

Sustainable Development and Environmental Problems: A High-School Pedagogical Experience

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(EEDD stands for Environmental and Sustainable
Development Education)*

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Outline

- Introduction: Environmental and Sustainable Development¹
- Scientific Workshops
- Example of scientific questions treated by the students
- A mediatic experience: the Nanook expedition and the Banquise Mission
- Pedagogical results assessment

¹Environmental and Sustainable Development: EEDD or E2D2

The story began with two federative events...

- October 01:
 - *Mission Banquise* (Jean-Louis ETIENNE)
 - Georges BRASSENS College
 - Anaïs (LEGOS)
- May 05:
 - Alone in the Arctic night(lecture S Levin)
- 2005-2006
 - Nanook Expedition (Stephane LEVIN)
 - Léon Blum College



...and two encounters with passionate scientists



→ students, teachers and scientists decided to work together!

Students were immediately enthusiastic about this project!

- Attractive ideas:
 - polar bears life and protection
 - environmental issues
 - spirit of adventure and dream



....and may be because they were interested in sciences!

Teachers immediately involved in these projects

- Attractive ideas
 - A good opportunity to teach **sciences**
 - Motivation due to recently created EEDD program (Education for Environment and Sustainable Development)
- EEDD pedagogical conditions and objectives: keep the balance between
 - education on scientific disciplines (here physics & chemistry) with emphasis on content and methods
 - A workshop based pedagogy taking advantage of the partnership with scientists working on a “real” project

EEDD

- not a new discipline
- obligatory since September 2004
- multidisciplinary based
- must be organized during regular classes
- must include outdoor projects and/or classes
(for example cultural scientific workshop)
- opening to environmental AND sustainable development topics

Sustainable development

- “Sustainable development is development that meets the needs of the present without compromising the ability of futures generations to meet their own needs”



Brutland Rapport

“Our Common Future” in 1987

Three Aspects: A Unique Approach

Time scale

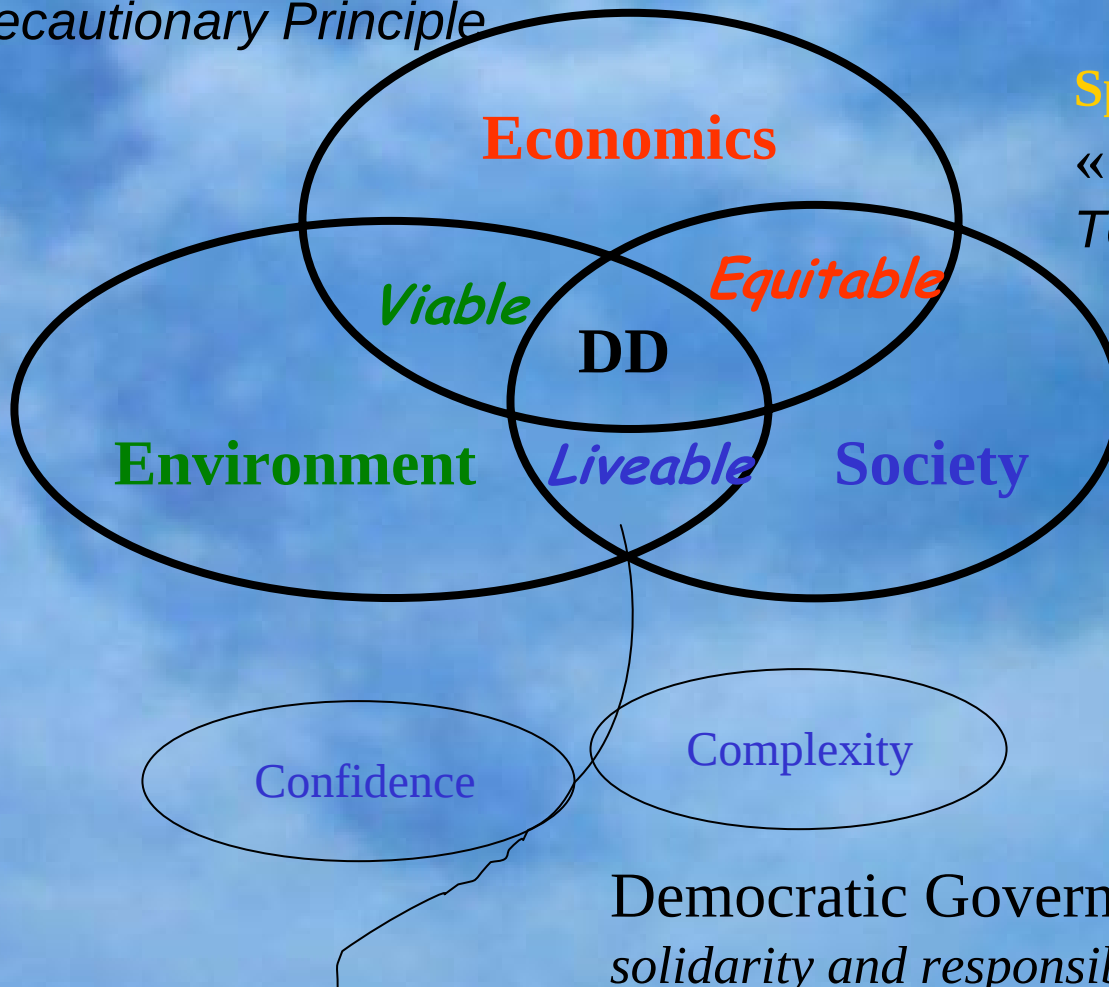
« from short to long term analysis »

