

# **An experience for learning Andean biodiversity contents included on the elementary school curriculum**

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## **SUMMARY**

This is an experience of the aromatic and medicinal plants school workshop in Peru for using biodiversity on a sustainable local basis. Our 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). 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> grade students (8 -10 years old) have been using knowledge, skills and attitudes about nature conservancy while seeding, watering, cultivating, harvesting plants, and transforming them on useful long life vegetal products, such as: herbal teas, rubbing creams, medicinal syrups and oily essences. Students recognize 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 outdoors, allowing a close contact to the environment. This school framework has allowed to exchange data about plant local usage from student's relatives and families. These contents are incorporated into the curriculum after being validated for future replication on public urban and rural school in Cusco surroundings mainly.

## **KEYWORDS**

Environmental education, schoolkids, biodiversity, Andes, aromatic and medicinal plants, green market, values, attitudes, traditional and cultural 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<sup>ème</sup>, 4<sup>ème</sup> et 5<sup>ème</sup> 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 habilités 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 CLES**

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 step by step the whole world. External western powerful forces are depleting old priceless traditional wisdom, cultural values and knowledge. A serious damage has been done to the education process especially in rural areas. However, cultural knowledge and traditional wisdom are still available in some older generations. The aromatic and medicinal plant school workshop (AMPSW) was born in 1996 and its design is based on the rich vegetal biodiversity of the high Andes and its inhabitant's traditional and cultural knowledge of the environment. Pukllasunchis is a pilot educational non-traditional school that decided to include this productive activity on the school academic timetable. Pukllasunchis was interested on environmental education since its previous experience working in 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 memoristic concepts as old traditional scheme does.

## MAIN AIMS

- 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.
- To recover popular wisdom on usage of native plants for health care, vegetal coverage, and food supply.

## CONTEXT

Pukllasunchis School is located in the city of Cusco- Peru, at 3300 m.o.s.l. on San Sebastian District, NE , and it 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. The last remaining native flora reserve nearby<sup>2</sup>. A high-density biodiversity distribution area has been located at Kachimayu riverbed for aromatic and medicinal local plants<sup>3</sup>. 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 purposes<sup>4</sup>. Some local rural communities are starting to protect *in situ* local vegetal biodiversity at this watershed combating 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 and 1996.

## MATERIALS AND METHOD

AMPSW was included on the educational programming and timetable. Male and female students from 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> grades applied for this workshop (7 - 11 years old)<sup>5</sup>.

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<sup>2</sup> 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](http://www.audes-conference.ethz.ch/abstracts)

<sup>3</sup> Justo Mantilla, IEPLAM. Personal communication.

<sup>4</sup> Erzinger and López-Giraldo. op.cit.

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 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, amber-glass pots, plastic lids, funnels, oils, vegetal grease, sugar, glass jars, lab materials, etc.)<sup>6</sup>. The school also provides a minimal laboratory room as physical location for the workshop, however some activities are realized 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. A continuous field research on aromatic plants in quechua language has been done (still does) by Pukllasunchis technical staff in Kachimayu area since 1998 onwards and translated in to Spanish for wide local replication mainly in urban schools.

## ACTIVITIES

Educational outdoor 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 in a more sustainable use (**Figure No 1**).

**Figure No 1.** Basic natural cycle followed. Plus school economic workshop flow

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

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

Programmed Activities for the AMPWS follow an aged-ability pattern and they are complementary related with practical job in natural and social science learning. Some of them are listed below:

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.

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essences.

<sup>6</sup> 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.cjir.org](http://www.cjir.org) Publications.

- To use specimens (alive or *in situ*) to study morphology and physiology, and habitat description (Drawings and Mapping).
- To develop practical skills working on the lab and/or the field.
- To harvest aromatic and medicinal plants following indications and the moon cycle.
- To make compost for improving soil quality.
- To use green fertilizer avoiding chemical ones and using pulses for multiple use.
- To distinguish between native and exotic plants. Benefits and costs.
- To work together in-groups with several responsibilities at the same time.
- To put into practice communicating skills while writing labels and selling products.
- 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 color, leave shaping), and modeling.
- To do experiments for biological pest control. Try and error.

