PROCEEDINGS OF THE INTERNATIONAL CONFERENCE

TEACHING COMPLEXITY AND UNCERTAINTY ON ENVIRONEMENTAL ISSUES

PRACTICES, THEORIES AND PRODUCTS

Edited by François Mélard & Pierre Stassart (SEED-ULg)

An International and Interdisciplinary Working Conference

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University of Liège, Dept. of Environmental Sciences and Management

SEED
UNITÉ DE RECHERCHE

Université de Liège ULg

Arlon campus environnement

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THE CONFERENCE RATIONALE

Environmental studies and management are singular in that they entail the development of holistic thinking and action for which a transversal approach is a must. We are testing this singularity in a range of themes as diverse as biodiversity management, agro-ecology, community participation, and the study of environmental science and technology. Unlike the "pure" natural sciences, environment and sustainability studies entail an "ecological" approach for which the various types of knowledge (biological, chemical, physical, etc., but also legal, economic, sociological, and so on) have to be tamed in order to be able to link them up. It is more a matter of grasping the many social and technical dimensions of the issues that are studied and taught than of making forays into a so-called interdisciplinarity in which the tensions between (scientific) fields replace the tensions among the tangle of practices and practical knowledge that are manifested by the stakeholders themselves.

The boundaries of environmental issues are by nature moving, changing, and closely related to the technical development and needs of society. They often put themselves forward at the outset in the form of controversies, scientific and technological uncertainties, and the complex network of interdependencies that they reveal. As such, they challenge the separations between scientific disciplines. *Far from the usual practices of university education and training, such controversy, uncertainty, and complexity can be seen as genuine resources for quality education that is open to the realities of today's world.* From this standpoint, they also raise new challenges of collaboration among the staff in charge of the education and training.

If we take a pragmatic approach (Dewey 1938), such subjects lend themselves excellently to the mobilization of 'situated' approaches, that is to say, learning approaches that focus more on *active* experience (Masciotra and Morel 2010). This entails either having students experience real-life situations that are shared by the practitioners themselves or putting them directly in a situation. Their learning will come then from what they make of the situation and how they experience it.

What kind of university graduate do we need? Alongside top specialists who focus on mastering specialized techniques and knowledge, more and more importance is being given to the training of environmental 'general practitioners' who are able to circumscribe issues and challenges that often lead them away from the territories of their original disciplines. In that respect, acquiring the skills needed to explore unstable and non-stabilized environmental situations is a must. When they hold managerial or leadership positions they will have to cope with a range of stakeholders, each of whom often has very different types of knowledge, ways of acting, world views, and responsibilities that must be brought together. Linking up these different elements is as much a necessity as a challenge. How can we prepare our students for such trials? How can we equip them with the theoretical, methodological, and human resources required to cope with such situations?

Given that one of the particularities of environmental education and training is to avoid cutting the subjects' scientific and technical dimensions off from their political and social dimensions, it is important to explain very clearly and to develop a genuinely critical mind in such programs. This means not only the critical mind that prompts one to develop or use such and such technical analytical protocol strictly, but, more basically, the critical mind that evaluates the societal consequences of a given piece of knowledge, theory, organizational choice, management scheme, and so on. The demands that employers make of their young university graduates have more to do with their abilities to take stock of existing technologies and policies, and even alternatives thereto,

reliably; deal with specific problems in the field; and understand their implications for society, much more so than the ability to provide optimal hypothetical solutions.

<u>Aims of the seminar</u>

The purpose of the seminar is threefold:

1. The starting point of this seminar is to **exchange experiences** on courses or seminars that are aimed at recognizing and taking account of the controversial, complex, and uncertain nature of environmental issues and their management.

2. Once these empirical foundations have been laid, we shall then **share theories or conceptual propositions** that make it possible to equip these teaching approaches and to give them theoretical and methodological foundations.

3. Finally, we shall focus on the **transition from practices to teaching methods/instruments as pedagogical innovation**, that is to say, we shall ask about the value, use, and transferability of these initiatives outside the contexts of their creation: How can a course or seminar be turned into a teaching instrument for other curricula (as for natural sciences or applied sciences), even in other areas of education? The purpose of all this being to enable a broader, heterogeneous student body to benefit from an approach that invites them to experience this environmental complexity.

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PARTICIPANTS

SCIENTIFIC COMITEE

Mélanie Dupuis, University of California Santa-Cruz, USA

Aurore François, Catholic University of Louvain, Belgium

Jean-Louis Hemptinne, University of Toulouse, France

Pierre Lannoy, University of Brussels, Belgium

François Mélard, University of Liège, Belgium

Pierre M. Stassart, University of Liège, Belgium

Dominique Verpoorten, University of Liège, Belgium

LIST OF THE PARTICIPANTS

Guest speakers

Alexandre Aebi, Université Neufchatel, Switzerland.

Dorothée Denayer, Department of Environmental Sciences and Managment, Université de Liège, Belgium.

Mélanie Dupuis, University of California Santa Cruz, USA.

Catherine Fallon, Department of Political Sciences, Université de Liège, Belgium.

Jean-Louis Hemptinne, Université de Toulouse, France.

Geir Lieblein, Department of Plant Sciences, Norwegian University of Life Sciences, Norway.

François Mélard, Department of Environmental Sciences and Managment, Université de Liège, Belgium.

Nathalie Semal, Department of Environmental Sciences and Managment, Université de Liège, Belgium.

Dominique Verpoorten, IFRES, Université de Liège, Belgium.

Frédérique Vincent, Institut Supérieur d'Ingénierie et de Gestion de l'Environnement, France.

Participants

André, Philippe – Engineer, Université de Liège, Belgium

Bachelet, Jean-François – Sociologist, Université de Liège, Belgium

Bellon, Stéphane – Agronomist, Institut National de la Recherche Agronomique, France

Caeymaex, Florence – Philosopher, Université de Liège, Belgium

Carnol, Monique – Ecologist, Université de Liège, Belgium

Cloots, Rudi - Chemist - Dean of the Faculty, Université de Liège, Belgium

Guillaume, Jean-François – Sociologist,   Université de Liège, Belgium

Corentin Hecquet – Sociologist, Université de Liège, Belgium

Bernard Leyh – Didactician /Chimistry, Université de Liège, Belgium

Clémence Massart – Environmental Management Sc., Université de Liège, Belgium

Julien Pieron – Philosopher, Université de Liège, Belgium

Pierre Stassart - Environmental Management Sc., Université de Liège, Belgium

Tuesday 20 may 2014

Place : council room (Building 140)

9h00 – 9h30 : coffee welcome

9h30 – 9h45 : Opening greetings (Pierre Stassart – SEED - ULg)

Session 1 : educational practices on environmental issues

9h45 – 10h35 : Geir Lieblein (Department of Plant Sciences, Norwegian University of Life Sciences, Norway) « Experiential learning for sustainable education: The case of agroecology at the Norwegian University of Life Sciences) ».

Discutant : Pierre Stassart

Coffee-break (10h35 – 10h50)

10h50 – 11h40 : François Mélard, Nathalie Semal & Dorothée Denayer (SEED, Université de Liège, Belgium) « The exploration of environmental controversies for educational purposes : How to learn again to slow down and hesitate ? ».

Discussant : Julien Pieron

11h40 – 12h30 : Jean-Louis Hemptinne (Université de Toulouse, France): « What exactly is ecology? How should we teach it to contribute to unravel complex environmental issues? ».

Discussant: Florence Caeymaex

Lunch (12h30 – 14h30)

14h30 – 15h20: Alexandre Aebi (Université Neufchatel, Switzerland) : « Sustainable teaching in agroecology: from classrooms to chestnut orchards ».

Discussant: Stéphane Bellon

Coffee-break (15h20 – 15h35)

15h35 – 16h25 : Catherine Fallon (SPIRAL – Université de Liège - Belgium) : "Learning by doing. Policy analysis through focus groups investigation in bachelor curriculum".

Discussant : François Mélard

16h25 – 16h35 : Logistic coordination

17h15 - 19h : Arlon tour

19h30 Official Reception

Wednesday 21 may 2014

Place : council room (Building 140)

Session 2 : theories and conceptual propositions

9h00 – 9h30 : coffee welcome

9h30 – 10h20 : Mélanie Dupuis (University of California Santa Cruz, USA) : Teaching Sustainability as Design ».

Discussant: Bernard Leyh

Coffee-break (10h20 – 10h35)

10h35 – 11h25 : Dorothée Denayer (SEED, Université de Liège, Belgium) « Go Beyond Interdisciplinarity : Environmental managers' skills, between official goals and real practices »

Discussant: Monique Carnol

11h25 – 12h15 : Dominique Verpoorten (IFRES, Université de Liège, Belgium) (TBC) : « Navigating in the uncertain world of controversies – A pedagogical wind rose ».

12h15 – 13h : Open discussion

Lunch (13h – 14h30)

Session 3 : Innovation and valorisation in an environmental transition contexts

14h30 – 14h55 : Prof. Frédérique Vincent (Institut Supérieur d'Ingénierie et de Gestion de l'Environnement, France)

14h55 – 16h : Open discussion

16h15 – 16h30 : Conference closure (François Mélard – SEED – ULg)

16h30 : Celebration : Belgian beers & pies

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CORPUS

In order of appearance:

Geir Lieblein (Department of Plant Sciences, Norwegian University of Life Sciences, Norway) « Experiential learning for sustainable education: The case of agroecology at the Norwegian University of Life Sciences) »

&

François Mélard, Nathalie Semal & Dorothée Denayer (SEED, Université de Liège, Belgium) « The exploration of environmental controversies for educational purposes : How to learn again to slow down and hesitate ? »

&

Alexandre Aebi (Université Neufchatel, Switzerland) : « Sustainable teaching in agroecology: from classrooms to chestnut orchards ».

&

Catherine Fallon (SPIRAL – Université de Liège - Belgium) : "Learning by doing. Policy analysis through focus groups investigation in bachelor curriculum".

&

Mélanie Dupuis (University of California Santa Cruz, USA) : Teaching Sustainability as Design ».

&

Dorothée Denayer (SEED, Université de Liège, Belgium) « Go Beyond Interdisciplinarity : Environmental managers' skills, between official goals and real practices »

&

Dominique Verpoorten (IFRES, Université de Liège, Belgium) (TBC) : « Navigating in the uncertain world of controversies – A pedagogical wind rose ».

&

Prof. Frédérique Vincent (Institut Supérieur d'Ingénierie et de Gestion de l'Environnement, France)

Experiential learning for sustainable education:

The case of MSc in Agroecology at NMBU

Geir Lieblein
Norwegian University of Life Sciences (NMBU)

International Interdisciplinary Conference, 20 - 21 May 2014, Arlon Campus, Belgium
Teaching Complexity and Uncertainty on Environmental Issues
Practices, Theories and Products

Thank you for the invitation to come to this extremely interesting and timely conference.
I will report from our work at NMBU, and will probably say something about
Both practice, theory and products

MSc Agroecology
2000 - present

We conceived the idea of an MSc in agroecology when we were running a series of Nordic PhD courses in AE in the mid-nineties,
And the MSc started in 2000,which means that we will receive the 15th cohort in August

The MSc Program – Overview

Semester 1   **Agroecology: Action Learning in Farming and Food Systems**
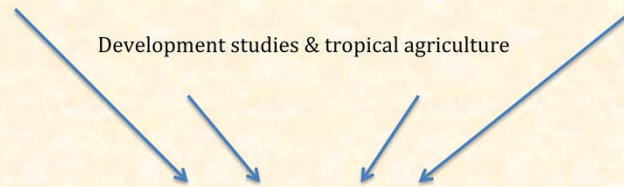A whole-semester course (16 weeks) at NMBU

Thematic areas (at NMBU or elsewhere)

Semester 2

Rural development   Food systems

Organic agriculture

Environmental studies   Economics

Hunger and human nutrition

Ecological engineering   Crop production

Semester 3   START TWO-SEMESTER THESIS
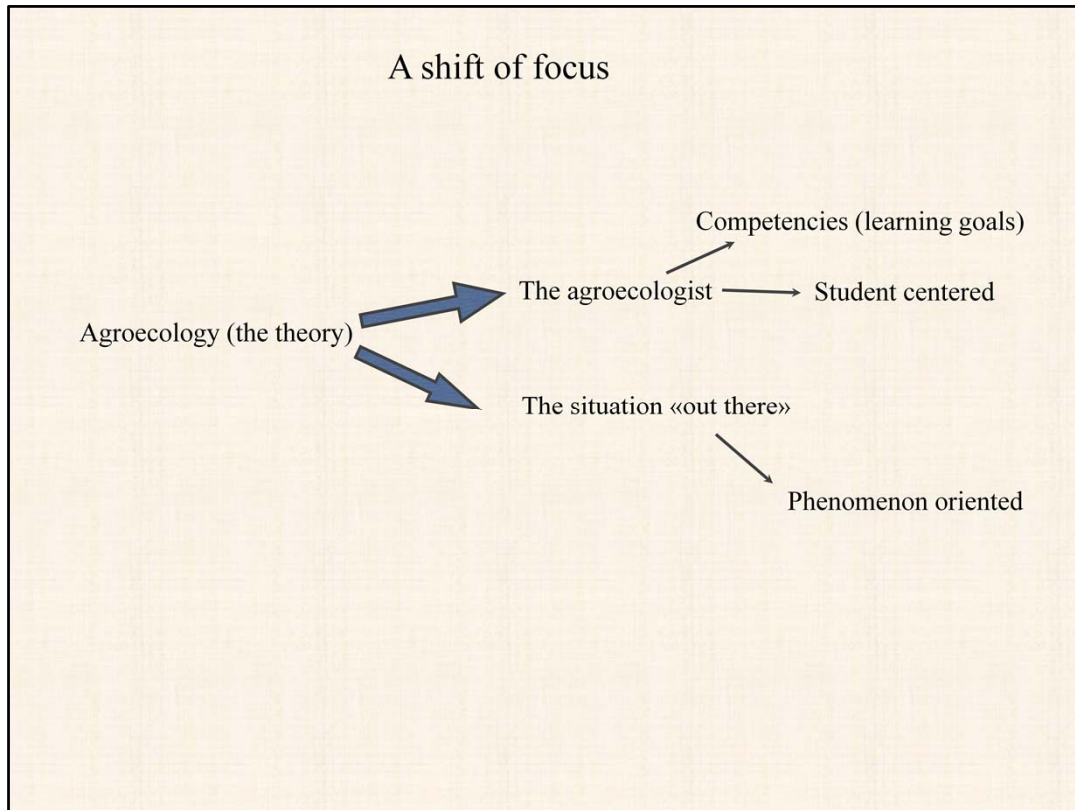
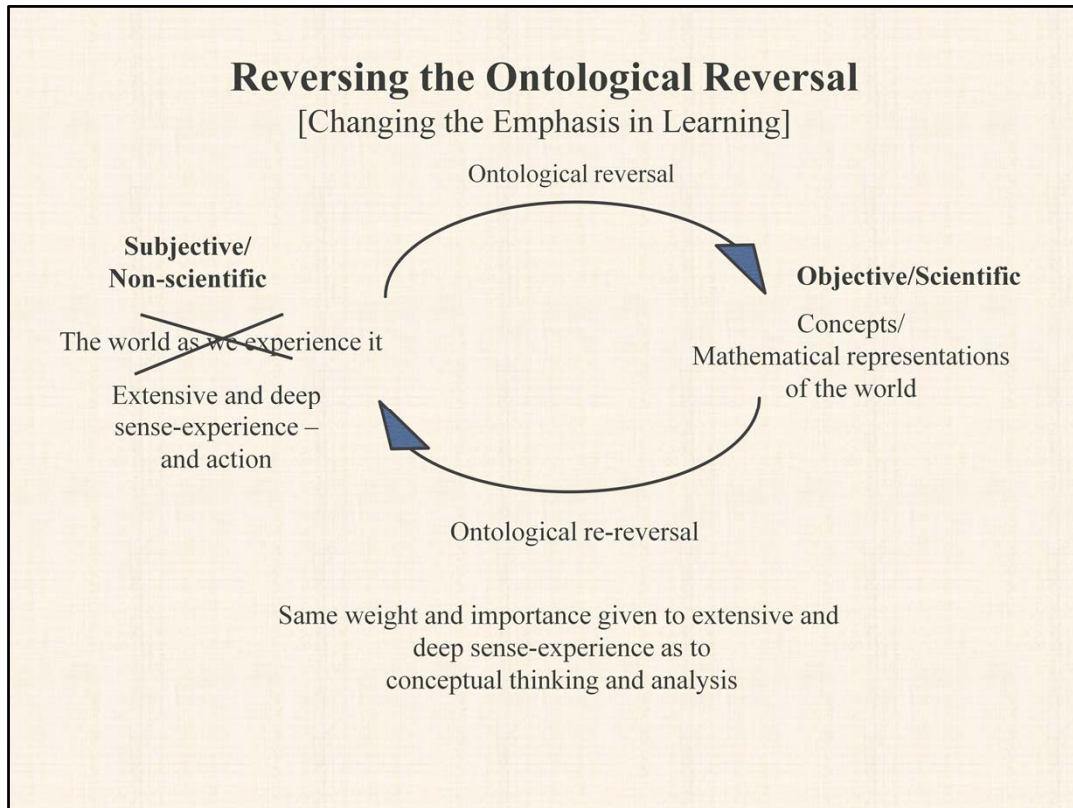Development studies & tropical agriculture

Semester 4   THESIS WORK

In what ways can we support agroecology students to become innovative and responsible *agents of change* in the dynamic context of agriculture and the food system?

Kirsten Oude Lenferink PAE303 2008

During the planning of the MSc it was a breakthtrough that we did not put the curriculum in the center, but rather the student,
And we asked ourselves:

A shift of focus

Competencies (learning goals)

Agroecology (the theory) → The agroecologist → Student centered

The situation «out there»

Phenomenon oriented

More DOING agroecology than KNOWING agroecology. Definitions not so important.