Precautionary Principle

Spatial scale

« from local to global »

Territoriality Principle



EEDD Workshops

- EEDD workshops were created institutionally to:
 - encourage students to work as a team,
 - put science in its historical and cultural dimension,
 - have an opportunity to do practical experiments and achieve concrete realisations,
 - reinforce the practice of scientific methods,
 - offer the opportunity to discover scientific careers.

Scientific Workshops

- Meeting place between educational and research institutions
- A student practical discovery of scientific practice in general
 - Easier for “hard” sciences
 - Proved to be more difficult for social and historical sciences, ...

Workshop daily life

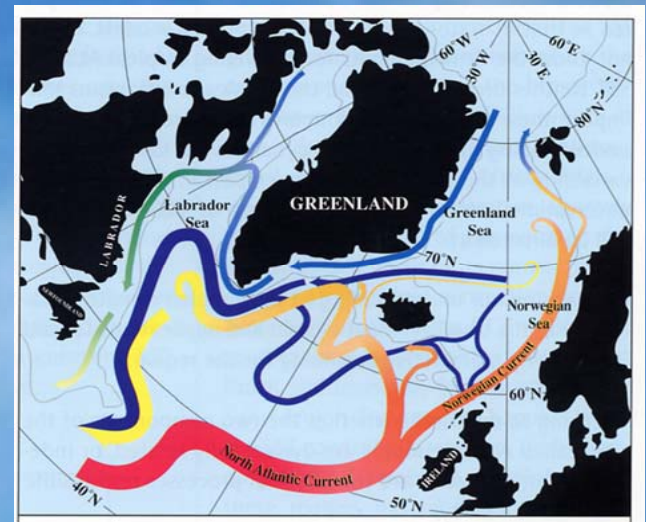
- Informal education
- Collective work
- Individual adapted tempo
- Attractive goal:
 - Bringing a real scientific contribution (participation to regular experimental campaigns)
 - Communication (expositions, ...)



Teacher role: boost student own initiative!