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 and nature.
- 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 compare natural environments and urban environments. Value Clarification.
- To design new packing alternatives for the products. (Creativity).

To allow **concepts** development:

- To investigate aromatic and medicinal properties from each one of the plants (using live samples and reviewing Herbarium collections and librarian books)
- To learn about wide existing 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 and/or cultivated grounds. Soil types, air quality, water springs and its relationship with living creatures and natural cycles.
- To try and develop new organic crops systems. Theoretical and practical challenges.
- 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 the school environment and global society interactions.

## RESULTS

A permanent AMPWS has been established in Pukllasunchis School since 1997. More than 90 students and/or teachers *per* year learned about local biodiversity and acquired skills in this productive school activity (**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 m<sup>2</sup>). The list of main native species and its properties are listed in **Table No 1**.

An open market is organized by Pukllasunchis each two month during the academic year to show the productive workshops' products at the artisan neighborhood of San Blas in Cusco City. Students sell all their hand-made products to the general public and tourists. The products offered in this market today 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 a coming elementary school teacher's training publication. Students are able to recognize vegetation in the field using their own senses, smelling, touching directly vegetation 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 and the traditional and cultural knowledge has been recovered enhancing original basic scientific information collected at the beginning of this research. All these contents are been incorporated into the curriculum after being validated for future replication at State urban and rural schools

**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 <sup>7</sup>	Scientific name	Used Part for Transformation	Main Aromatic and Medicinal Properties
1	<i>Cedroncillo</i>	<i>Aloysia herrerae</i>	Leaves	Affections of the hearts originated by nervous. Stomachache, soft somniferous, natural 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>	<b>Grindelia boliviana</b>	Leaves and flowers	Disinfectant for wounds. As antiseptic/antibacterial in infections of the respiratory tract. Hits, fractures, black and blue marks, dislocations.
4	<i>May'cha</i>	<i>Senecio rudbeckiifolius</i>	Leaves	Intestinal fever, diarrhea, dysentery. Hits and muscular pains.
5	<i>Muña</i>	<i>Minthostachys setosa</i>	Leaves	For influenza, eyes relax, stomachache and as digestive drink. Preserver and aromatic prop. Against mites (acaridae)
6	<i>Payqo</i>	<i>Chenopodium ambrosioides</i>	Leaves and seeds	Stomachache, digestive, antiparasitic
7	<i>Yawar ch'onka</i>	<i>Oenothera rosea</i>	Leaves and roots	Hits, black and blue marks, luxation, dislocation. Treatment against cystitis.
8	<i>Q'eto-qeto</i>	<i>Gamochaeta purpurea</i>	Leaves and roots	Throat infection. Gastritis, stomachache
9	<i>Chinchirkuma</i>	<i>Mutisia acuminata</i>	Leaves and flowers	For gallstones and kidneystones
10	<i>Markhu</i>	<i>Ambrosia arborescens</i>	Leaves and flowers	In rheumatism, arthritis, post childbirth rubbing. Digestive, spicy, Condiment.
11	<i>Mullak'a</i>	<i>Muehlenbeckia volcanica</i>	Roots	Hepatic, anti-inflammatory, kidney affections, depurative.
12	<i>Chiqchipa</i>	<i>Tagetes mandonii</i>	Stems, leaves, flowers and seeds	Condiment. Spicy, Stomachache.
13	<i>Allqo kiska</i>	<i>Xantium spinosum</i>	Roots	As depurative and as anti-inflammatory