Reversing the Ontological Reversal
[Changing the Emphasis in Learning]

Ontological reversal

**Subjective/
Non-scientific**

The world as we experience it

Extensive and deep
sense-experience –
and action

Objective/Scientific

Concepts/
Mathematical representations
of the world

Ontological re-reversal

Same weight and importance given to extensive and
deep sense-experience as to
conceptual thinking and analysis

At the philosophical level, we saw what we were doing as a reversal of the ontological reversal in science and education (rf. Harvey)

Starting with the Phenomena
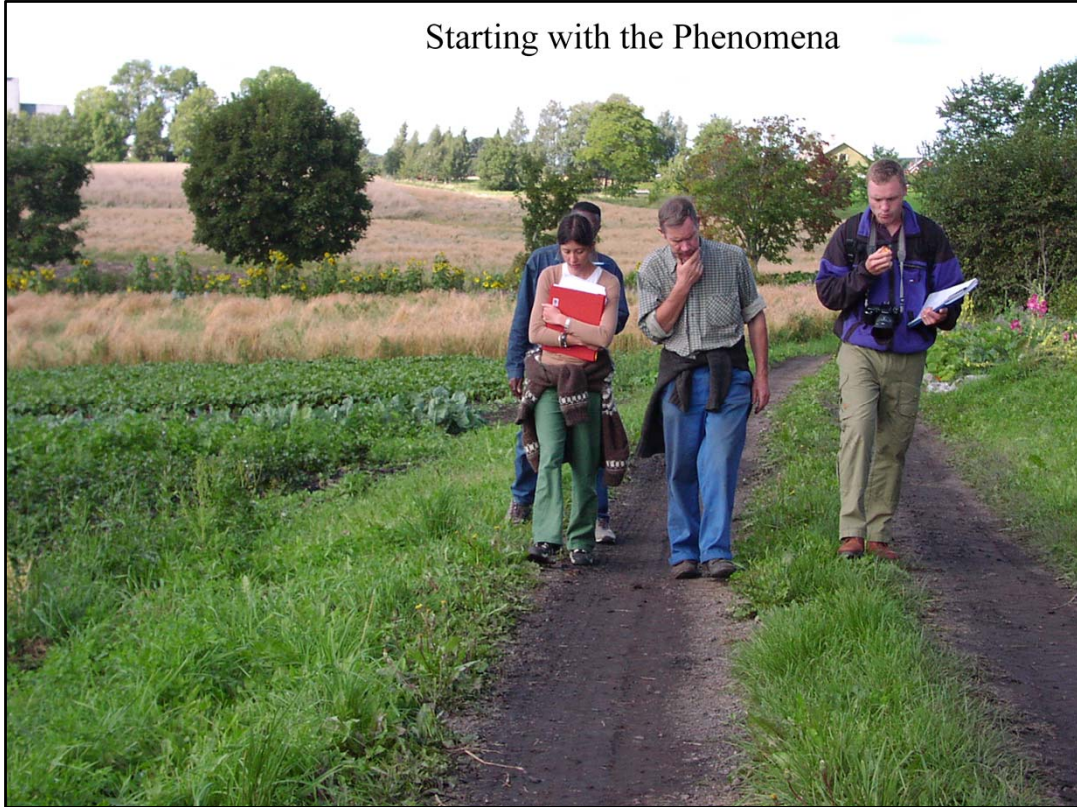
The students start with phenomena in the field, where they observe the situation, using several of their senses, and try to see things from different perspectives, also that of those who live situation, as well as other stakeholders involved.
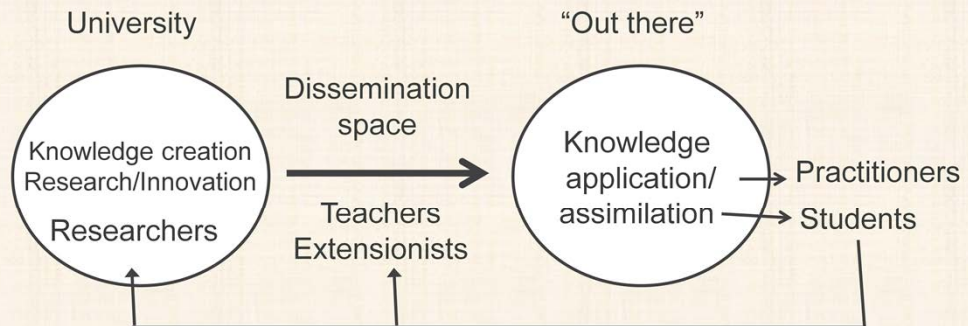
Reflecting on Experiences
– Individually and Together

After being in the field, students reflect on this experience, individually and in groups, and explore questions they may have encountered...
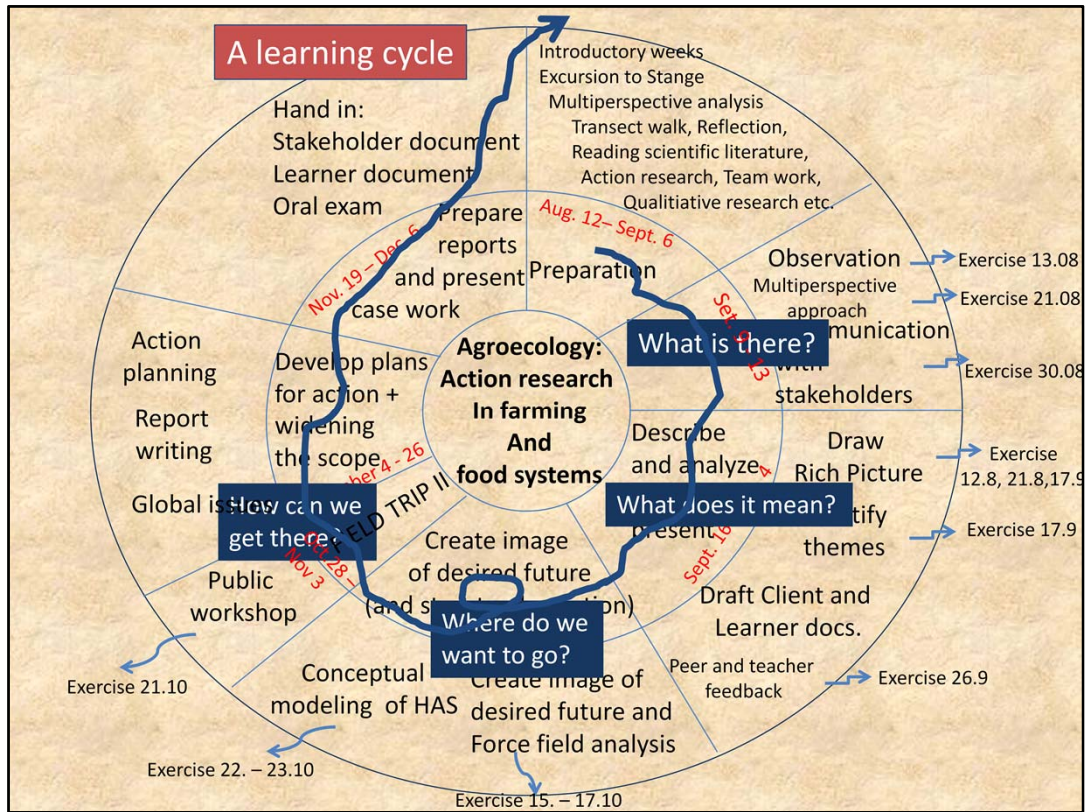
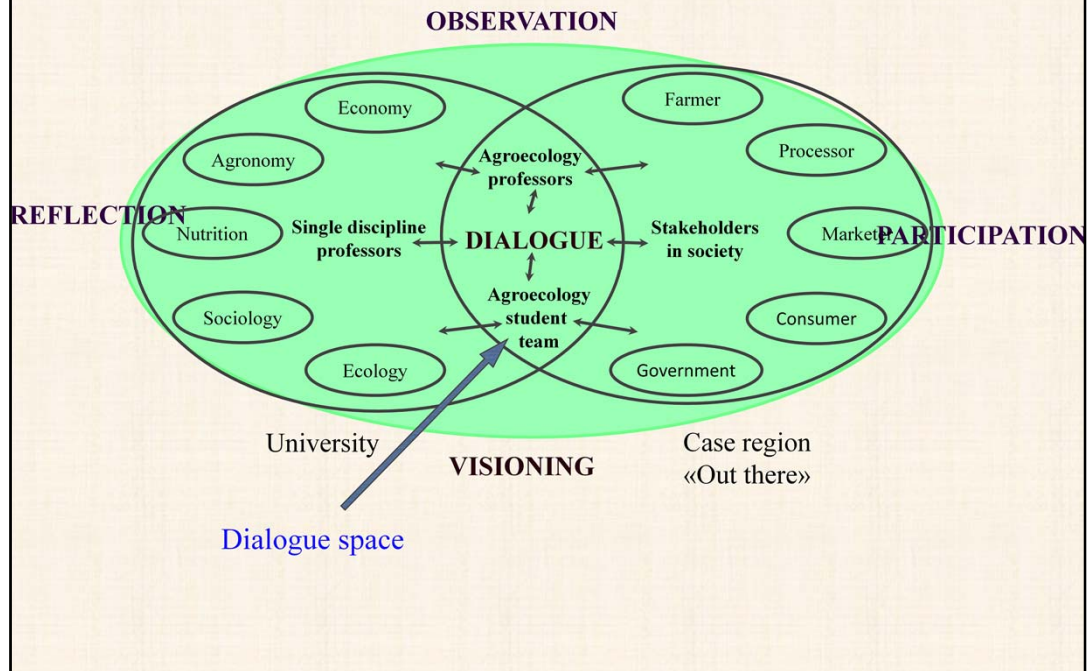In terms of what we do during the first intensive agroecology semester, …
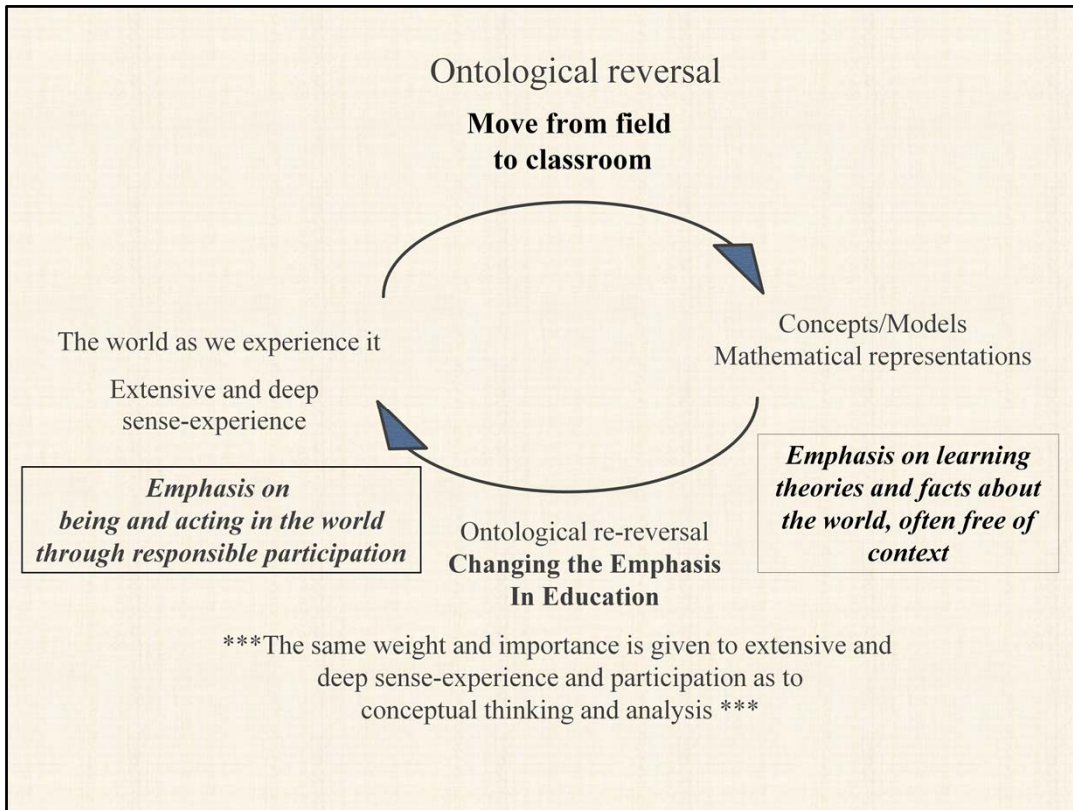
Ontological reversal

**Move from field
to classroom**

The world as we experience it

Extensive and deep
sense-experience

Concepts/Models
Mathematical representations

*Emphasis on
being and acting in the world
through responsible participation*

Ontological re-reversal
**Changing the Emphasis
In Education**

*Emphasis on learning
theories and facts about
the world, often free of
context*

***The same weight and importance is given to extensive and
deep sense-experience and participation as to
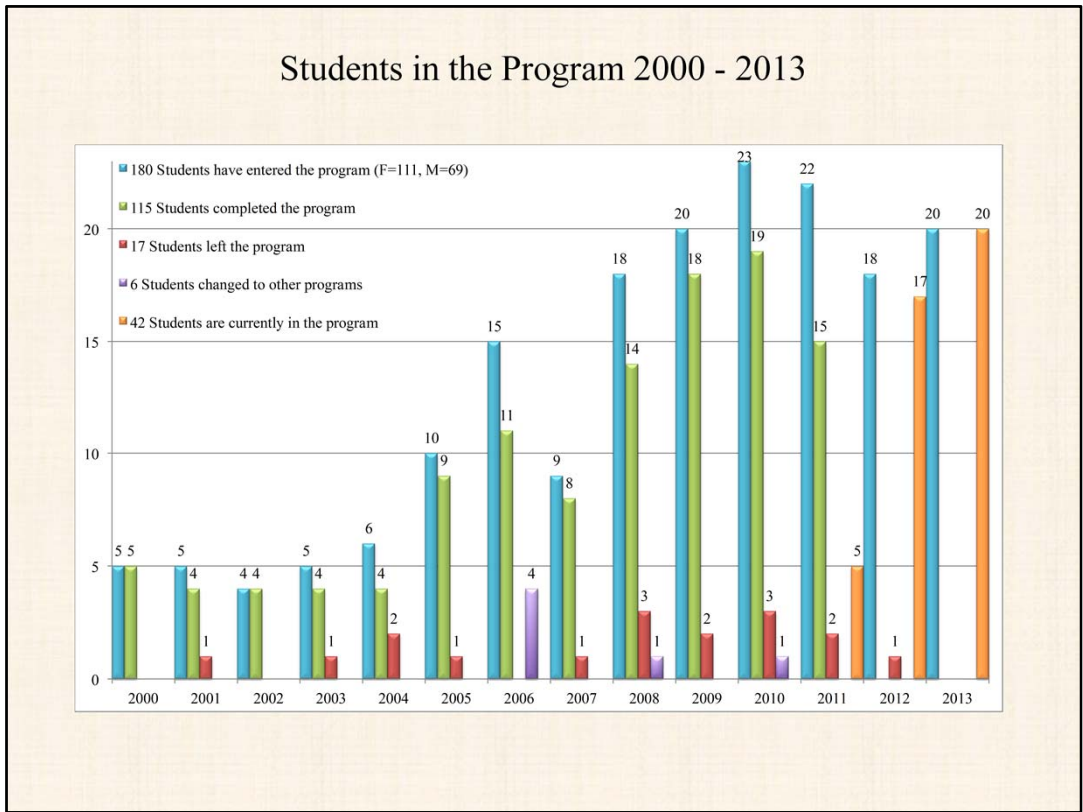conceptual thinking and analysis ***