Pedagogical advantages

- Experience real scientific investigation (observations, questions, experiments and conclusions)
- Facing difficult questions (for example: atmospheric temperature gradients, carbon cycle, but also practical question such as the workshop budget)
- Cooperative effort between highly and weakly skilled students, each group keeping its own interest and rhythm



Examples of Scientific Questions Treated with the Students

- Climatology
- Climatology history
- Biological diversity
- Greenhouse effect and global warming
- The ocean machinery

- Definition
- Different climates (major characteristics, fauna, flora, ...)
- The complex ocean « machinery » resulting from various interactions
 - atmosphere (pedagogical illustration: temperature variation)
 - lithosphere
 - hydrosphere (pedagogical illustration: ocean role on temperature moderation)
 - cryosphere
- other parameters: elevation, latitude

Climatology History

- How to learn about past Earth climate changes?
 - short time: evidence in books, contemporary memory, etc...
 - long time: paleontology, tree rings, ancient coral, gas bubbles trapped in ice cores, ...

Glacier des Argentieres Alpes

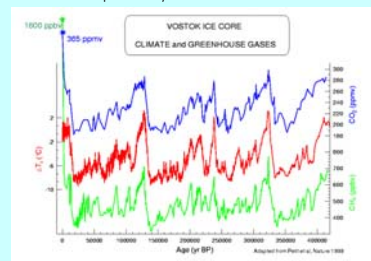


1770



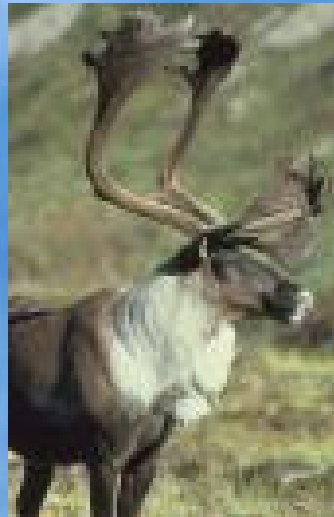
1966

Variations de la température du CO₂ et du CH₄ entre 0 et -400 ka
D'après les analyses de la carotte de Vostok



Biological Diversity: the Nanook expedition

- Three student groups classified 3 ecosystems:
 - Arctic Ocean
 - Toundra
 - Ice field
- Importance of plankton in these ecosystems



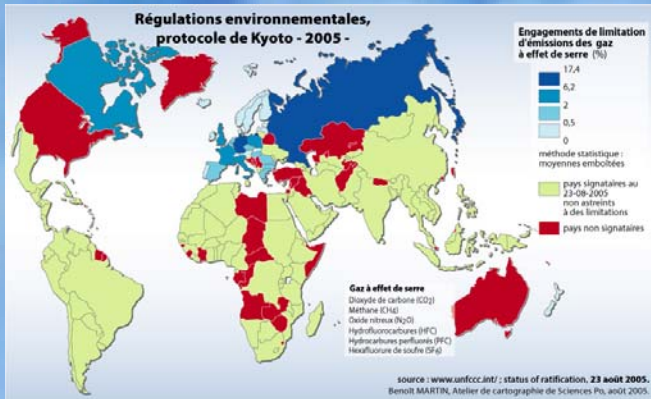
Biological Diversity: Local Examples



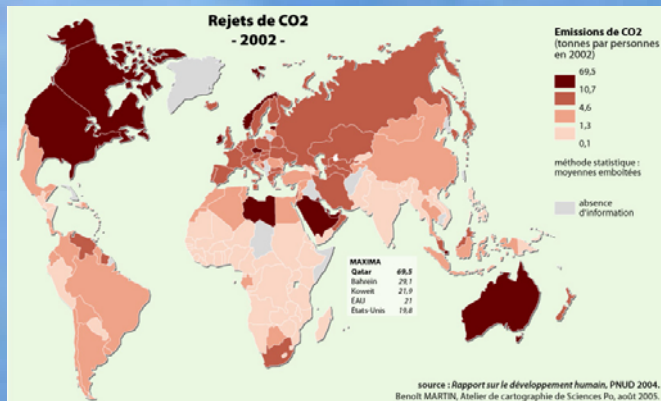
- The high-school aquarium
 - emphasizes ecosystem equilibrium, and by extension our planet fragility
- The « Bouconne » forest
 - work with forest guards on the actual risks and threats
- A mountain ecosystem (Pyrénées)



