been done (still does) by Pukllasunchis technical staff in Kachimayu area since 1998 onwards.

ACTIVITIES

Educational outdoors activities are scheduled for seeding, watering, fertilizing, and harvesting aromatic and medicinal plants, then transforming on useful long life vegetal products, such as: herbal teas, rubbing creams, medicinal syrups and recently extracting oily essences.

The AMPWS works on the appropriate use of natural resources at school level, following a nature cycle leading to: a systemic view of the environment with active participation of the school community and a sustainable use (See Figure No 1).

Figure No 1. Basic natural cycle followed plus Scholar economic workshop flow

Organic rubbish → Composting → Organic fertiliser → Aromatic and medicinal plants → Transformation → Green Market Sales → Organic rubbish.

→ Sales → School Common benefits (Collective Green fund) → New equipment / materials (Self-reliance).

Several activities are programmed for the AMPWS. These ones follow an aged-ability pattern and are complementary related with practical job in natural and social science learning. Some of them are listed below.

Activities:

To allow skills development:

- To do experiments using senses: smelling, touching, shaping, feeling, coloring, tasting, hearing and then communicating and reporting to others their findings.
- To interview the inhabitants nearby the school on aromatic and medicinal plants usage.
- To use specimens (alive) to study morphology and physiology, and habitat description.
- To develop practical skills working on the lab and/or the field.

⁶ More detailed information on : O Chauvin, Lucien (editor). *Education for the Future. Environment and Sustainable Development in Peru*. Lima. Catholic Institute of International Relations. International Cooperation for Development. CIIR-ICD. 2000. Pags 74-93. www.ciir.org Publications.

- To harvest aromatic and medicinal plants.
- To make compost
- To use green fertiliser
- To distinguish between native and exotic plants.
- To work together by groups with several responsibilities at the same time.
- To compare natural environments and urban environments
- To put into practice communicating skills while writing labels and selling.
- To make decisions and hold opinions.
- To prepare products following basic scientific methods, rules and instructions.
- To identify local plants using basic biological features (smell, flower colour, leave shape), and students-self-made ones.
- To design new packing alternatives for the products.

To allow attitudes development:

- To have a respectful attitude while collecting plants and/or working on nature.
- To optimize valuable materials and resources while working with them.
- To hold a co-operative attitude while working on a productive activity
- To value elder relatives or population knowledge about plants
- To look for new possible cultivating sites at family/community basis (abandoned terraces, community grounds, yards, public parks) near the school for replicating the experience and expand this pilot project on community basis.

To allow contents development:

- To investigate aromatic and medicinal properties from each one of the plants (using live fonts and text ones)
- To study biodiversity on landscapes nearby such as birds, frogs, toads, fish, herbs, weeds, mushrooms, caterpillars, butterflies, bugs and other arthropods and invertebrates (worms).
- To study outside the classroom on a natural wild vegetal biodiversity or cultivated plants.
- To do experiments for biological pest control.
- To try and develop new organic crops systems.
- To apply theoretical concepts while working on the field or at the lab.
- To learn about aseptic practices while preparing medicines and food products.
- To practice mathematics calculation while weighting, measuring and selling.
- To have a systemic and holistic view from scholar environment and other ones.

RESULTS

A permanent AMPWS has been established in Pukllasunchis School. Since 1997, more than 90 students par year learned about local biodiversity and acquired skills in this productive activity (See **Figure No 2 and No 3**). Nowadays, 8 school terraces are planted with native and some exotic aromatic and medicinal plants as productive vegetal basis (almost 350 m²). The list of main native species and its properties are listed in **Table No 1**.

Each two months, an open market is organized by Pukllasunchis to show the productive workshops' products at the artisan neighborhood of San Blas. Students sell the products to the general public and tourists. The products offered in the market are shown on **Table 2**.

More than 400 photographs have been taken to identify on the field Kachimayu flora and they are being classified for an elementary school publication. Students are able to recognize vegetation in the field using their own senses, smelling, touching directly and they are developing affection and feelings for nature as a vital part of their elementary value education. The theoretical classroom concepts are enhanced with practice in natural environments, allowing a close contact to it. This school framework has allowed fluid exchanging information on plant use from student's relatives and families enhancing the school community relationship. All these contents are been incorporated into the curriculum after being validated for future replication.

Table No 1. Some species planted on Pukllasunchis school terraces. They are classified by use and the plant' part used is also indicated.