Focus changed from agroecology to the agroecologist
The key competencies

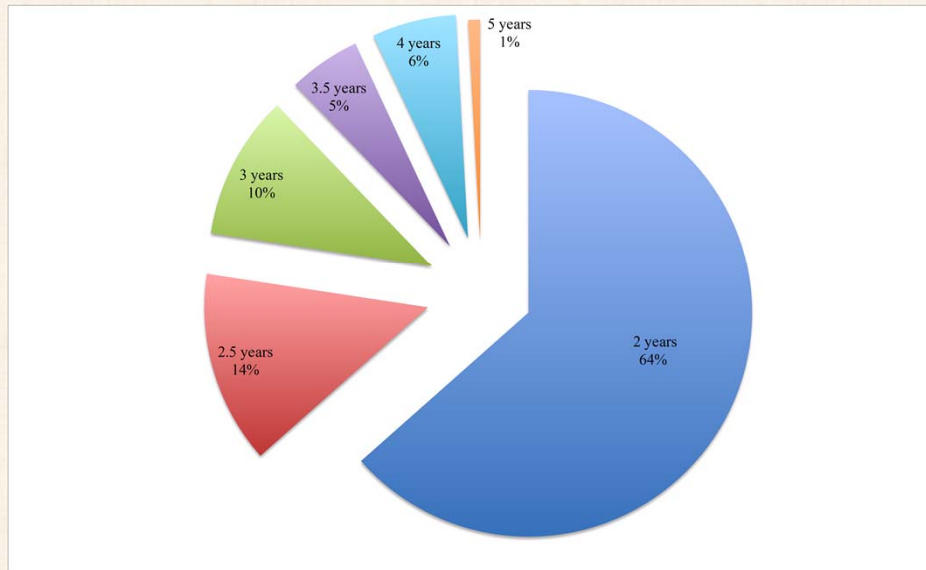## Program Students and Guest Students 2000 - 2013
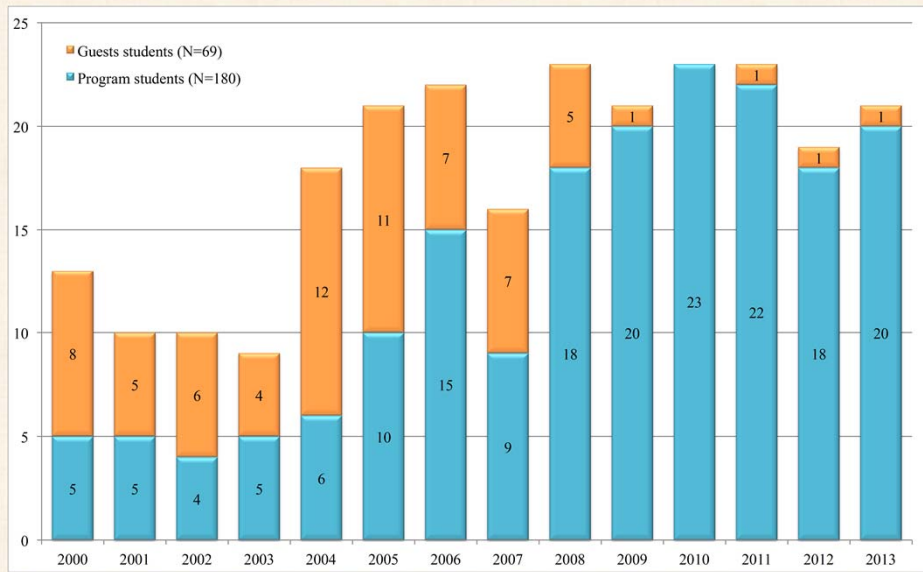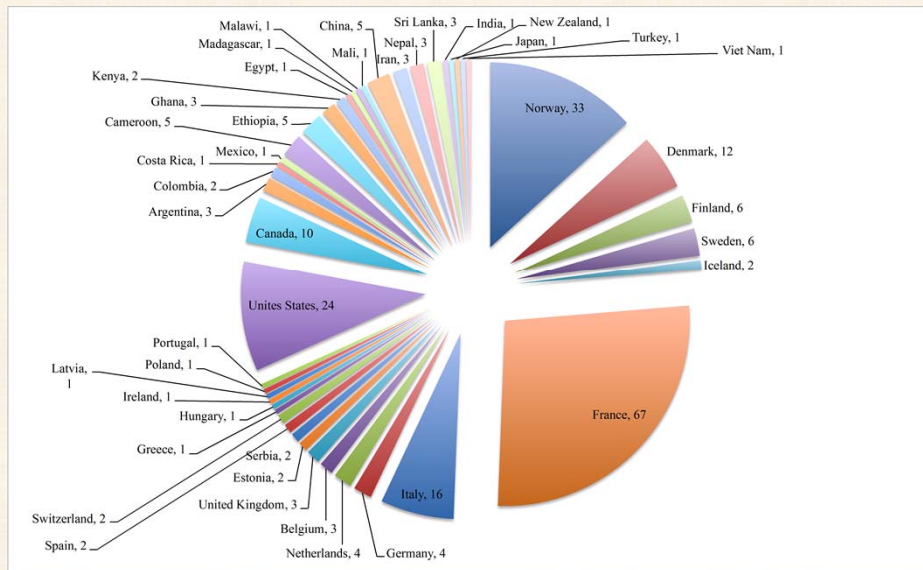
Students in the Program 2000 - 2013
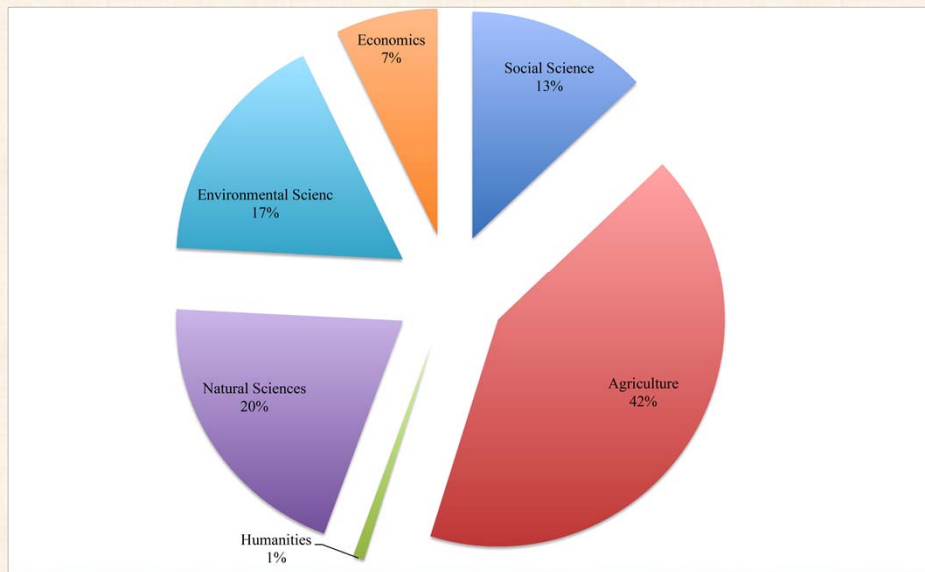
Drop out is only around 10%

Duration in the Program
Students who entered the program between 2000 – 2011 (N=115) and have completed
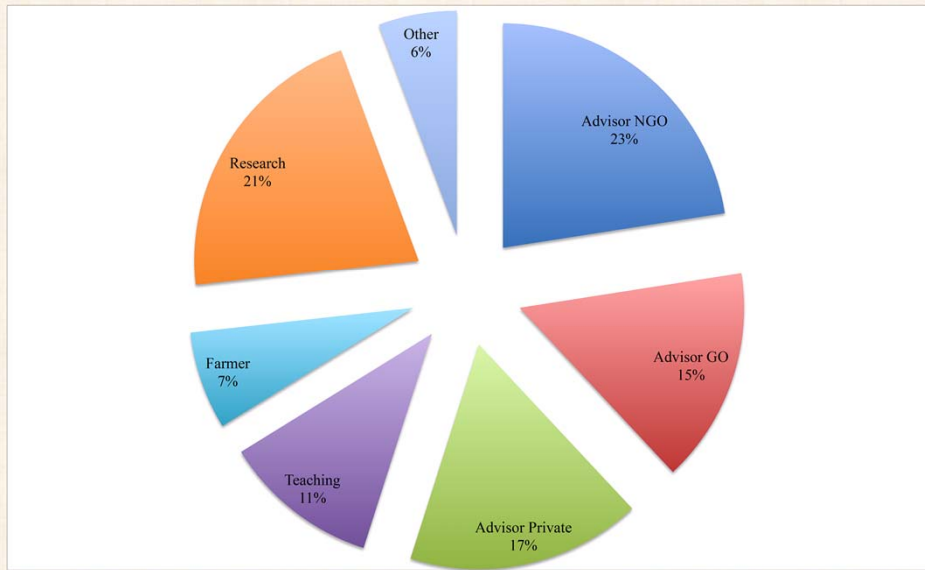
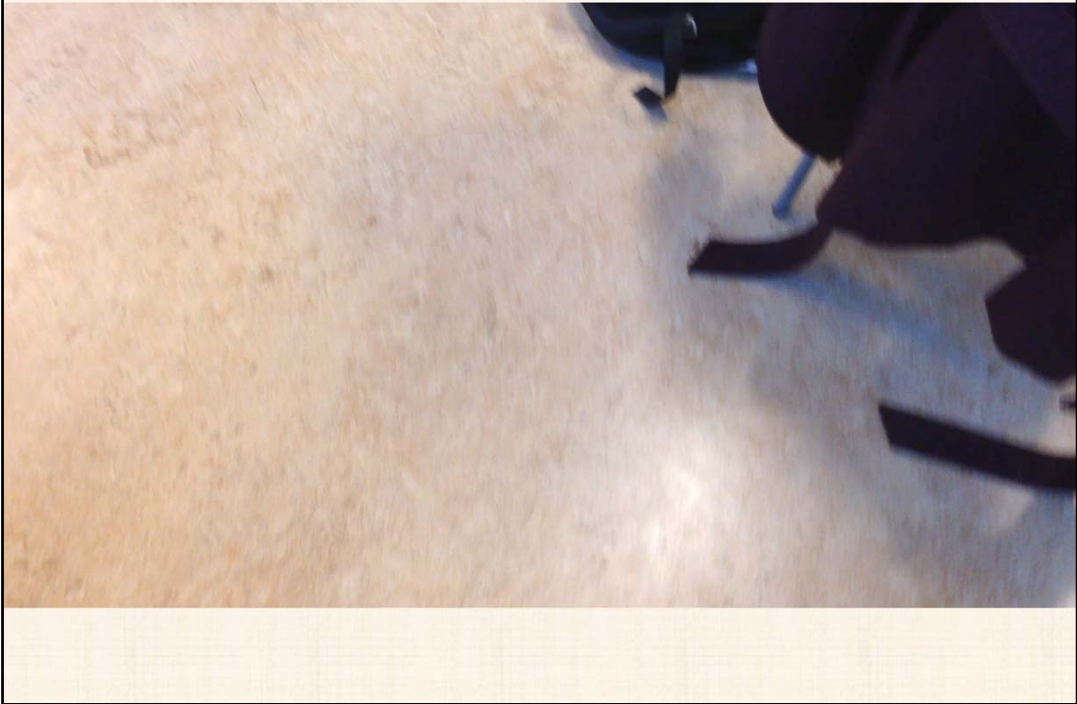Students by Country (44) 2000 – 2013 (N=249)

Educational Background of Program Students (N=124)

Current Occupation of Program Students (N=71)

A Glimpse from a Reflection Session with Engaged Students

Four main purposes of
"returning to the farming and food systems as they are"

Enables learning of complex topics
Provides source of enthusiasm/energy to delve into theory
Supports the connection between university and society
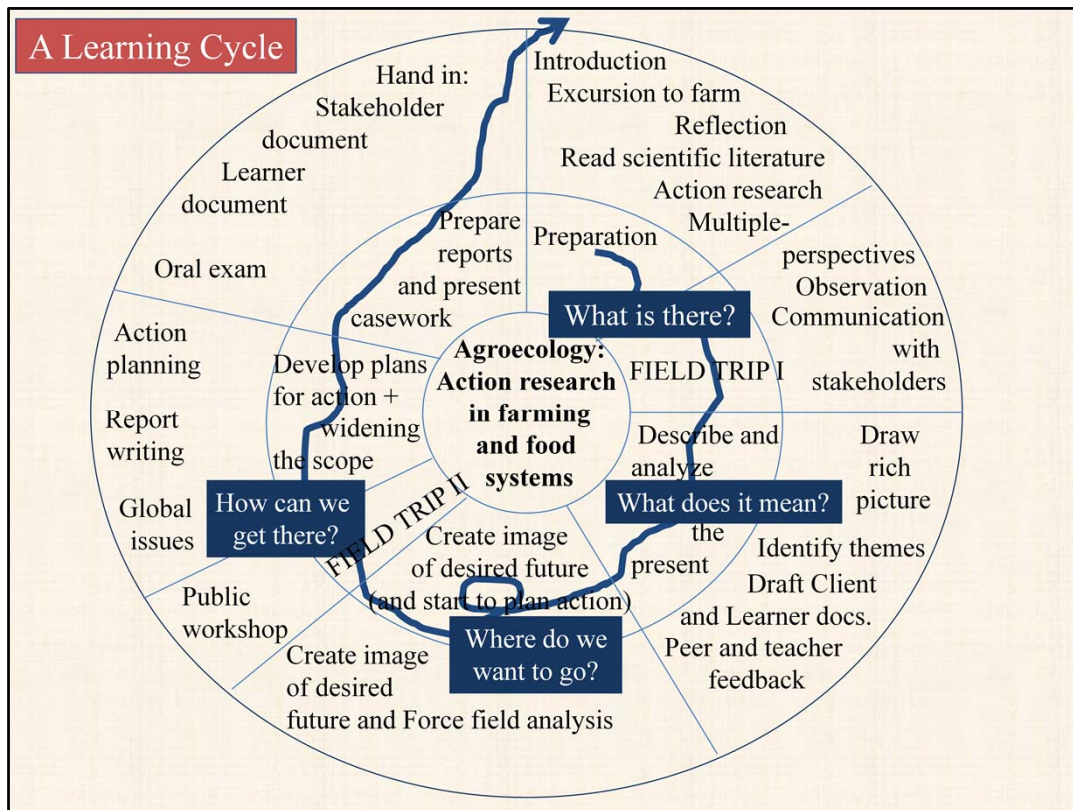Introduces a platform for civic engagement

Kirsten Oude Lenferink PAE303 2008

This way of
organizing a course is   not 'an easy option', but require:

Careful planning, belief, commitment
Taking risks, letting go of authority
Students taking a more active role in their own learning
But, empowered students excel in their work!

Not only a questin of key competencies for students, but also for teachers!
What have we learned?

                risks, giving away some
take a more active role in their
          th it, when empowered stude

Positive outcome for the students are:

A Learning Cycle

Hand in:
Stakeholder document
Learner document

Oral exam

Action planning

Report writing

Global issues

Public workshop

Introduction
Excursion to farm
Reflection
Read scientific literature
Action research
Multiple-perspectives
Observation
Communication with stakeholders

Prepare reports and present casework

Preparation

What is there?

Develop plans for action + widening the scope

Agroecology: Action research in farming and food systems

FIELD TRIP I

Describe and analyze

Draw rich picture

What does it mean?

the present

Identify themes
Draft Client and Learner docs.
Peer and teacher feedback

FIELD TRIP II

How can we get there?

Create image of desired future (and start to plan action)

Where do we want to go?

Create image of desired future and Force field analysis

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The process of learning from experience can be thought of as a cycle of learning, as explained in this figure by Geir Lieblein, as we see a simplified version of here. In the center the course, which consists of parts; preparation for the field, field trips, description and analysis of what you sensed, create images of this, back into the field to get feedback on reflection and to learn more, and then develop action plans and write reports and present this work. In the outer circle you see some example of practical tasks and exercises that students participate in throughout the semester, to learn and develop the skills and competencies needed practice this on their own. On top are the overarching ideas guiding the process...
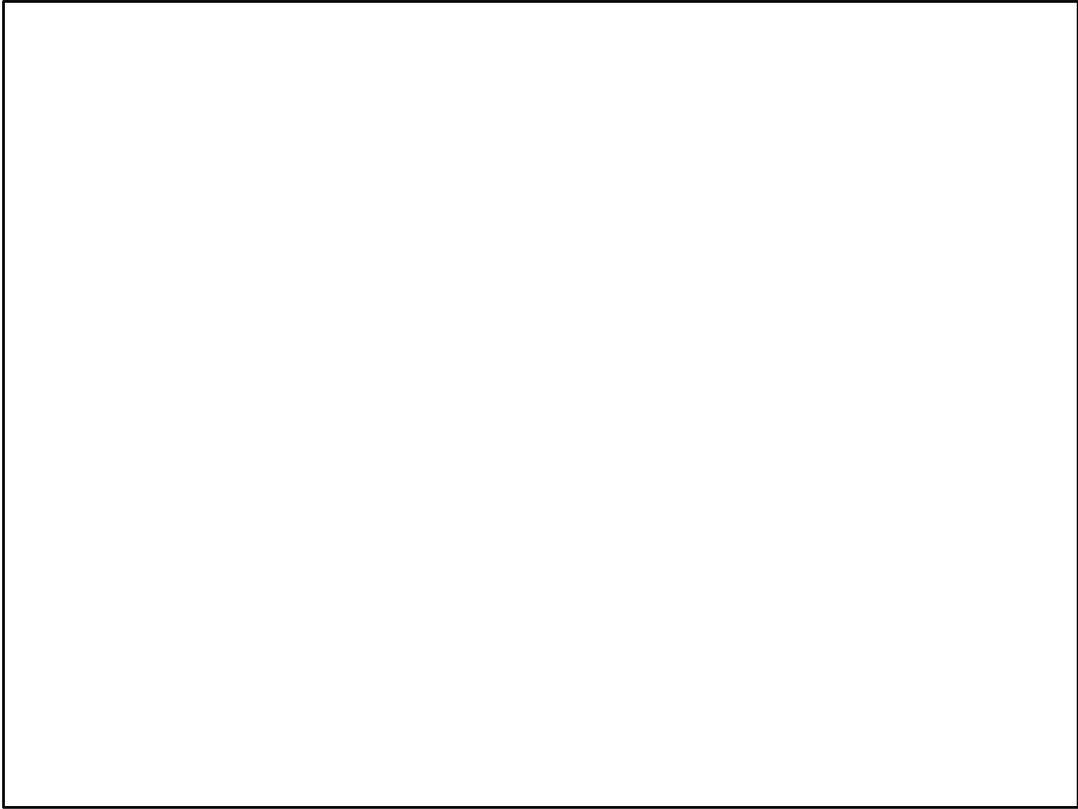
Educational Background of Program Students and Guests (N=149)
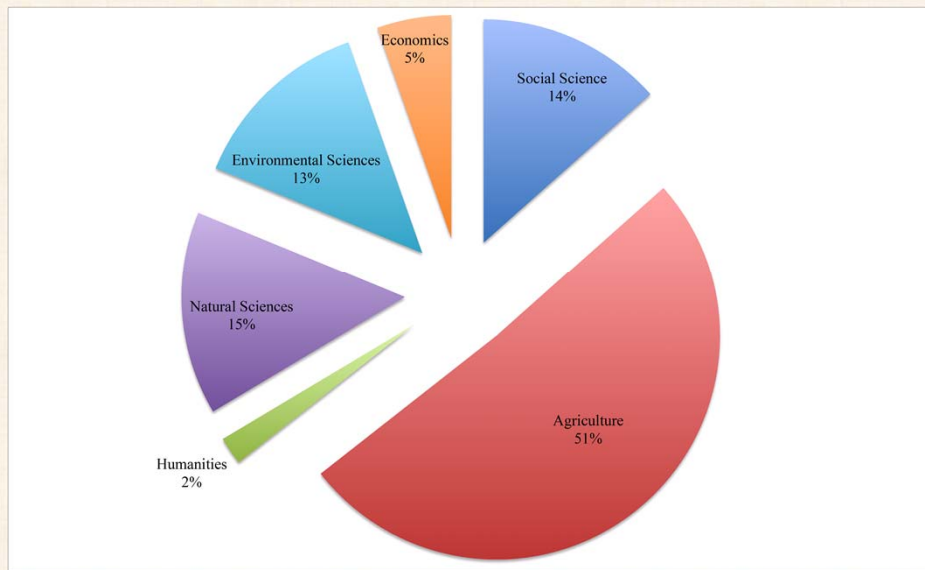
Current Occupation of Program Students and Guests (N=100)
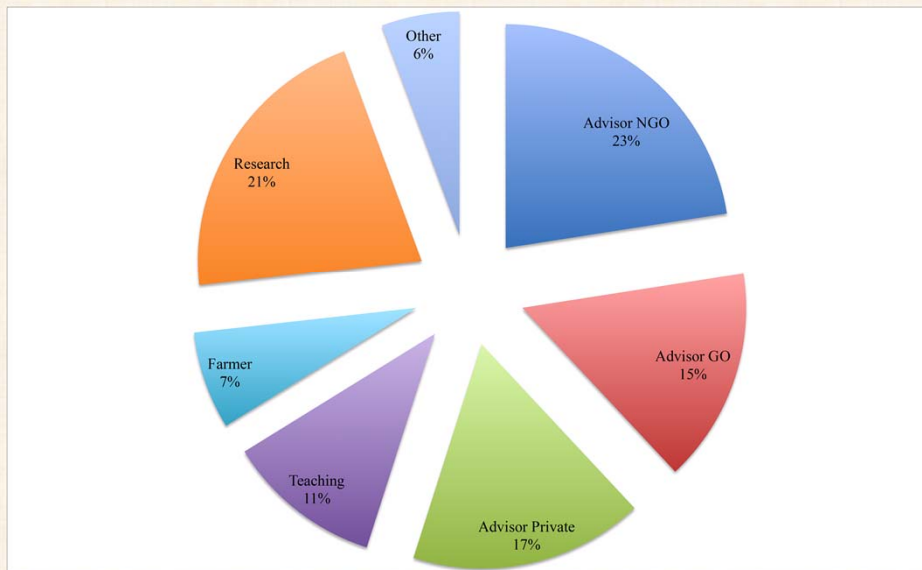
Agroecology Education: Action-oriented Learning and Research

GEIR LIEBLEIN, TOR ARVID BRELAND, CHARLES FRANCIS and
EDVIN ØSTERGAARD

Norwegian University of Life Sciences, Ås, Norway

ABSTRACT   Purpose: This article examines and evaluates the potential contributions from
action learning and action research with stakeholders to higher education in agriculture and food
systems.
Design/Methodology/Approach: The research is based on our experiences over the past two
decades of running PhD courses and an MSc degree programme in Agroecology in Norway that
have attracted students from the Nordic region and other countries.
Findings: We conclude that collaborating with non-university stakeholders as an integral part of a
university course or programme serves four main purposes, two directly related to learning and
two that can be considered as practical implications. Firstly, it enables learning about complex
topics, a learning that cannot be achieved by merely reading or listening. Secondly, the real-life
flare of such activities provides the students with enthusiasm and energy to delve into theory.
Practical Implications: Thirdly, students collaborating with non-university stakeholders connect
university and society. Fourthly, this process builds social relevance and civic engagement not
found in conventional courses or curricula.
Originality/Value: The article presents conceptual foundations and practical implementation of a
unique educational programme in agriculture and food systems.