Greenhouse Effect and Climate Change



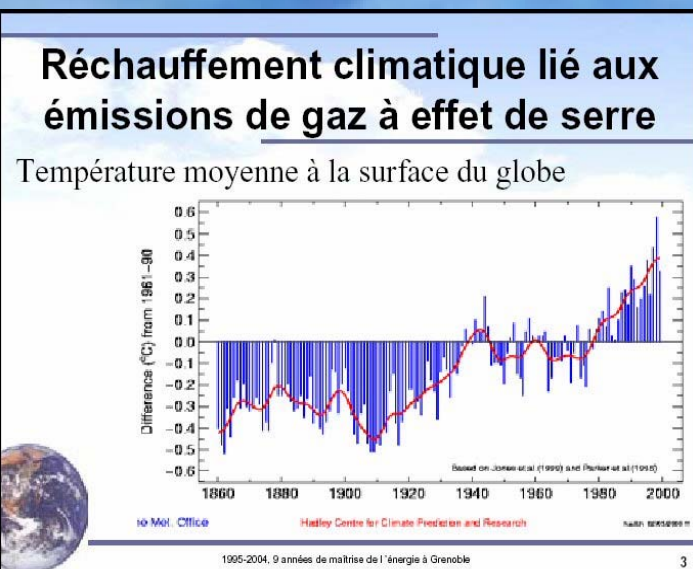
- Short time



- Greenhouse effect :
 - Natural
 - Anthropogenic
- Most important greenhouse gases
- What and who is responsible for greenhouse gases emissions?
- Carbon dioxide
 - Kyoto Protocol
 - Individual and collective solutions

Greenhouse Effect and Climate Change

Long time



- Increase of average temperature
- Disappearing Arctic ice and permafrost
- Disappearing glaciers
- Oceanic streams modifications
- Albedo modification
- Modification of carbon cycle
- Sea level rising
- Paroxistic climatic episodes

The Ocean “Machinery”

MISSION
BANQUISE



- The oceanic carbon cycle:
 - The role of dissolved macronutrients (nitrates, silicates, phosphates,...)
 - The ocean CO₂ biological pump
- Oceanic circulation:
 - temperature effect
 - salinity effect
- The oceans thermal inertia

A Mediatic Experience ☺

Mission Nanook

- several meetings with Stéphane Lévin (Internet, Phone, Lectures...)



- ...a first-hand testimony: *“the arctic ecosystem and inuit’s life have already been modified by global warming”*

Mission Banquise

- a french massive participation to J.L. Etienne expedition



- the origin of a close relationship with CNRS researchers from Toulouse

Pedagogical results assessment

- Collective work
- Work on real subject
- Action and understanding

PROJECT EVALUATION

work in small groups
(3 or 4 students)

Help each other to go forward
(Student Solidarity)