14	<i>Estrella kiska</i>	<i>Acycarpha tribuloides</i>	Roots and leaves	(prostate and urinary tract). Abortive. Kidney affections Decrease of inflammation (in prostate and urinary tract). As abortive
15	<i>Altea</i>	<i>Acaulimalva engleriana</i>	Roots	As depurative. Decrease of inflammation in the digestive tract
16	<i>Aceitunilla</i>	<i>Monnina salicifolia</i>	Leaves and stem's cortex	For whooping cough
17	<i>Ayaq zapatillas</i>	<i>Calceolaria engleriana</i>	Leaves and flowers	Flowers: for coughs Leaves: for liver and kidney treatment
18	<i>Pinco – pinco</i>	<i>Ephedra americana</i>	Stems and leaves	As a diuretic

Table 2. *Aromatic and Medicinal Plants products made by Pukllasunchis Schoolkids (Up dated Jun 2000.*

Product	Procedures	Number of types
1. Herbal teas	Collection, Drying leaves. Selection, Weight and Pack.	<b>5</b> - <b>Muña</b> , ( <i>Minthostachys setosa</i> ), <b>mint</b> ( <i>M. piperita</i> ), <b>Tyme</b> ( <i>Tymus vulgaris</i> ), <b>Toronjil</b> <i>Mellisa officinalis</i> , <b>Allqo kiska</b> ( <i>Xantium spinosum</i> )- .
2. Creams (for Rubbing and for cough).	<b>Grease based. Heat. Pack</b>	<b>8</b> - Chiri-Chiri, Calendula, Muña, Ch'ílka, Maych'a, Yawar ch'onka, and <i>Eucaliptus</i> - .
3. Tinctures	Alcoholic extraction. Time. Filter. Pack	<b>5</b> – Artichokes, <i>Salvia officinalis</i> ), Maych'a, Ch'íri- ch'íri, Tyme - .
4. Essences	Oily extraction. Packing	<b>3</b> - Muña, Markhu, Ch'ílka- .

## DISCUSSION 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 while teaching at early stages in formal, non-formal and informal learning procedures. Besides, this workshop is an important tool to spread between the school community and local population in general, the traditional value usage of aromatic and medicinal plants. This will contribute to solve basic human needs with low-input optimizing the distribution of scarce money resources. For example first, the usage of local medicinal plants cultivated on family basis for community health care. Second, a multiple usage of aromatic plants as green coverage avoiding erosion on abandon cliffs and steep lands for further cultivation. And thirdly, using aromatic and local plants as a valuable food resource. It is necessary to promote eating local pulses and fruits as protein and vitamins sources avoiding the present popular replacement of rich nutritious food (p.e tarwi beans) for pasta or abandon traditional dishes and condiments “to be more western criollo and less indigenous ([chol@](#))”. This is a misunderstanding that is guiding people towards an increase of bad nutrition and another lost on identity and self-esteem.

Working with biodiversity contents made out of cultural and scientific knowledge is a pilot experience to be considered for replication. The students can see directly the meaning of its relevance of the local vegetal biodiversity existence and its relationship with their quality of life. It gives students a direct experience with biodiversity global concerns too. We think that if schoolkids get involved in direct experience facts around local biodiversity. they will

know it, they will love it, they can transform it, they talk with adults and elderly people about it, they can learn to respect it. Then, they will care, they will value it and finally **they would be able to conserve it**. Just like if it were the case of any other value learning like justice: children wouldn't be righteous persons if they live daily in unfair (non-justice) environments<sup>8</sup>

It is only the experience of living a value that makes you learning it. There is no other way.

Finally, this experience is ready to be shared with Pukllasunchis' Rural Schools project. Quechua native schoolkids have such a big knowledge about their environment as adults do. And this experience would be even more a meaningful learning experience for them while recovering and valuing their own cultural knowledge in today's world.

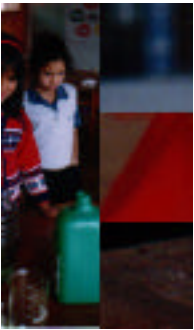


Figure 1.



Figure