KEY WORDS: Action research, Action learning, Agroecology, Stakeholder-oriented education,
Experiential learning, Agroecological competencies

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Plant and Environmental Sciences, PO Box 5003, N-1432 Ås, Norway. Email: geir.lieblein@umb.no

Introduction

In what ways can we educate students to become effective agents of change in the dynamic context of current global problems in agriculture and food systems? This question has been the point of departure for our work during the past 15 years to establish and develop higher education in agroecology. The first step in dealing with this challenge is to clarify the global problems surrounding farming and food. Current challenges were summarized well by Jules Pretty (2002: xi):

> Something is wrong with our agricultural and food systems. Despite great progress for increasing productivity during the last century, hundreds of millions of people remain hungry and malnourished. Further, hundreds of millions eat too much, or the wrong sorts of food and it is making them ill. The health of the environment suffers too, as degradation seems to accompany many of the agricultural systems we have evolved in recent years.

The role of farming has changed over the past decades from a production orientation to an increased recognition of the multifunctionality of agriculture and rural areas (Knickel et al. 2009).

Our core educational question poses a challenge to the current system, since the goals we seek are difficult to achieve and are not directly compatible with the ways most academic institutions operate today. Currently the development of knowledge has been split up in small disciplinary pieces. In addition, academic institutions are not paying much attention to the link between research, education and practical situation improvement in society. At universities students are sent on a rambling journey of choosing courses within different disciplines and sub-disciplines. Too often these courses may have few or no direct linkages to each other or to society. Such a structure does not contribute to broad goals for which students should be educated. They are given little support in terms of training for the complex reality where they will operate as professionals. With reference to research, Van der Ploeg (2003) argues that more and more knowledge about agriculture is generated in sectorized knowledge systems that are disconnected from everyday experiences and practises on farms.

One must recognize that agricultural universities, with their pragmatic roots (Bawden, 1991), were initially built on an action-oriented profile. Although perhaps true in a historical perspective, during the recent decades these universities have embraced the process of 'academization' and turned towards the Humbolt ethos of giving priority to research and education that is disconnected from practise. Levin (2008) proposes that an action-oriented approach in higher education represents an important base for students to engage in change activities in their professional careers. Without such an academic experience, they will find it hard to engage in change-oriented activities later in life. This view is supported by Pfeffer and Sutton (2000) who found that the knowledge actually leading to action will much more likely come from knowledge gained in being involved in action-oriented activities than knowledge developed through reading or listening to lectures.

The essential foundation for an education that is action-oriented is a conceptual shift from theory towards action as the starting point for the learning process. In action-oriented education we bring the students in contact with people and situations

'out there'. Students then experience the true complexity of such local situations and become aware of the range of knowledge, skills and attitudes needed to deal with these situations. They also learn to appreciate the uniqueness of location and context. Within the domain of action-oriented education, both action learning and action research can take place. They both include action, an ability to deal with complex issues, and they demand that this activity lead to a comprehensive understanding through a reflection process over the range of issues they are confronted with. The boundary between action learning and action research is fluid, since they both contain action and reflection. The step from mere learning to research implies that more emphasis is placed on methodological rigor and on publishing of the work, in order to enable participation in a wider discourse on the topics involved. As such, action-oriented education challenges the classical division between action and re-search and between research and education. Action research 'seeks to bring together action and reflection, theory and practice, in participation with others, in the pursuit of practical solutions to issues of pressing concern to people, and more generally the flourishing of individual persons and their communities' (Reason and Bradbury, 2008: 4). As such, it has a strong link to experiential learning (Kolb, 1984). It is important to note that action research is not applied research, since action research 'explicitly rejects the separation between thought and action that underlies the pure/applied distinction' (Greenwood and Levin, 2007: 5).

The analyses and conceptual models presented in this article draw on our experiences of developing and running an action-oriented MSc programme in agroecology in Norway. The feedback from the students has provided an important source of information for our own reflections about action-oriented education, and we have strengthened the reflection practice through publication of articles and book chapters that summarized the experiences (e.g., Francis et al., 2003, 2008, 2009; Lieblein et al., 1999, 2000a, 2007; Østergaard et al., 2010). The purpose of this paper is to bring together the concepts of action learning and action research with higher education in agriculture and the wider food system. We start by describing the MSc programme in agroecology that has been running since 2000. We then proceed by discussing the main learning outcomes of developing such an action-oriented education. Finally, we turn to looking at the implications for key agroecological competencies.

Developing Action-oriented Education in Agroecology

MSc Programme in Agroecology (1999–2010)

In 1993 a group of Nordic researchers and educators started planning a series of PhD courses in organic farming and agroecology. The main emphasis of these courses was on how to develop research methodologies that are compatible with the holistic ethos of organic farming (Lieblein et al. 1999, 2000a). To benefit a wider audience of students in the Nordic region and elsewhere, we then developed a prototype one-semester course in agroecology that was tested in the spring semester of 1999. From this learning experience in which teachers and students were co-learning, we moved towards designing a semester-long learning activity with two courses: PAE 302 Agroecology and Farming Systems and PAE 303 Agroecology and Food Systems which were launched in autumn 2000. Developing an MSc programme in agroecology centred on these two introductory courses in a core agroecology semester that built on action research and experiential learning. The PAE 302 curriculum focused on project work to assist a farmer with the difficulties associated with converting to organic farming, while in PAE 303, students performed a county-wide food system analysis through interviews with relevant stakeholders and a week immersed in the community. Contacts included producers, processors, distributors, retailers, associa-tions, schools and government agencies. Based on in-depth conversations with students about their experiences from the courses as well as the instructors' observations and reflections, the courses were modified and improved each year. For example, we established a series of literature seminars in 2006, where students in groups were given responsibility for presenting selected literature for discussion in the class. In 2007 we linked these seminars to the web platform of the course so that each student was asked to publish, prior to the presentation, a two-page commentary on the papers to be covered and then to critique the comments of at least two other students.

   In 2008, the PAE 303 course was adapted to work with a new initiative by the Norwegian Government called 'Eco-uplift' (Økoløft). The initiative was designed by two Norwegian ministries to enable the government to reach the Norwegian goal of 15% organic production and consumption by 2020. The 'Eco-uplift' is accomplished through a support structure where equally matched national and municipal govern-ment funds are allocated to municipalities to support food initiatives that increase the public use of organic food. By incorporating the 'Eco-uplift' project into the food systems curriculum, students gain an even closer relationship and commitment to stakeholders involved in the local food system, greater support and funding from the municipality, clearer boundaries and goals for the project work, and the opportunity to catalyze real and lasting improvements in the community.

Scope of the MSc Agroecology Programme

The programme starts with a whole-semester course, Agroecology: Action learning in farming and food systems, see Figure 1. The rest of the programme is designed individually in collaboration between teachers and students, depending on their thematic preferences. It ends with a thesis (one- or two-semester). The core faculty consists of four professors that are responsible for the first semester, thesis advising
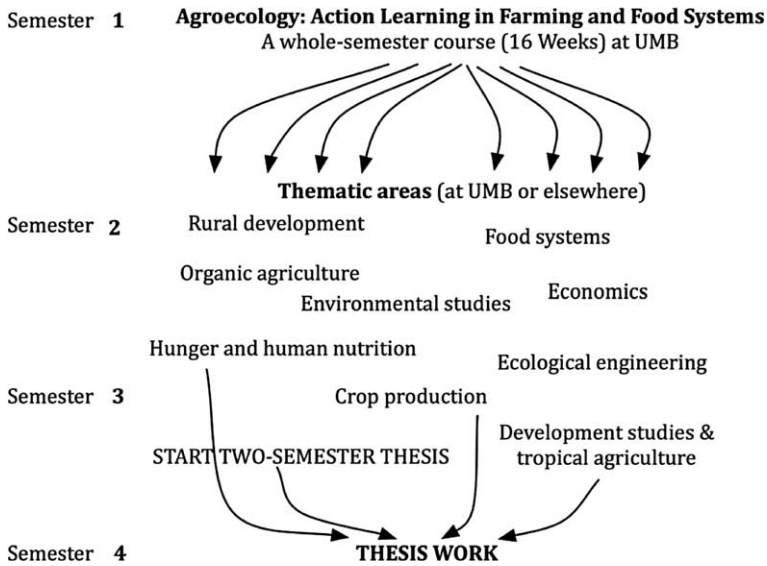
Figure 1. The scope of the MSc agroecology at UMB.

and counselling regarding course choices in semester two and three. In addition, 10–15 other researchers/teachers give lectures during the first semester course. Table 1 shows that the majority of the students have come from the Nordic or other countries in Europe, but that students from North America, Asia or Africa have been represented in all years. The number of students has been around the target of 20 for the past seven years, and the number of countries represented in the class has been around 10 or more almost every year. So far, 189 students from 38 different countries have participated in the programme. During the first five years around half of the students participated in the first agroecology semester as guest students, whereas all students are now full agroecology programme students.

Table 1. Student numbers and their region of origin in the Master's programme in agroecology at the Norwegian University of Life Sciences in the period 1999–2010.

Year	Nordic countries	Europe	North America	Latin America	Africa	Asia	Total number of students	No. of countries
1999	3	0	1	0	0	0	4	4
2000	9	2	1	0	1	0	13	9
2001	5	2	1	2	0	0	10	7
2002	4	3	2	0	0	1	10	7
2003	1	3	1	1	2	1	9	6
2004	4	10	2	0	1	1	18	12
2005	4	11	3	1	0	1	20	10
2006	4	8	1	0	5	3	21	12
2007	5	8	1	1	1	0	16	9
2008	3	13	4	0	1	2	23	8
2009	4	11	3	0	1	1	20	10
2010	4	12	2	0	2	5	25	13
Sum	50	83	22	5	14	15	189	

Full-semester Agroecology Course from 2009

From 2009, the two courses were integrated so that students performed a farming system analysis on a farm in the same municipality as their 'Eco-uplift' casework was located. From 2011 this course is called 'Agroecology: Action learning in farming and food systems'. This change gave multiple benefits, including enabling the students to learn more about the production component of the food system in which they were working, giving them more time in the field to observe and learn about the farming and food systems, and providing the necessary time and resources to lead a public meeting in their community. The first two-week phase of the course aims at preparing the students for the shift from a passive, theoretical and discipline-based education to an active, action-oriented learning process. The first day of the course was devoted to a transect walk exercise. The purpose of this exercise is to highlight the value of one's own observations for learning, and further to allow the students to practise their skills of observation and separating observations and judgement. The experiences of the transect walk were conceptualized and viewed in relation to the course as a whole in a subsequent reflection session. During the first week, there was also a session on the students' experiences and competencies, to recognize the value of what each student can bring into the learning community. Finally, during the first week there was a whole-day 'Diversity Icebreaker' session, which included a psychological test of personality and preferences for communication and thinking styles (Ekelund and Langvik, 2008). The main purpose of this exercise is to allow the students to explore human diversity, and to affirm each individual with special reference to how their skills may contribute to the team work in the course. During the second week, the students stayed on an organic farm. As teams they conducted a multi-perspective exploration of a farming system, based on farm visits. As a new activity in 2009, the students also spent one full day working on the farm. The main purpose of this new activity was to broaden the range and inherent depth of participation in relation to the farming system and to engage all senses in the activity.

During the next 14 weeks of the course, the students' learning was based on participation in the nation-wide 'Eco-uplift' project. The task they were given did not contain a concrete problem formulation nor was it a search for fixed answers. The assignment was simple: explore the present and future wanted situations of the assigned municipality in relation to public use of organic food, and develop a plan for how the situation as a whole can be improved. Following initial preparation on campus, including lectures and seminars on key concepts and suggested methods for dealing with the task, groups of five–six students went for one full week to explore the present situation in its full richness in four municipalities located in different parts of southern Norway. This was facilitated through the local 'Eco-uplift' project leader and additional interviews with a range of stakeholders. The teacher group split up to visit all groups on location during this week. Upon returning to campus, the students summarized their findings, which were presented to the class and teachers for feedback. Copies of the presentations were also sent to the key clients for their suggestions.

The teachers then led workshops on Soft Systems Methodology (Checkland and Poulter, 2006), to improve student skills in dealing with complex situations, and on visionary thinking (Parker, 1991; Vidal, 2004), to explicitly introduce the importance of creativity.

Based on these activities, the groups designed their plans for the second visit to the case locations. Aims of this visit were to move from exploring the present situation to the desired future situation and the actions needed to move towards that goal. For the second visit, the students were given the additional specific task of planning and facilitating a public meeting with local stakeholders. After a four-week stay on campus, the student teams returned to the municipalities to present their findings in workshops tailored to their casework. The teams incorporated the results and feedback from these visits into finalized proposals for action that stakeholders and key clients could carry out to improve the local and organic foodsheds where the students worked.

Based on their experiences and analyses, student groups developed unique public workshop agendas that they presented to interested project participants.

After returning to campus, the students summarized their experiences and findings, and gave oral presentations to the whole class and teachers. They also maintained communication with the local project leader in the process of writing their final documents.

Ultimately, all four groups created client reports with strategies to reach the goals of the 'Eco-uplift' project based on their understanding of the community and feedback from stakeholders.

Throughout the course the teaching staff, consisting of three professors and one teaching assistant, facilitated weekly reflection sessions enabling in-depth conversations around students' experiences and facilitated an enhanced communication between teachers and students. In recognizing the importance of the theoretical domain, every second week the students were given the task of presenting core agroecology literature for plenary discussion in the class. A range of outside and internal presenters were also invited to give presentations on topics of relevance to the casework of the students, such as qualitative research methods including interview techniques, systems thinking, action research, facilitation, agronomic and environmental topics, consumer issues, human nutrition and food systems.

Learning and Research Outcomes of Developing Action-oriented Education

In the previous section we described our journey of developing a pedagogy relevant for agroecology. Central in that journey was the realization of letting situations 'out there' be the starting point for learning, and the goal of developing knowledge for improving those situations. The knowledge dimension of such an approach is further emphasized in the proposal by Kurt Lewin (1948) that involvement in a change process in a prerequisite for fully understanding a complex situation.

Based on this conceptual foundation, our continuous effort of improving agroecological education has in itself been an action learning process for the faculty. We conceive action learning as 'learning from action or concrete experience, as well as taking action as a result of this learning' (Zuber-Skerrit, 2001: 2). This time it is not the action 'out there' that is in focus, but our own actions as teachers and researchers. We have during the past years moved this action-learning process of developing knowledge for improved educational practice in a direction more susceptible to careful scrutiny, and thus turned it into action research. As in the action research tradition, there is a double aim: practical action for improvement and

acquisition of theoretical knowledge to be communicated through publications in scientific journals. The innovations that have been introduced through the first nine years of the courses have compelled us to prepare several conceptual articles about learning theory (Lieblein et al., 2004, 2007), methods of practical education for responsible action in the field (Lieblein and Francis, 2007), and reorganization of the agricultural universities to accommodate the implementation of education that involves close interaction of farmers and communities (Lieblein et al., 2000b).