No	Common Name ⁷	Scientific name	Used Part	Main Aromatic and Medicinal Properties
1	<i>Cedroncillo</i>	<i>Aloysia herrerae</i>	Leaves	Hearts affections with nervous origin. Stomachache. Somniferous, sedative
2	<i>Ch'ilka</i>	<i>Ageratina sternbergiana</i>	Leaves	Against fever caused by mosquitoes bits. Fractures and hits (inflammation). Post childbirth rubbing.
3	<i>Ch'iri – Ch'iri</i>	<i>Grindelia boliviana</i>	Leaves and flowers	Antiseptic, antibacterial in respiratory tract. Hits, fractures, black and blue marks, dislocation.
4	<i>May'cha</i>	<i>Senecio rudbeckifolius</i>	Leaves	Intestinal fever, diarrhea, dysentery. Hits and muscular pains.
5	<i>Muña</i>	<i>Minthostachys setosa</i>	Leaves	Flue, eyes relax, stomachache and digestive. Preserver and aromatic. Against mites (acaridae)
6	<i>Payqo</i>	<i>Chenopodium ambrosiodes</i>	Leaves and seeds	Stomachache, digestive, antiparasitic
7	<i>Yawar ch'onka</i>	<i>Oenotheraea rosea</i>	Leaves and roots	Hits, black and blue marks, luxation, dislocation. Treatment against cystitis.
8	<i>Q'eto – q'eto</i>	<i>Gamochaeta purpurea</i>	Leaves and roots	Throat infection, gastritis, stomachic
9	<i>Chinchirkuma</i>	<i>Mutisia acuminata</i>	Leaves and flowers	Gallstones and kidneystones
10	<i>Markhu</i>	<i>Ambrosia arborescens</i>	Leaves and flowers	Rheumatism, arthritis, post childbirth rubbing, digestive. Condiment.
11	<i>Mullak'a</i>	<i>Muehlenbeckia volcanica</i>	Roots	Hepatic, anti-inflammatory, kidneyaffections, depurative
12	<i>Chiqchipa</i>	<i>Tagetes mandonii</i>	Stems, leaves, flowers and seeds	Condiment. Stomachache.
13	<i>Allqo kiska</i>	<i>Xantium spinosum</i>	Roots	Depurative, anti-inflammatory (prostate and urinary tract). Abortive. Kidney affections.
14	<i>Estrella kiska</i>	<i>Acycarpha tribuloides</i>	Roots and leaves	Decrease of inflammation (in prostate and urinary tract). Abortive
15	<i>Altea</i>	<i>Aculimalva engleriana</i>	Roots	Depurative. Decrease of inflammation in digestive tract
16	<i>Aceitunilla</i>	<i>Monnina salicifolia</i>	Leaves and stem's	Whooping cough

⁷ Most of the common name are given in *quechua* (most comun andean native language)

			cortex	
17	<i>Ayaq zapatillas</i>	<i>Calceolaria engleriana</i>	Leaves and flowers	Flowers: cough Leaves: Liver and kidney treatment
18	<i>Pinco – pinco</i>	<i>Ephedra americana</i>	Stems and leaves	Diuretic

Table 2. Aromatic and Medicinal Plants products made by Pukllasunchis School kids.

Product	Procedures	Number of types
1. Herbal teas	Collection, Drying leaves. Selection, Weight and Pack.	5 (Muña, mint (<i>Melissa piperita</i>), tomillo (<i>tymus vulgaris</i>), toronjil (<i>Melissa officinalis</i>), allqo kiska)
2. Creams (for Rubbing).	Grease based. Heat. Pack	8 (Chiri-Chiri, Calendula, muña, ch'ilka, maych'a, yawar ch'onka, eucalipto and "for COUGH")
3. Teintures	Alcoholic extraction. Time. Filter. Pack	5 (Artichokes, Salvia (<i>Salvia officinalis</i>), maych'a, ch'iri-ch'iri, tomillo)
4. Essences	Oily extraction. Packing	3 (Muña, markhu, ch'ilka)

DISCUSION AND CONCLUSIONS

This workshop has been linked with other educational activities, such as rubbish classification and recycled paper workshop trying to manage nature cycles and networking. This environmental education experience may guide to avoid future destructive behaviors against nature and to promote respect, justice, co-operation, diversity, harmony and transcendence.

Besides, this workshop is an important tool to diffuse and spread -between scholar and non scholar population- the use of medicinal plants for health care. It also allows working in biodiversity contents: by making use of cultural knowledge - so the students see the meaning of its importance- and local vegetal biodiversity. It gives students a direct experience with biodiversity concerns. We think that if children get involved in direct experiences facts around local biodiversity (so they know it, they transform it, they talk with adult people about it) then they would be able to conserve it. Just like if it were the case of any other value learning like justice: children would be righteous persons if they daily live in justice environments⁸

Finally, this experience is ready to be shared with Pukllasunchis' Rural Schools project. These children (quechua native speakers) have such a big knowledge about their environment as adults do. So this would be an even more meaningful learning experience for them.

"An educational experience for learning Andean biodiversity contents in the school" by Juan Diego López-Giraldo, Noé Chávez, Ingrid Salcedo, Yda Torreblanca, Caterina Cardenas. Abstract submitted to Bioed 2000 Symposium, May 2000. París.

⁸ Ortega, P et al. *Valores y educación*, Barcelona, Ed. Ariel, 1996.