Collective Work

To involve
others
disciplines

Self-assessment of the group
or individual work

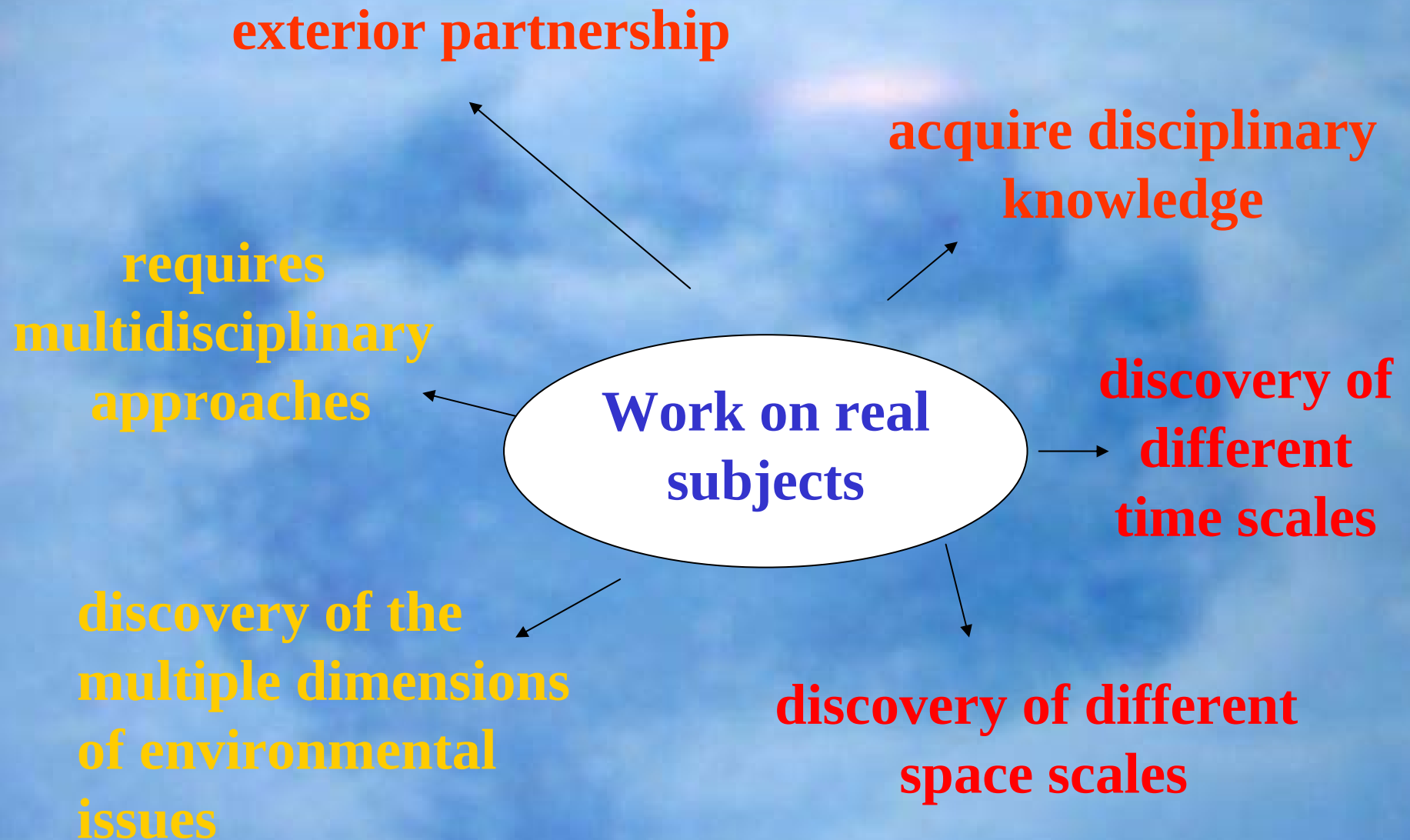
Self organization
and planification

Legend:

Red : achieved goal

Black : goal not achieved

Yellow: goal partly achieved



Legend:

Red : achieved goal

Black : goal not achieved

Yellow: goal partly achieved

**responsibility and
involvement**



**Accept to change
personal beliefs**

**To be able to understand
contradictory interests**

Act as a citizen

Legend:

Red : achieved goal

Black : goal not achieved

Yellow: goal partly achieved

First assessment

- Student participation: no desertion during the school year, and some students continued for several years
- Discovery of the scientists professions
- Discovery of scientific practice
- Increased awareness of:
 - ecological problems
 - social problems induced by ecological ruptures

Impact on student vocation

- 4 years after the student participation to this EEDD program:
 - Students with initial low levels have increased performances in scientific matters
 - Improved social attitudes
 - Increased scientific vocation materialized by specialized orientations ... especially girls.
 - Attitude towards environment? Difficult to assess ...

Acknowledgements

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- High school and teachers colleagues
- ...Polar Bears