The Dual Learning Ladder as a Model of Action-oriented Learning

In the project work, the agroecology students enter the case* an 'Eco-uplift' municipality* at step three, not step one, on the learning ladder presented in Figure 2. They explore the current situation through their own observations and contact with stakeholders in the municipality. If the students lack information at this stage they can step down the external learning ladder to search for existing theoretical knowledge. Stepping down the learning ladder to acquire facts, principles and theories becomes an open-ended activity. Instead of the teachers providing a fixed or closed set
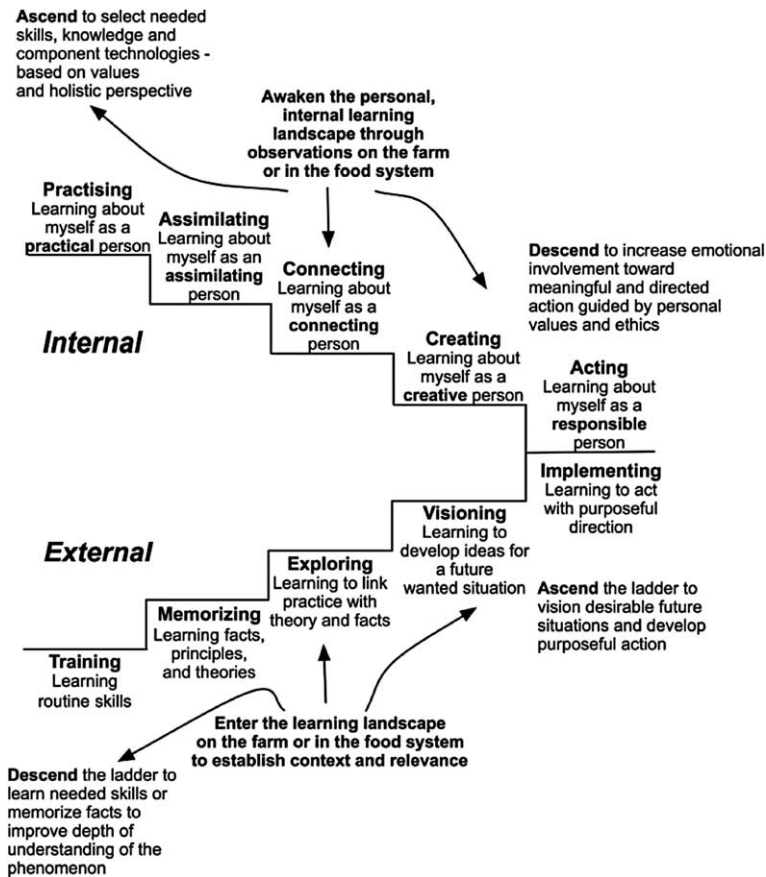
Figure 2. The dual learning ladder.
Source: Adapted from Lieblein et al., 2007.

of readings, their task is to facilitate the students' search for relevant theory and information (Lieblein et al., 2007).

Based on the exploration of the present situation, the students can then move up the learning ladder to the creative step of visioning desired futures in order to provide direction for action. Whereas the lower levels of the learning ladder are often de-contextualized, the importance of values and ethics increases as the students move upwards. Parallel to the students moving on the external ladder, they also step up and down on an internal learning ladder. Their exploration in the outer world of the municipal cases becomes coupled with an exploration of their individual inner worlds.

Students Bridging University and Municipality in Action-oriented Learning

One of the main challenges in developing action-oriented education at universities is that the students have to become 'citizens of two worlds' in their learning process, the theoretical world of the university and the practical world of the municipality (Figure 3, adapted from Østergaard et al., 2010). Coming from traditional higher education activities, the students are not used to both being able to interact with concrete situations in the outer world and to integrate that learning with deep, theoretical reflections in their inner world. According to Levin (2007), the task of the action-oriented teacher is to nurture action capability and in parallel to facilitate reflective capacity of the students.

Students' Views On Their Learning

Overall the feedback from the students has been very positive. The average evaluation scores for the courses in all years have been higher than the university average, which we consider quite favourable given the class size (around 20 students) and diversity of the students country and discipline backgrounds. The two main challenges involved in action-oriented education appear to relate to paradigmatic and interpersonal issues. Working in teams represents a cornerstone in action research and action learning, but
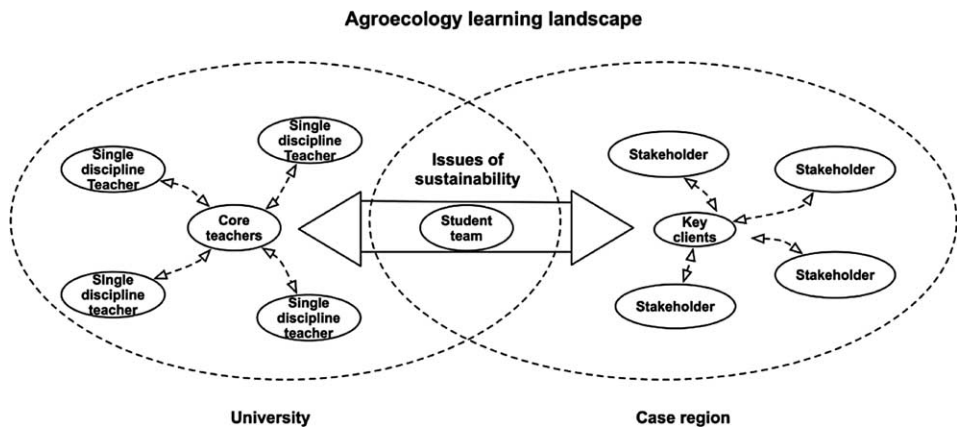

Figure 3. Students bridging academia and municipality, developing the skills of operating effectively in both contexts.
Source: Adapted from Østergaard et al., 2010.

team work is difficult, especially in highly heterogenous classes. This diversity can sometimes undermine the whole learning process. Although we as teachers are highly aware of both potentials and problems of team work, and try to facilitate good team relations, we still see bad team dynamics occur every year. The paradigmatic challenge is related to the academic background of most students. Everyday experiences, our own immediate observations of the world, have been trivialized in formal learning environments, or 'set aside as belonging to the ''not real''' (Dahlin, 2003: 78). What has been presented as 'the real', and therefore science based, are 'the abstract representations and mathematic formulas' (Dahlin, 2003: 78). In the agroecology courses we aim at basing the learning process on daily life experiences as the primary source of learning. This comes as a shock to many students, who have been taught that climbing the academic ladder is a climb away from these experiences towards abstract representations. They therefore feel that starting our MSc programme is an academic step down, making them feel uncomfortable.

This frustration often exists among many students during the first four–five weeks of the course and, interestingly enough, every year we see students who grasp the importance of an action orientation: 'What I found most frustrating in the beginning of the semester, was what I appreciated the most in the end. This was the freedom and own responsibility in group work, the holistic approach and different perspectives and the reflection on our own learning and the group work' (Swedish student, 2004).

The main challenge for the students in terms of learning about agroecology frequently has to do with how to orient oneself in the different hierarchical levels of the system: 'Often it was hard to know when it was necessary to go into details and when it was more beneficial to work on a higher level in the agroecosystem' (Norwegian student, 2001). Another challenge that recurs each year in the team activities is when students recognize the different levels of motivation, maturity and expectations among the team members and how difficult it is for some to overcome the long-engrained learning practice of focus on narrow pieces of the system rather than the whole. This appears to be a function of cultural differences and prior education, of language skills, and of clarity of long-term goals of each student.

Teacher Competencies

The shift from a theory to an action orientation in agroecology education represents a challenge not only to students, but also to teachers, who themselves are educated in conventional, discipline-based academic environments. The teachers must master solid agroecological knowledge but in addition a substantial pedagogical competency, including ability and willingness to improvise. We as teachers have had to give away the traditional university professor's explicit control of each phase of learning, and learn to work more continuously and closely with the students. In doing so, we open ourselves up to more explicit feedback from the students, and we have therefore coined this educational approach a 'pedagogy with no mercy'. We find that this type of teaching and learning method requires a high level of confidence and courage.

Action-oriented Education and the Key Agroecological Competencies

The vital challenge of developing action-oriented education is connected to the students having to move back and forth between two worlds: the reflective world of

academia and the action-oriented world of society. This implies developing the ability to move between the specific★ every case is unique★ and the general (the theory), and to link the two. The challenges, both at the institutional level and for the individual student, of establishing this move are linked to the distinct analytical perspectives of traditional research and education. In society, the students are confronted with everyday experiences that they are asked to use as a resource in their learning process. For most of them this is very challenging, at first because many have been subject to the trivialization of everyday experiences during their previous education. During the first weeks of our course many students, as a result, have the impression that they 'learn nothing'. It is essential to raise student awareness and confidence in their own past experiences, and to validate and integrate their ideas into the groups' social learning.

Let us return to our initial questions: in what ways can we educate students to become effective agents of change in the face of the current global problems in agriculture and food systems?

Our main response to this question is to move both learning and researching activities 'out' into society. As professionals, our students will later face unique and complex situations out there, and we see it as our main task to prepare them for dealing with such situations. In moving from theory to concrete situations, there is, with reference to Aristotle in the Nicomachean Ethics (Bostock, 2000), a shift from theoretical knowledge (theology, natural sciences and mathematics) to practical knowledge (called Praxis by Aristotle). The practical knowledge is activated and developed when dealing with unique cases, and it is different from theoretical knowledge.

Our task as educators is to establish a dialogue-space where the stakeholders outside of university can meet with students and agroecology teachers (Figure 4). In this middle ground of shared concern and action, all participants can learn from each other as they collaborate on improving unique and complex situations, such as what we catalyze in the 'Eco-uplift' project. During this activity, the students have the opportunity to develop what we see as agroecological key competencies: deep reflection, rich observation, creative visioning, responsible participation and dialogue-based communication. If, during their formal education, students do not
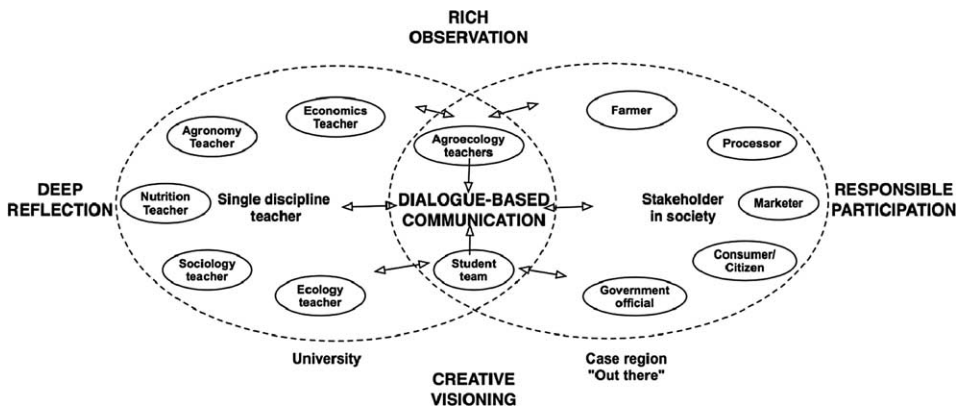

Figure 4. Students learning agroecological skills through action-oriented learning.

get the possibility of training these skills, including their interrelationships, they are likely not to have the opportunity later.

Deep reflection is the skill of consciously connecting theoretical aspects in agroecology and personal growth and learning to the improvement of situations which the students meet in the case regions. Rich observation is the skill of carefully examining situations with which the students are confronted. This has the intention of an unbiased examination. Further, and parallel to the 'outer' observation, the 'inner' observation has the students' own learning process in focus. Creative visioning is the skill of transcending the mere repetition of actions to be taken in the fieldwork. The skill of creativity implies articulating new and innovative ways of approaching problems and challenges experienced by the stakeholders. The 'results' of these 'creations' might be presented in the clients' document. Responsible participation is the skill of participating in the fieldwork, not as a distant researcher, but rather with personal commitment and dedication, and in fact an immersion together with the stakeholders in the context of the community. Dialogue-based communication is the core competency of performing a two-way communication. The dialogue takes place between students and people in the field, between students and teachers, and among the students themselves.

These competencies must be trained during the course period* not separately, but always connected to the actual situations. They can, however, separately be analyzed and discussed by, for example, reflection on the question: 'How can we strengthen ourselves as responsible participants in this casework?'

It is of further importance that we have established a flexible but rigorous protocol for the students' casework in the regions. With the additional requirement of presenting their results, including their own reflections and links between theory and practice, they are in fact doing action research on open-ended cases (Francis et al., 2009) as part of their agroecology education. As such, the researching activity is integrated in the educational activity. As teachers, we are doing two types of action research, to be able to support the students in their learning process: we participate and reflect jointly with the students as part of their project work, and in parallel we explore and reflect on our own practice as educators with the aim of improving the overall learning process.

The major global challenges facing agriculture and food systems and the expansion from food production to multifunctionality in agriculture call for what Knickel et al. (2009) call second order innovations in research and education at agricultural universities. In second order innovations, existing assumptions are being challenged and new paradigms are developed. However, we see mainly only first order innovations (Knickel et al., 2009) taking place in academia, where incremental changes are being made without challenging the basic structure of the system where it operates. We hold the lack of change to be a consequence partly of the scientific ethos that dominates our institutions ('rigorous research is made by the distant observer') and partly of the way our universities are presently organized.

Conclusion

We started this paper by arguing that agricultural and life-science universities are in real jeopardy, with the current socially-disconnected methods, professional practices

and organizational structures. Disciplinary specialization and educational activities that, in the real sense have become disconnected from the world of practice, have taken over the scene. There is an urgent need to reconsider the dual mission of higher education: to educate professionals and to foster civic engagement. What is needed for addressing this dual mission is a systemic and phenomenon-oriented research and teaching that redefines disciplinary boundaries, professional identities and where the relationship between university and non-university stakeholders are re-contextualized. We have argued that both action research and action learning are strategies that support students' learning and at the same time create a closer link between university and society.

Collaborating with non-university stakeholders as an integral part of a university programme serves four main purposes. Firstly, it enables learning about complex topics, a learning that cannot be substituted by merely reading or listening. Secondly, it supports the connecting of university and society. Thirdly, the real-life flare of such activities provides the students with enthusiasm and energy to delve into theoretical activities. Fourthly, the process builds social relevance and civic engagement that is seldom found in conventional courses or curricula.

Our experiences from the past and our thinking about the future suggest that the way ahead is about widening the midfield of higher education in agriculture and food, to allow students to become increasingly immersed in situations 'out there'. When students collaborate with non-university stakeholders, the expectations of methodological and theoretical rigor increase. This is so because the stakeholders that the students interact with must make decisions in much more blurry and complex situations than most academics want to deal with. The students have to do it in a way that is defensible to stakeholders whose well-being and life-support is depending on the quality of the decisions being made. Our task as researchers and teachers has more and more become one of facilitation of learning that is developed though communication between students and non-university stakeholders. A widespread emergence of such a type of education will not happen overnight, and will demand considerable creativity, knowledge and motivation. More research on extra-campus learning as a core part of higher education programmes is needed, as well as on challenges to develop such learning programmes and strategies to overcome these challenges.

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The exploration of environmental controversies for pedagogical purposes ...

How to learn again to slow down and hesitate ?

François Mélard
Nathalie Semal
Dorothée Denayer

Teaching complexity and uncertainty on Environmental Issues – Arlon Campus – Environment - 20-21 May 2014

Can we learn again to slow down and hesitate? To this question François and I would like to answer « Yes, we can! » - By exploring environmental controversies with students
In this speech we will show how and for what kind of pedagogical purposes it is worth to slow down and hesitate.

Environmental issues sometimes emerged from public controversies... And this is to be taken seriously

For instance, this is often the case about flooding hazards in urbanized places... Here, on this slide at Tubize – a little town in the south of Brussels – in 2010 two thousand and ten.

A diversity of actors

A diversity of stakes

From the newspaper articles and headlines on the former slide, we can infer that as the controversy spread in the press...

Heterogeneous (and sometimes new...) *actors* emerged and spoke in public:

- the residents claimed for practical and urgent measures from the local authority of Tubize;

- the mayor took refuge behind forth coming hydrological expertise's;

- the Regional Center of Crisis Management explained the exceptional character of this flood;

- Environmental NGOs commented on the de bated strategies of this flood's management...

Moreover new and heterogeneous *stakes* emerged:

- victims, who were not able to insure themselves any more , *incurred the ruin* while the land pressure exerted on the local authority resulted in anarchic housing-development in the minor bed of the river **(which was an economical**

dimension of the problem);

- Populations at risk were specifically low-incomes people **(which was a social dimension of the problem)**;

- Critics are issued about the lack of coordination between the multi-level authorities implied in the management of the Senne and its channel **(which was a political dimension)**;

- Scientific uncertainties on the hydrological and ecological state of the river, as well as the effects of measurements applied, proved to be decisive **(which was a technical dimension)**

These were the few elements that we – as trainers –knew before choosing this controversy as a case study. In a few words, this situation was complex.

A UK crop circle, created by activists to signify uncertainty over where genetic contamination can occur.

Keep it complex

When knowledge is uncertain, experts should avoid pressures to simplify their advice. Render decision-makers accountable for decisions, says **Andy Stirling**.

robust and democratically accountable.

A rigorous definition of uncertainty can be traced back to the twentieth-century economist Frank Knight[1]. For Knight, "a measurable uncertainty, or 'risk' proper ... is so far different from an unmeasurable one that it is not in effect an uncertainty at all". This is not just a matter of words, or even methods. The stakes are potentially much higher. A preoccupation with assessing risk means that policy-makers are denied exposure to dissenting interpretations and the possibility of downright surprise.

Of course, no-one can reliably foresee the unpredictable, but there are lessons to be learned from past mistakes. For example, the belated recognition that seemingly inert and benign halogenated hydrocarbons were interfering with the ozone layer. Or the slowness to acknowledge the possibility of novel transmission mechanisms for spongiform encephalopathies, in animal breeding and in the food chain. In the early stages, these sources of harm were not formally characterized as possible risks — they were 'early warnings' offered by dissenting voices. Policy recommendations that miss such warnings court overconfidence and error.

The question is how to move away ▶

But wouldnt this kind of situation be too complex for pedagogical purposes? Our approach can be summarize by this call of Andy Stirling in his article in Nature:

Keep it Complex!

But how? Our answer: By letting in the protagonists of the controversy into the university.

Our purpose

- Turn complexity and uncertainties as pedagogical ressources

- To present a seminar : the « Integrated Exercices » (MSGE)

The purpose of our talk today is double:
First, to share with you the interest to work on those complex situations with students: How to turn scientific and technical uncertainties, complexity and the confrontation of contradictory points of view, into pedagogical resources? How to learn from those apparent messy, intricate, convoluted and sometimes confused situations in order to shed lights on typical or new environmental dynamics.
Second, To share with you our – now - 15 years of experience in conducting a seminar called « Integrated Exercises » that take place in our 1st year of Master in Environmental Sciences and Management.

the IE setup

- How to equip both students and trainers in their exploration of the controversy ?

  - With the design of a specific setup (in time and space)

  - With the use of a specific theoretical framework

How to equip both students and trainers in their exploration of the controversy ?
With the design of a specific setup (in time and space)
With the use of a specific theoretical framework

Week n°1 : exploration					
	Monday	Tuesday	Wednesday	Thursday	Friday
am	Plenary session / Working session		Fieldwork		X
pm	Working session				X

Week n°2 : exploration & analysis					
	Monday	Tuesday	Wednesday	Thursday	Friday
am					Oral presentations
pm					

Here is some key information about the setup of the integrated exercises.

Issues are explored through a sequence of activities spread **over a period of two weeks**. There are two main types of activities:

- speeches by some of the actors involved in the controversy, highlighted in yellow on this slide,

- Group working supervised **by a team of trainers,** highlighted in green on this slide.

The Wednesday of the first week is special: students and trainers go on the field in order to meet some local residents and members of municipality administration and to visit locations where the problem occurs.

Group working modalities vary during IE. On first week, group working is devoted to analyse each actor's speech and point of view, with a theoretical framework (the CATWOE grid). On the second week, students compare actors' points of view as they are synthesized. On this basis, they raise key issues of the problem. Then they have to focus on one of them, that are to analyse the different ways proposed by the actors to frame this key issue. As these activities are highly

interpretative, vivid debates occur between the group members. Their confrontation to both different points of view and different interpretation of these points of view are resources for learning.

The output of each group is to explore a specific issue (related to the more general topic); usually a very technical, object oriented in order to show the different modes of knowledge production, the different modes of resolution considered and their consequences. At the end of the second week, each group of students expose a synthesis of its collective work on it to the other groups (in grey) and to the trainers plus an external researcher or professional. **As a keynote speaker,** he or she put an end to the EI by giving a conference that links his or her research findings with the work realized by the students.

_____

Quelques éléments d'information sur l'organisation des EI
L'exploration se réalise à travers une alternance d'activités étalées sur deux périodes d'une semaine, séparées par un intervalle de deux semaines. Les lundi, mardi et mercredi matin, un éventail choisi de protagonistes du problème exposent oralement leur point de vue sur la problématique aux étudiants, en séance plénière dans le grand auditoire. Le mercredi de la première semaine est un peu différent : un déplacement sur le terrain est organisé, au cours duquel les étudiants rencontrent également des protagonistes du problème - typiquement des riverains et des membres de l'administration communale - et visitent des lieux où le problème se manifeste. Les après-midi et les jeudi sont consacrés à des travaux en groupes multidisciplinaires d'environ 8 personnes dans de petites salles.
Au cours de ces travaux de groupes, lors de **la première semaine**, les interventions sont analysées par les étudiants à l'aide de la grille CATWOE.
Lors de **la deuxième semaine**, les étudiants mettent en comparaison les points de vue des acteurs, sur base de leur analyse à l'aide de la grille CATWOE en sous-main, et dégagent des enjeux clés de la problématique sur base de cette comparaison. Ils sont amenés à choisir l'un de ces enjeux clés et de l'analyser de manière approfondie à travers les différents points de vue exprimés. _Ces travaux de groupe sont animés par les encadrants qui font l'exercice avec les étudiants car ils découvrent les témoignages (les données) en même temps qu'eux._ C'est cette position particulière qui nous amène à parler « d'encadrants » plutôt que « d'enseignants ». La deuxième semaine se termine par un exposé oral où les étudiants présentent oralement une synthèse de leur travail. Cette présentation orale est réalisée en présence d'un chercheur ou professionnel extérieur qui clôturera les EI par une conférence faisant le lien entre les travaux réalisés par les étudiants et leur propre recherche.

Week n°1 : exploration

	Monday	Tuesday	Wednesday	Thursday	Friday
am	Scientist & Historian	Crisis Management Officer	Local Public Authority & Citizen's Association (fieldworks)		X
pm					X

Week n°2 : exploration & analysis

	Monday	Tuesday	Wednesday	Thursday	Friday
am	River Management Association	River Planning Administration	Environmental NGO		Oral presentations
pm					Feed-back & Conference

For example, for the case study of floodings in Tubize, we chose – as trainers – the following list of actors of the controversy. Specialists speaking about the history and the state of art of water management

————————————————

Pour l'étude de cas sur les inondations de Tubize, nous avons choisis les intervenants suivants…
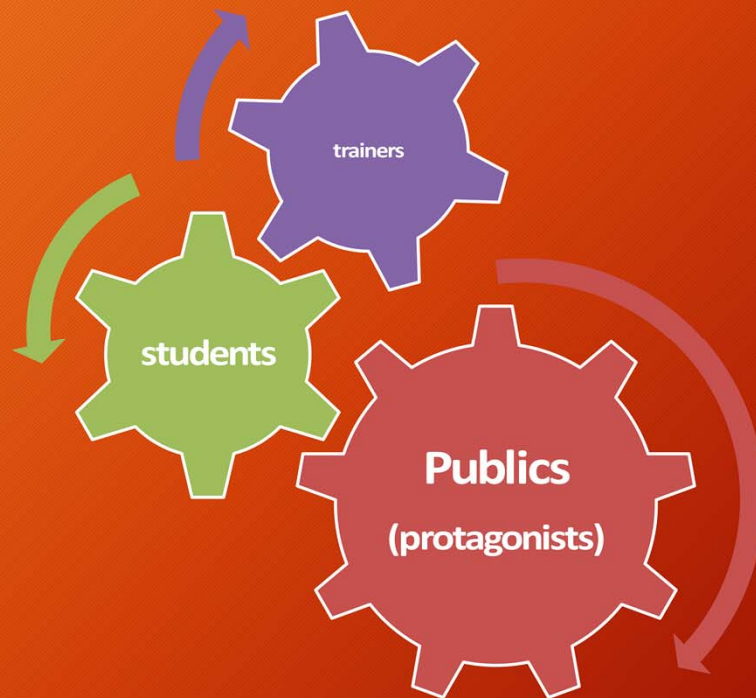
The exploration of the situation involve a triad made by protagonists (publics), students and trainers

Why do we use the notion of triad?

Because the entering of the protagonists into the university and the relationships between them and both students and trainers has to be carefully set up. Let us here be clear: the integrated exercise don't mimic a real situation. On the contrary, this is an artificial situation organized in details in order to shape the interactions. This is a key issue because the aim of the integrated exercises is « Emergence »: it is about to make something new happen between the triad members, something that is not thoroughly predictable and that is - in the same time - partly framed. This emergence is largely based on the epistemic attitude (posture) of the people involved in the triad and on the forms of symetry that the learning setup (dispositif) allows to build between them.

_____

Pourquoi parler de triade ?

L'entrée de ces acteurs à l'université et les relations qui se tissent entre eux et les étudiants et encadrants ne sont pas laissées au hasard, elles sont soigneusement mises en scène. Les EI ne reproduisent pas la situation réelle. C'est une situation artificielle, minutieusement organisée afin de mettre en place la délicate triade entre intervenants, étudiants et encadrants. Car le principe des EI, c'est l'émergence : il s'agit de susciter quelque chose d'inédit, donc non totalement

prévisible mais néanmoins cadré, entre les « acteurs » des EI. Cette émergence tient beaucoup à la posture de chaque catégorie d'acteurs et des formes de symétries que le dispositif permet de construire entre eux.

	Trainers	Students	Protagonists
Excerpts	*« its time to stop : the situation is becoming too complex ! »*	*« You... who are you to speak about [science] ? What are your qualifications ? »*	*« I'm an ingeneer, but also as mediator [enrolled as expert]... »*
To let aside (the price to pay)	- To frame the problem - To solve the problem - To optimize the solution	- To react as a specialist of its own discipline - To search who is wrong or right - To search for the consensus	- To behave just as a stakeholder
To bring back (posture)	- To keep the tensions alive - To give room to hesitations and learning spaces	- To take a distance with preestablished categories & expertises - To be involved personally	- To be a witness of the situations - To speak in behalf of their experiences (as a practitioner) - To share their hesitations

First of all, each group is convey to adopt a new attitude (posture) that the usual (institutional, traditional) one.

To a first approximation, it can be said that entering in the setup (dispositif) requires from each of the three groups members that they leave aside and bring back something. But the « right of access » is different for each one, as you can see here...

Here is an attempt to characterize those attitudes through selective spontaneous reactions that express discomforts.

Excerpts:

« *It's time to stop: the situation is becoming too complex!* » (From a young engineer)

« *You... who are you to speak about science? What are your (professional or educational) qualifications?* » (students with a background in applied sciences who, in the back of the room, was tackling members of an environmental NGO about their « scientific interpretations » of the situation)

« *I'm an engineer, but also a mediator...* » (a scientist speaking about its role of

expert)

Now let see the cost and benefits related to each of them!

This displacement of posture produces insecurities:

- **For the protagonists**, to whom it is asked to share their practices; practices that imply always a part of tinkering, of doubts, of risky associations that some would usually prefer to silence;

- **For the students**, for whom it is given the chance to live an experience that contrast with more usual, classical mode of teaching. It means to experience complexity and tensions, to experience the confrontation and resistance, to discover that uncertainties « are part of the job »; to give up the myth of the so-called objectivity of expertise, all of this leads some to hesitate, and to live a saving perplexity.

- **For the trainers**, it is acknowledging the existence of different (and sometime unexpected...) forms of expertise, it is learning about the case at the same time as the students and to endanger the risk of being out of their comfort zone, or out of their area of expertise.

Two consequences out of thoses moving attitudes...

- To work a tension between...
  - Complexification
  - Problem solving

- To craft a threefold symetry :
  - For the students
  - Between trainers
  - Between trainers & students

We can highlight two consequences out of those moving attitudes...

- At the core of environmental management practices: It leads to work on **the fundamental tension**s that arise between...

- The complexification (opening) of the problem (who are the actors, what are the competing knowledge's, the different mode of action,) & its resolution (closure) (the range of solutions to the problem and their implementations).

It means to promote management not just as mastering technical tools to implement decision, but as practices according to which

    1) problems and actors' identities are explored and transformed
    2) and limits of what is knowable are themselves movable.

This, of course, generates often cognitive and emotional disturbances that have to be taken in charge by the trainers and its setup.

A second consequence :

- A threefold **kind of symmetry** is crafted between the members of the triad:

- **Symmetry for the students** in the way to take into account the different actors of the problem... All are regarded as legitimate, without granting privilege to the scientific speech. The speeches are not treated on a hierarchical basis but are confronted and articulated. Here trainers with their work of supervision have a central role to play because it is often in the debate and the controversy that contradictory premises and claims emerge from the protagonists discourses.

- **A symmetry between trainers** : they come from different disciplinary backgrounds (engineer, biologist, sociologist, anthropologist...) and convergent methodology and pedagogical objectives have to be negotiated;

- **A symmetry between trainers and students:** as for the students, trainers are not necessary specialists of the problem. Despite having a minimum documented the case study (to assess its feasibility), they will discover and learn at the same rhythm that the students. They are themselves in an exploring mode (which necessitates the same type of learning commitment in regard of the protagonists of the case). Of course, this is possible because they master another type of skills (the one they want to transmit to students) : to master a methodological framework, to research and clarify the different point of view, to highlight different stakes and competing mode for resolution of the problem. In fact, to develop a critical mind.

C.A.T.W.O.E ?

A methodological equipment for both the trainers and the students

Soft Systems Methodology | January 1 | 2011

The Soft Systems Methodology (SSM) is a systemic approach for tackling real-world problematic situations. Soft Systems Methodology is the result of the continuing Action Research of Peter Checkland, Brian Wilson and many others, conducted over 30 years, to provide a framework for users to deal with the kind of messy problem situations that lack a formal problem definition.

Includes a 30-year retrospective

Soft Systems Methodology in Action

Peter Checkland and Jim Scholes

WILEY

Which methodological equipment are we talking about?

In a pedagogical perspective, the rigorous and symmetrical exploration of both…

1)   the ties that link the concerned publics to the/their problems and

2)   Their ways – each time very specific – to consider key dimensions of the problem and their modes of resolution… constitute an important issue.

An important issue for developing a critical mind and acquiring key professional skills.

To meet this stake, the CATWOE as a guide for analysis constitutes a precious aid in the IE's setup. CATWOE is a mnemotechnic device to record "what we need to be interested in to understand a problem and envisage its solution" (Checkland 1999). CATWOE is part of the Soft System Methodology investigated by Peter Checkland (an engineer of the University of Lancaster). It is designed has a management tool, but a management tool that gives up a rationalizing **thought** in favor of the investigation of the intelligibility of the situation and a collective apprenticeship.

As we will see, and according to Checkland, it is presented in the form of "a

simple checklist to control the thought, aiming at stimulating an open reflection"
(Checkland 1998).

The C.A.T.W.O.E (Soft System Methodology — P. Checkland)

C	*Customers*	The beneficiaries/victims of the transformation
A	*Actors*	The entities (human, objects, institutions) to be mobilised.
T	*Transformation process*	The passage from the actual to the « improved » situation.
W	*World view*	Beliefs and values that justify the transformation.
O	*Owner*	The key entity on which rest the transformation
E	*Environmental contraints*	The external entities that weight on the situation.

This guide is used by the students in order to interpret the discourse of each protagonist as a coherent system.

The **T** as the « Transformation Process » enable to understand the way the protagonist envisage the future: the type of new situation desired.

The **W** points to the world view the protagonist have to justify this transformation (that's to say his/her values, beliefs...)

The **C** (as Customers) is about the victims or beneficiaries as impacted actors by the transformation

The **O** serves to characterize the owner of the problem i.e. the entity that has the power to facilitate or stop the transformation

The **E** is all about the contextual facts that weigh on the problem, facts that are conceived as out of reach by the protagonist, and which existence is not questioned.

Those Meta-categorises serves, according to Peter Checkland, to make a picture of the discourse of each protagonist as a coherent « system of activities ». The system that may be compared one to the other.

A little sketch…

C	Customers	The beneficiaries/victims of the transformation
A	Actors	The entities (human, objects, institutions) to be mobilised
T	Transform ation process	The passage from the actual situation to the « improved » one.
W	Weltangsc hauung	Beliefs and values that justify the transformation.
O	Owner	The key entity on which rest the problem
E	Environme ntal contraints	The external entities that weight on the situation.

O

A   T , W   C

E
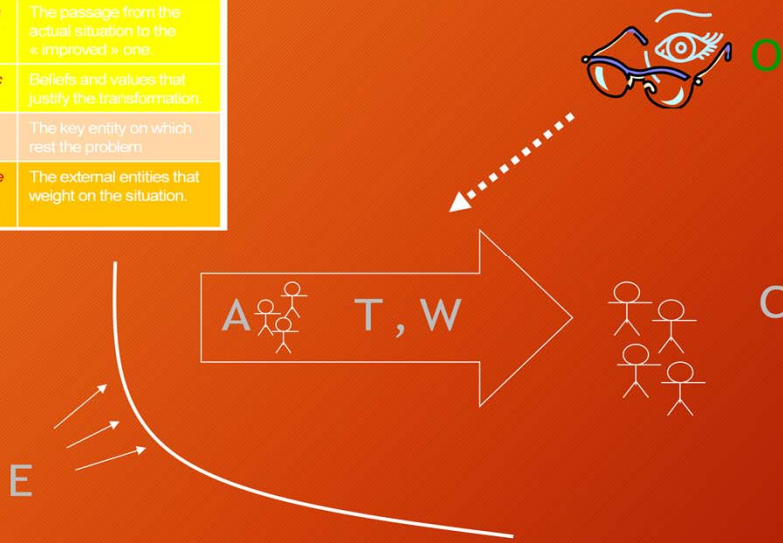
(J.-B Narby 2010)	Limitation of the vulnerability	Mastering of the hydrological regime
Responsability	To cope with causes beyond control	technical
Efforts to do	Renonciation to the use of too vulnerable spaces	Financial investments, technical landscaping, coordination at the scale of the water basin
Relations to nature	Rivers are considerate as living entities, with sometimes unpredectible behaviors, that has to be respected	Rivers are at the disposal to humans, and are artifacts.
Knowledge productions	Analysis of historical swellings (crues), local observations, production of public Flood risk maps	Modelisation of hydrological regimes
Claims	Underestimation of the complexity, ignorance of uncertainty, past is forgotten, persons are exposed to the hazards of technical infrastructures	Actions are planned, their effects are modelized, change is controled and anticipated (futur ≠ past)

Here is some type of outputs of the EI… in the case of Flooding's management at Tubize:

From the confrontation of the different point of view (out of the comparison of the different CATWOE's grids) emerged two different way to relate to nature and to manage flooding:

Either you speak **of limitation of the vulnerability** (as for the Crisis 'management Officer, the historian of technology, the association of citizens…) or you speak of **mastering the water/hydrological regime**… (As for the chief engineer of the river management Administration or the Local Public Authority…).

Each position may be seen as two different ways to frame the problem and to envisage solutions.

That's to Say: see illustration of Narby

IE as Publics Based Learning

- From a *Problem* Based learning   to...
          a *Publics* Based Learning...

- From Interdisciplinarity to...
                    multidimensionality...

We will conclude by the following remarks...

The IE is centred on a case study... however it is not a **Problem** Based learning,... but we would say a **Publics** Based Learning... precisely because there is often disagreements of what is the problem, and how to deal with it. It is « publics » in the sense that there are multiple actors involved in the controversy, with multiple, diverse and sometimes contradictory accounts of what had happened, of why and how to deal with the problem.

Thus in contrast with the usual path which leads to take the problem as a point of departure for the learning process... i.e. A definition made by the teacher/professor (as expert of the problem) that should enable students to apply the disciplinary knowledges and techniques to « solve » the problem... We propose to take precisely the publicly debated accounts as a resource for the learning process with the students.

In this sense, **Publics** based learning: is not a matter of interdisciplinarity!

... We do have a multiplicity of publics (protagonists) displaying often competing ways of defining or ways of coping with the problem.

It is their own discourse/claim that is multidimensional : we have to be able and to accept to hear an expert when he or she share their values or belief when talking about society, as we do have to take into account impacted citizens or civil association when they speak about scientific or technical issues.

Precisely, this is in part what participates to produce the tensions between complexity exploration and problem solving and which is at the heart of management as practice.

Thank you !

Sustainable teaching in agroecology: from classrooms to chestnut orchards

Alexandre Aebi

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Institut d'ethnologie

UNIVERSITÉ DE NEUCHÂTEL
Institut de biologie

Teaching complexity and uncertainty on Environmental Issues.
Practices, Theories and Products, Arlon, 20-21 May 2014

An interdisciplinary bachelor between biology and anthropology

Mapping environmental controversies

Numeric tools

Science and technology studies

Biological analyses

Controversy mapping

Interviews, Observations, The laboratory life

Socio-anthropology of environmental concerns
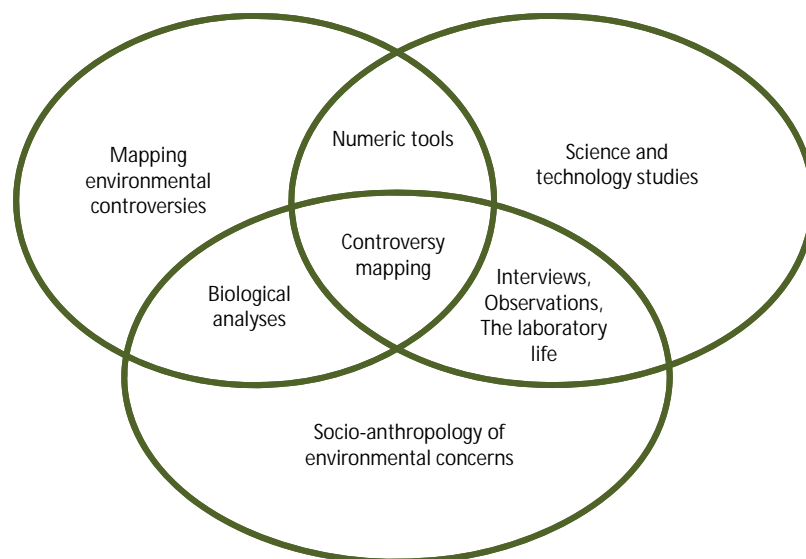
Classical biological control (exotic species)

Torymus sinensis, a chinese natural enemy succesfully used since 1979 to control the chestnut gallwasp.

Negative impact on the environment detected in Japan
(formation of hybrids between *T. sinensis* and a native species, impact on the population of the native species)

Introduced in Italy (Piemonte) since 2005

Aebi et al. (2011) Agroscope ART Report ISBN: 978-3-905733-20-4
Aebi et al. (2007) EPPO Bulletin 37: 166-171
Aebi et al. (2006) Springer-Verlag, Tokyo. p: 103-121

Picture: Corradetti

Picture: Stone

http://e2nz.org/

Picture: Corradetti

Bigler et al. (2006) CABI Publishing, Wallingford, UK. 299 pp.
Gibbs et al, Aebi A (2011) BioControl 56:527–538
Moryia et al. (2003) 1st International Symposium on Biological Control of Arthropods
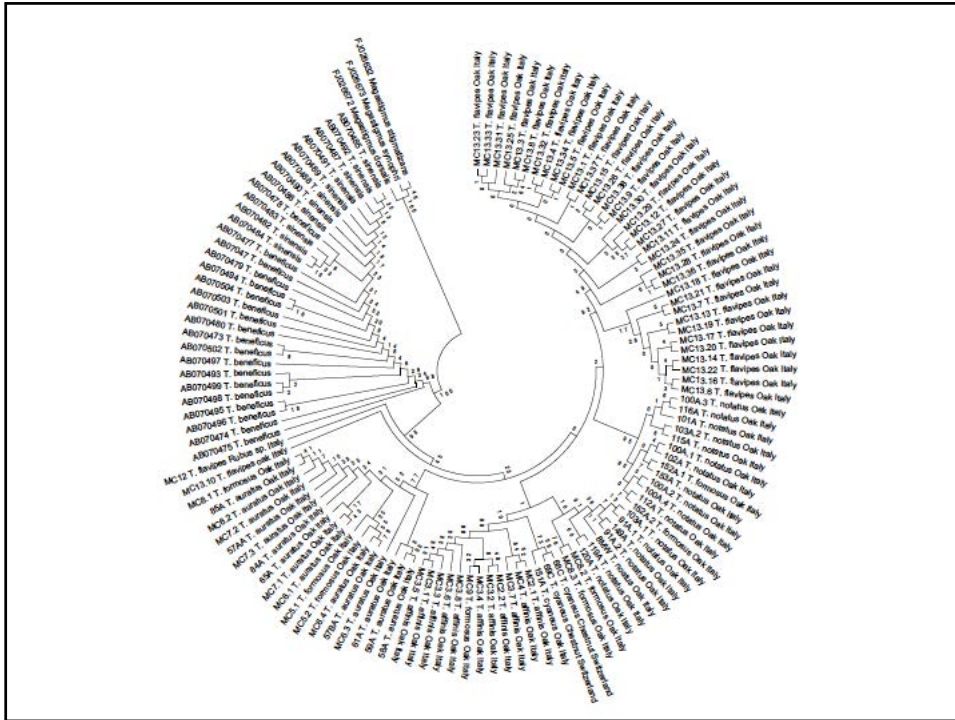
First analysis of the « problem »:

Scientists say that…

Bern splits hairs

And chestnut producers must be patient …

Picture: Pichard

Biologists and their study objects

Regulators and the legal framework

Amateur naturalists passionate about chestnuts

The interplay with the media

An heritage

www.lebendige-traditionen.ch

Several « hybrid problems »:

Torymus frankenseinimus

Heritage vs production (nurseries)

agriculture vs natural forests

Frontiers in biology

Bern in the international scene
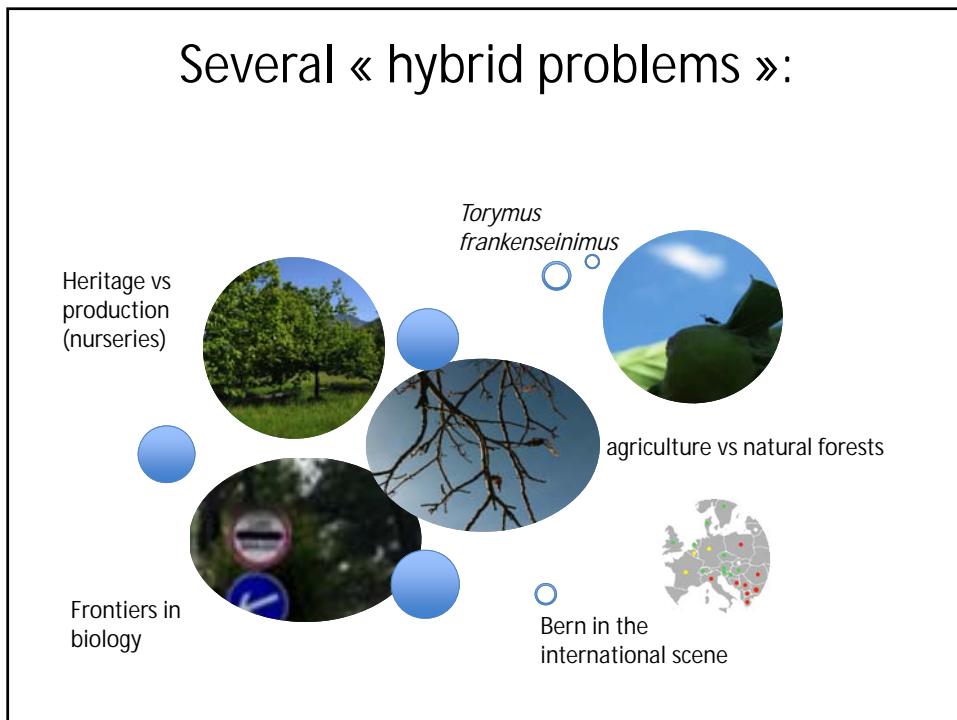
The initial problem « disapears »

An interdiciplinary approach allowed us to:

- re-shape the problem's boundaries, understand its complexity
- understand the point of view and arguments of practitioners, chestnut amateurs, scientists and regulators.
- Understand complicated environmental risk assessments (CH vs FR vc IT)

Give hope to chestnut owners.

Understand that practitioners own a precious know-how.

The bond between practitioners and their trees is the key to maintain chestnut orchards, a precious ecosystem.

Thank you!

Ellen Hertz, Edoardo Guaschino, Dalinda Bouraoui, students of the course « Socio-anthropologie des problèmes publiques »

Franz Bigler, Mario Waldburger (Agroscope ART)
Nicola Schönenberger, Corrado Cara (Innovabridge, TI)

CHAPITRE XI

L'enseignement des *focus groups* en science politique

Sébastien BRUNET, Céline PAROTTE et Stéphanie VANHAEREN

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de la Prospective et de la Statistique et Professeur à l'Université de Liège

Chargée de recherche, Université de Liège – SPIRAL

Chargée de recherche, Université de Liège – SPIRAL

Introduction

En sciences humaines et sociales, la mobilisation de techniques délibératives comme les groupes focalisés (*focus groups*) est de nos jours devenue pratique courante. Pour s'en convaincre, il suffit d'identifier les recherches et publications qui, au cours de ces dix dernières années, ont mobilisé ladite technique. La science politique n'échappe pas à ce mouvement général puisque les groupes focalisés permettent *in fine* de recueillir des informations relatives aux perceptions et représentations des individus, que ceux-ci soient interrogés sur la mise en œuvre de politiques publiques, leur engagement politique, leur confiance aux institutions ou encore leur connaissance d'usage ou profane.

À l'Université de Liège, les étudiants de deuxième année de baccalauréat en science politique sont invités depuis quelques années à réaliser un exercice de *focus group* dans le cadre du cours de méthodologie qualitative. C'est l'accumulation de matériaux – travaux écrits des étudiants, observation des *focus groups* par les évaluateurs de l'exercice, procès verbaux des réunions entre étudiants, courriels échangés avec le personnel scientifique et académique, éléments d'autocritique rétrospective des étudiants issus de leur rapport d'analyse – qui fait l'objet de ce chapitre. Par conséquent, s'il est certes question de montrer l'intérêt que représente la mobilisation de la technique des groupes focalisés, ce chapitre est surtout l'occasion de mettre plus particulièrement en évi-

dence les apports d'un tel outil dans le cadre d'un cursus universitaire à destination des étudiants en science politique. Dans ce cadre et dans un souci d'illustration, il sera régulièrement ponctué d'extraits issus des rapports d'analyse d'étudiants.

D'une manière générale, la réalisation d'entretiens de groupe comporte quelques difficultés qui rendent l'apprentissage de l'étudiant d'autant plus intéressant qu'il comporte une dimension quasi ludique. Elle reste une épreuve enrichissante non seulement par la conduite de la discussion, la dynamique de groupe qu'elle génère et l'analyse dont elle fait l'objet, mais également par l'organisation et la coordination que requiert sa mise en place.

I. Une méthode en huit étapes appropriée par les étudiants en science politique

Alfred Goldman (Goldman, 1962) définit la technique des *focus groups* à partir de ce qu'il appelle le *Group Depth Interview*. L'intensité – *depth* – implique la recherche d'une information qui va au-delà de ce qu'il est possible habituellement de collecter au niveau d'une relation interpersonnelle[1]. On insiste de la sorte sur la qualité de l'information que peut fournir l'interaction entre les individus qui est en fait, une conséquence directe de l'existence du groupe lui-même.

La notion d'*interview* met en évidence la présence d'une tierce personne ou d'un modérateur qui utilise le groupe en tant que dispositif susceptible de lui fournir des informations pertinentes, que cela soit dans le cadre d'une recherche ou dans le cadre d'une prise de décision. Du point de vue de ceux qui utilisent la technique, la perspective adoptée est donc partiellement instrumentale. En outre, les *focus groups* représentent, pour les participants, un moment d'apprentissage privilégié au cours duquel ils pourront exprimer et faire entendre librement leurs points de vue.

Ajouté à cette définition en trois points, le terme *focus* signifie simplement que l'entretien concerne un nombre limité de thèmes d'investigation (Steward & Shamdasani, 2007 : 10). Ceux-ci sont fonction des objectifs du commanditaire de la technique, et seront au centre de la phase délicate d'analyse des groupes de discussion.

Au-delà de cette définition en trois points, il n'existe pas de modèle « prêt-à-porter » ou standardisé de la technique du *focus group*, puisque celle-ci doit être adaptée aux conditions particulières des contextes dans lesquels elle est mise en œuvre. Cependant, au regard de la pratique, il est possible de décrire un certain nombre de principes fondamentaux et

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[1]   Comme c'est le cas lors d'une interview individuelle par exemple.

de lignes de conduite qui pourront rendre cette technique opérationnelle et exploitable pour les praticiens.

Pour faciliter le travail de l'étudiant, nous leur avons décrit huit étapes à distinguer dans la mise en œuvre de *focus groups* :

1. La définition des thèmes ;
2. L'élaboration du protocole ;
3. La définition de la population-cible et la composition du groupe ;
4. L'élaboration du guide d'entretien ;
5. Le groupe test ;
6. Le recrutement des participants ;
7. L'animation du *focus group* ;
8. L'analyse.

Aussi, nous présenterons ces retours d'expériences au travers de ces huit étapes chronologiques qui mènent au *focus group*. Cependant, deux moments sont clairement distingués chez les étudiants : celui qui concerne les étapes nécessaires à la préparation du *focus group* (étapes 1 à 6) et les étapes de réalisation du *focus group* proprement dit (étapes 7 et 8). C'est pourquoi, l'animation du *focus group* fera l'objet d'un développement plus particulier, en portant une attention spéciale à la disposition de l'espace, au rôle de l'observateur et de l'animateur et à la phase de débriefing. Enfin, l'étape de l'analyse se divisera en deux temps : celui de la retranscription et celui de l'autocritique.

A. La définition des thèmes

Dans le cadre du cours de « Méthodologie qualitative en Science Politique » organisé à l'Université de Liège, le choix du thème sur lequel portera le *focus group* est du ressort des étudiants. Totalement libres et indépendants à cette première étape de mise en œuvre, on constate que les thématiques choisies par les groupes d'étudiants portent sur des matières diverses telles que l'enseignement, l'environnement, les politiques urbaines et les questions sociales, familiales et sociétales, les nouvelles technologies de l'information et de la communication.

Quelques exemples de thèmes abordés par les étudiants.

Enseignement et pédagogie	« La pédagogie active » (2006-2007) « La pertinence des programmes scolaires au travers des yeux des professeurs » (2006-2007) « Le niveau des compétences des élèves à la sortie de l'enseignement primaire est-il homogène/égal ? » (2007-2008) « L'importance de l'influence de la religion

	catholique dans l'enseignement secondaire libre en Communauté Française de Belgique » (2009-2010) « Le passage des études d'instituteurs primaires de trois à cinq ans » (2010-2011) « Quelles sont les raisons qui poussent des parents à inscrire leur(s) enfant(s) dans une école pratiquant la pédagogie Freinet ? » (2010-2011)
Les questions environnementales	« Actions citoyennes en matière de lutte contre le réchauffement climatique » (2007-2008) « La rationalisation des collectes de déchets ménagers » (2008-2009) « Quels efforts la jeunesse est-elle prête à réaliser pour lutter contre le réchauffement climatique ? » (2009-2010)
Les politiques urbaines	« L'influence de la religion sur la ville quotidienne » (2006-2007) « Installation d'un centre de prostitution à Liège » (2010-2011) « La mobilité lente dans le centre ville de Liège » (2009-2010)
Les questions de société	« Quel avenir pour les médias traditionnels à l'heure de l'outil Internet ? » (2008-2009) « Facebook et son impact dans le milieu socioprofessionnel » (2008-2009) « Engagement politique des jeunes » (2006-2007) « Le congé de paternité » (2008-2009) « La Belgique francophone : terre de sportifs de haut niveau ? » (2008-2009) « Les freins de la réinsertion professionnelle rencontrée par les chômeurs de longue durée » (2009-2010) « Les jeunes en situation d'extrême précarité à Liège » (2009-2010) « Temps de crise : Le moral des citoyens des classes populaires » (2010-2011)
Législation et projets politiques	« Les restaurateurs face à l'interdiction de fumer » (2006-2007) « Les Tribunaux d'application des peines » (2006-2007) « Le droit de vote à 16 ans » (2009-2010) « L'interdiction du port du voile dans les lieux publics » (2010-2011) « Loi anti-tabac du 1er janvier 2010 interdisant de fumer dans les brasseries proposant de la nourriture et perspective d'avenir » (2010-2011) « La diminution de la TVA dans la restauration » (2009-2010)

Le plus souvent, toutefois, c'est après avoir déterminé la composition de leur population-cible que les étudiants choisissent le thème de leur

focus group. À leurs yeux, il faut en effet que les participants soient facilement mobilisables ; par conséquent, ils font souvent appel à leurs connaissances (famille, amis, anciens professeurs).

Comme dit précédemment, pour les étudiants en science politique, ce choix de la thématique est aussi directement lié au choix du public cible (cf. *infra*). En fonction des contraintes de temps et de disponibilité du public cible choisi, les étudiants font face à une série de questions redondantes : le choix du public cible est-il pertinent par rapport au thème ? Comment puis-je m'organiser au mieux pour les joindre ? Les personnes-ressources sont-elles mobilisables ? En effet, mobiliser plusieurs personnes sur la thématique d'un sujet sensible peut demander beaucoup de temps et d'énergie. Compte tenu du contexte, des groupes cibles a priori plus accessibles peuvent se révéler par la suite difficiles à mobiliser.

> Le premier obstacle que nous avons rencontré est celui de la recherche des participants (...). En effet, un des avantages présumés de notre *focus group* était notre public cible : des professeurs. (...). Nous pensions que leur profil sociologique et leurs horaires constitueraient un bénéfice dans notre travail. Nous avons eu bon nombre de contacts enthousiastes à l'idée de participer à notre *focus group*, mais peu de confirmations (Extrait du groupe « L'importance de l'influence de la religion catholique dans l'enseignement secondaire libre en Communauté Française de Belgique », année 2009-2010).

De surcroît, ces étudiants ont été confrontés à de nombreux refus de certains établissements de les recevoir une fois la thématique présentée.

Un autre groupe dont le thème était « Les 18-25 ans en situation précaire à Liège » se trouvaient face à l'impossibilité de joindre les participants par des moyens perçus comme plus « classiques » (téléphone, courrier, mail, etc.). La position de repli fut de composer un groupe avec des intervenants travaillant avec cette catégorie particulière de personnes en situation de précarité.

Les étudiants motivent généralement le choix de leur thème par le désir de correspondre à un sujet d'actualité, tout en évitant, dans une optique de bilan, les sujets délicats qui pourraient déboucher sur de simples oppositions ou des réactions de sensibilité.

Certains étudiants veulent dépasser le simple cadre du travail imposé et donner à leur expérience de *focus group* une finalité sociétale d'aide à la décision de politique publique : par exemple, au cours de l'année académique 2008-2009, un groupe d'étudiants a réalisé un groupe focalisé à l'intention des autorités municipales de la ville de Herstal dans le cadre d'un projet de rationalisation de collecte de déchets.

Notons encore deux éléments. Premièrement, malgré la volonté de s'inscrire dans une approche scientifique, il est rare que les étudiants déterminent leur choix en fonction de ce qu'une recherche de type qualitative pourrait apporter à un thème particulier. Ensuite, dans une optique d'efficacité, l'adhésion de l'ensemble des membres du groupe de travail au thème choisi est un élément fréquemment rapporté.

> (...) Pour la rentrée, chacun devait avoir réfléchi à un thème. Il a été convenu qu'on procéderait à un vote à la première réunion (Extrait du groupe « Les 18-25 ans en situation précaire à Liège »).

B. L'élaboration du protocole

Le protocole est présenté aux étudiants comme un document écrit comprenant un texte de présentation de la recherche et les questions ou les dimensions qui seront abordées lors des séances de discussion. Il est rappelé que le protocole fournit un schéma théorique du déroulement de chaque séance de réunion d'équipe. Deux dimensions sont à distinguer dans ce protocole. La première dimension consiste en la répartition des tâches pour tout ce qui constituera le rapport final : recherche juridique et législative, scientifique et bibliographique ; recherche presse et actualité ; entretiens exploratoires auprès des *stakeholders*. La deuxième dimension est plus particulièrement la répartition des rôles incombant à chacun le jour du déroulement du *focus group* (les observateurs, l'animateur, les responsables logistiques).

Les étudiants attirent l'attention sur le fait que l'attribution des tâches est un exercice délicat, où tenir compte des qualités personnelles et relationnelles de chacun est un gage de succès. Différents rôles, non exclusivement attribuables à une seule personne et non exhaustifs, sont identifiés par les étudiants : le chargé de communication extérieure au groupe de travail, les équipes de recherches exploratoires, le rédacteur, le secrétaire, le responsable logistique, le coordinateur du groupe de travail et l'animateur du *focus group* – et éventuellement son assistant – qui sont des rôles majeurs lors de l'élaboration du travail de recherche.

Ce que les étudiants retirent principalement d'un tel exercice sont les contraintes – gérer le temps et les caractères de chacun, aboutir à des consensus – et l'intérêt – l'enrichissement des idées, la mise au point d'une méthodologie de travail – que représente un travail de groupe. Forts d'une expérience de recherche, ils sont généralement heureux d'ouvrir l'environnement universitaire aux personnes extérieures. Leur dernière satisfaction – et non la moindre – est d'avoir bénéficié d'une expérience d'animation de groupe où le débat a pu être créé.

C. La définition de la population-cible et la composition du groupe

La composition des groupes est une étape préalable importante qui requiert rigueur et imagination. Elle touche deux notions souvent mal interprétées par les étudiants : l'homogénéité et la compatibilité du groupe (Steward et Shamdasani, 2007 : 25-28).

Premièrement, les étudiants en charge de la réalisation des groupes de discussion doivent sélectionner des participants qui présentent à leurs yeux des caractéristiques pertinentes par rapport à la thématique abordée. Ces caractéristiques communes identifiées par le chercheur participeront à l'homogénéité du groupe. Ainsi, un groupe homogène est un groupe dont les membres présentent un certain nombre de points communs jugés opportuns par les initiateurs de la méthode. En pratique, les étudiants confondent le concept d'homogénéité avec celui de représentativité.

La compatibilité du groupe est un autre élément important étroitement lié à la notion de cohésion. En effet, le concept de « compatibilité » suppose que les participants ont des caractéristiques personnelles suffisamment similaires – besoins, personnalité, attitudes – afin de pouvoir constituer une communauté d'intérêts (Goldman, 1962 : 61-68). Elle suppose l'absence de caractéristiques antagonistes qui peuvent être sources de conflits. À cet égard, certains étudiants commettent l'erreur de croire que les participants doivent avoir tous un avis identique sur la problématique : la compatibilité est souvent assimilée à l'obtention d'un consensus. La réunion de personnes présentant un certain nombre de caractéristiques communes est en effet de nature à faciliter l'émergence des opinions et révélations à caractère personnel. Il faut par exemple s'abstenir d'intégrer dans un groupe une ou plusieurs personnes pouvant être perçues comme plus ou mieux informées que les autres, et ce, dans le but d'éviter que les participants n'hésitent à partager leurs expériences et opinions (Krueger, 1994 : 14), ce qui favoriserait l'apparition de phénomènes de *leadership*. Un problème de ce genre s'est ainsi posé pour le groupe travaillant sur l'installation d'un centre de prostitution à Liège : face à quatre acteurs de terrain (travailleurs sociaux et agents de police), deux participants (dont une étudiante en criminologie) se sont retrouvés isolés de la conversation qui relatait essentiellement la réalité du travail des précédents.

L'extrait du groupe « Temps de crise : le moral des citoyens des classes populaires » (2010-2011) l'illustre également :

Madame E. et Monsieur J. n'auraient pas pu avoir une conversation entre eux à cause de la différence de milieu, d'éducation et de formation. Du

coup, cela manquait de cohérence car les gens ne parlaient pas de la même chose.

D. L'élaboration du guide d'entretien

Le guide se présente soit sous forme schématique, soit sous forme de questionnaire. Le contenu du guide peut fortement varier en fonction du type d'information que l'on souhaite obtenir.

C'est un guide et un outil pour l'animation et pour l'analyse. Pour l'animation, il est rappelé aux étudiants que le guide d'entretien n'est pas figé une fois pour toute au début de la mise en œuvre de la démarche. Il doit être flexible et adaptable afin d'intégrer les enseignements éventuels obtenus au gré des recherches. Le guide est un élément extrêmement important du point de vue de l'analyse. Il constitue en général le point de départ à partir duquel les opinions et perceptions des participants peuvent être analysées et comparées.

La rédaction des questions prévues par le guide n'est certes pas un exercice à sous-estimer. Il s'agit au contraire d'y porter une attention toute particulière afin de satisfaire simultanément aux conditions d'accessibilité et d'appropriation de la question. Les participants doivent pouvoir en effet comprendre facilement et rapidement la question mais aussi se l'approprier de manière à ce qu'elle « fasse sens » dans le cadre de leurs expériences singulières. Ces deux conditions participent directement à la dynamique de groupe.

Dans les cas pratiques d'étudiants, il est le fil conducteur pour l'animation et doit cependant être un outil à manipuler avec souplesse et agilité. Il est préférable que les questions le composant soient claires, courtes, ouvertes, non biaisées et fassent appel à l'expérience propre ou au vécu des participants.

Ainsi, le guide touchant au thème de la précarité chez les 18-25 ans comprenait à l'origine des questions induisant les réponses, d'autres portant un jugement de valeur, ou bien soulevant des hypothèses non vérifiées.

> Nous avons décidé de ne pas inviter des jeunes précarisés pour ce *focus group* pour différentes raisons. Par contre, nous aurions aimé savoir quand même ce que ceux-ci ressentaient par rapport à leur situation. De quelle manière croyez vous que les jeunes perçoivent leur situation ? (Extrait du protocole du groupe sur les jeunes en situation d'extrême précarité à Liège, année 2009-2010).

Dans ce cas précis, il avait été déconseillé de demander aux intervenants de se mettre à la place des jeunes qu'ils côtoient, et de plutôt faire appel à leur expérience de terrain : « Est ce que ces jeunes se confient

souvent à vous ? », « Comment s'expriment-ils sur leur situation personnelle ? ».

Autre exemple de biais dans la formulation des questions : « Est-ce que le manque de formation/d'accès à l'emploi est une des causes principales de la précarité ? » revient presque à demander aux participants de confirmer une idée préconçue ou de valider une hypothèse. Ainsi, il est préférable que la question soit formulée de la manière la plus large possible : « Quelles sont, selon vous, les causes principales de cette précarité ? ».

Enfin, les connaissances déjà acquises par les étudiants de 2e bachelier en science politique peuvent différer de celles du groupe-cible interrogé. À cet égard, l'extrait du groupe « Temps de crise : Le moral des citoyens des classes populaires » (2010-2011) est illustratif. En effet, le volet « crise politique » du guide utilisé lors du *focus group* sur le concept de crise reflétait la perception des étudiants et ne renvoyait pas au référentiel commun du groupe-cible, les citoyens des classes populaires – ce que les étudiants ont analysé bien maladroitement comme une incapacité à s'élever à leur propre niveau de conceptualisation :

> Le public cible n'avait pas toujours les compétences pour répondre aux questions posées, ce qui a entraîné une simplification caricaturale de certaines problématiques, vue par le prisme de gens parfois déphasés. Le débat a tourné en discussions de comptoir. Ils ne comprenaient pas les enjeux.

E. Le focus group test

Avant de conduire tout *focus group,* il est conseillé aux étudiants de soumettre le protocole et le guide à la critique ou encore d'organiser un « *focus group test* » afin de les améliorer. Dans cette perspective, l'organisation d'un groupe test est de nature à révéler des informations relatives à la longueur du protocole, à la formulation des questions, à l'identification des zones d'incompréhension et, enfin, à la mise en évidence d'un thème ignoré par le protocole.

Cependant, il est à noter que l'organisation d'un groupe test ne garantit pas l'élaboration d'un protocole parfait, à l'abri de tout problème. La qualité d'un protocole résidera dès lors dans son adaptabilité et sa flexibilité par rapport aux conditions particulières rencontrées sur le terrain. De plus, il peut arriver que l'information recueillie lors du groupe test soit assez pertinente pour que ce dernier dépasse son statut d'essai.

Faute de temps, très peu d'étudiants conduisent un *focus group test.* Mais beaucoup reviennent vers le corps académique ou scientifique afin de juger de la pertinence des questions composant le guide d'entretien. Certains d'entre eux, n'hésitent pas à conduire des entretiens individuels

exploratoires auprès de personnes ressources afin d'affiner leur connaissance sur la thématique choisie ou d'enrichir certains pans du guide d'entretien qui auraient été négligés.

F. Le recrutement des participants

Le recrutement ne répond pas à un degré élevé de standardisation mais est au moins constitué d'une phase d'invitation mentionnant clairement le contexte général dans lequel se déroule le groupe focalisé (commanditaire, objet de la recherche et identité de l'équipe organisatrice) ainsi que les modalités d'organisation (date, lieu, durée, modes de contact pour confirmation). Il peut être réalisé au moyen de différentes techniques comme le « bouche à oreille », la publication de petites annonces ou via les réseaux sociaux, l'affichage dans des lieux publics, le contact direct par téléphone, mail ou courrier. Il est bien souvent conseillé aux étudiants de préférer le contact téléphonique ou direct avec les participants afin d'obtenir le résultat attendu.

Dans la pratique, le recrutement des participants est une phase délicate qui pose des problèmes particuliers d'ordre technique ou organisationnel. Les étudiants modifient parfois leur thème compte tenu de leur prise de conscience de la difficulté voire de l'impossibilité à joindre le public cible identifié (cf. *supra*). Au cours de l'année académique 2010-2011, un groupe d'étudiants a dû se résoudre à abandonner son souhait initial de travailler sur la consommation de drogues douces, le public-cible désiré – les consommateurs – étant difficile à mobiliser.

Il faut cependant noter que, bien souvent, les étudiants ont recours à des intermédiaires (écoles, communes, associations, etc.), utilisés pour leur caractère familier, afin de toucher le plus grand nombre de participants possible.

> Afin de trouver des parents, nous avons contacté le Lycée Léonie de Waha pour rentrer en contact avec des membres du comité de parents. Après avoir obtenu quelques numéros, nous avons demandé aux parents eux-mêmes s'ils ne connaissaient pas d'autres parents qui seraient intéressés (Extrait du groupe « Quelles sont les raisons qui poussent des parents à inscrire leur(s) enfant(s) dans une école pratiquant la pédagogie Freinet ? », année 2010-2011).

Le recrutement pose aussi la question du nombre idéal de participants à un *focus group*. Ce nombre est relativement difficile à déterminer. Toutefois, on s'accorde généralement à dire qu'un groupe composé de huit à douze personnes facilite la dynamique de groupe. En dessous de huit personnes, la dynamique de groupe a quelquefois beaucoup de mal à démarrer et le risque est grand de voir le groupe focalisé tourner en entretien individuel. Au-delà de douze participants, l'animateur peut rencontrer des difficultés à maintenir la discussion sur les thèmes identi-

fiés, à distribuer la parole et à éviter la constitution de sous-groupes (Steward & Shamdasani, 2007 : 58).

G. L'animation du focus group

La conduite d'un *focus group* n'est pas une tâche simple : elle combine un ensemble de variables associant notamment la mobilisation de techniques d'animation et l'aménagement de « zones de confort » pour les participants dans le dessein de privilégier un espace de discussion où chacun se sente « autorisé » à prendre la parole. Au-delà de cette remarque générale touchant à la dynamique de groupe, trois temps se distinguent au regard de la pratique étudiante : penser l'espace et la disposition des participants ; animer et observer la discussion ; fournir un premier *feedback* sur l'exercice par une auto-évaluation. Ils font l'objet d'un développement particulier dans cette section.

1. Disposition des participants : penser l'espace

Pour les étudiants, bien avant le lancement de la discussion, le déroulement du *focus group* doit être pensé en termes d'espace. En effet, le lieu choisi peut avoir rôle important dans la dynamique de groupe. Selon le groupe cible considéré, un endroit neutre ou familier peut avoir un impact. Faut-il un endroit neutre ou un endroit qui est familier aux participants ? Les participants devront-ils faire de longs déplacements pour s'y rendre ?

Par exemple, les étudiants dont le *focus group* était composé d'une équipe de pompiers volontaires ont préféré les interviewer dans la salle commune de leur caserne. Un autre composé de restaurateurs de la ville de Liège a choisi de les recevoir dans l'établissement de l'un des intervenants. Cet endroit familier pour une partie des participants présentait l'inconvénient d'être bruyant. Ce qui a eu pour conséquence de rendre parfois la discussion inaudible et a facilité la création de sous-groupes discutant en aparté. Un groupe ayant pour sujet le droit de vote à seize ans a monopolisé des élèves de secondaire au sein des locaux de l'Université de Liège sur le campus du Sart-Tilman situé à l'extérieur de la ville. Vu la distance des lieux par rapport au centre ville, certains élèves ne sont pas venus ou d'autres se sont plaints de la difficulté à trouver le local de réunion.

Le choix de la salle, la disposition des chaises, le positionnement des participants, des observateurs et du facilitateur sont d'autres éléments à prendre en considération. En effet, une salle trop petite peut donner un effet d'étouffement, une salle trop grande ou encore trop bruyante peut influer sur la dynamique du groupe. En fonction de leur positionnement autour de la table, des intervenants peuvent déjà se trouver en position défavorable pour nourrir la discussion. La présence de chaises vides

suite aux différents désistements contribue à créer une distance entre les intervenants. Par ailleurs, un animateur entouré devra veiller à ne pas exclure par sa posture les personnes qui sont directement à sa droite ou à sa gauche.

> Le fait que la facilitatrice se soit positionnée seule face aux participants a eu pour conséquence une moins bonne interaction entre les jeunes conseillers qui, la plupart du temps, tournaient leur regard vers l'animatrice (Extrait du groupe sur le droit de vote à 16 ans, année 2009-2010).

> Nous avions prévu une table pour dix personnes – animateur inclus – et notre animateur n'a finalement eu que six intervenants à écouter. Nous avions laissé libre choix aux participants de l'endroit où s'asseoir, et ce fût une erreur de notre part de ne pas avoir rapidement restreint le nombre de chaises au nombre d'invités. L'effet voulu d'obtenir un « cercle » pour la conversation est tombé à l'eau ; les invités ont involontairement formé un arc de cercle et laissé un invité de côté, assis près du coordinateur, ce qui l'a un peu écarté du débat. » (Extrait du groupe sur les jeunes en situation d'extrême précarité à Liège, année 2009-2010)

Lors de l'installation des participants, il ne faut pas avoir peur de changer ce qui était prévu au départ en fonction des contingences. Le groupe d'étudiants organisant un *focus group* dont le thème était le congé parental a dû reconsidérer la composition du *focus group* suite à de nombreux désistements le jour même du déroulement de la discussion. Ils ont donc invité des étudiants à participer à la discussion en leur demandant de se projeter en tant que « futurs pères ».

2. *Le rôle de l'animateur*

Lorsqu'arrive la discussion, le rôle de l'animateur au sein du groupe reste un élément central pour les étudiants en science politique. C'est à lui que revient la tâche délicate d'être au service du groupe en étant tantôt un suiveur, un intervenant effacé, tantôt un guide affirmé. Bref, une tâche ardue tant il devra faire preuve de subtilité et d'adaptabilité. Comment maintenir un débat sans pour autant être trop directif ou au contraire trop éteint ? Comment parer au phénomène de *leadership* ? Comment mettre les participants à l'aise ?

L'animateur commence par introduire le débat : il est important de présenter avec clarté les acteurs en présence, le pourquoi, le contexte et le fonctionnement du *focus group*. Lors de l'introduction, le modérateur dispose de quelques minutes pour créer un climat de confiance ; présenter les observateurs et les personnes présentes pour évaluer le groupe d'étudiants ; délivrer le cadre général dans lequel s'inscrit le processus participatif (le cours de méthodologie enseigné aux étudiants en science politique) et les consignes ; garantir la confidentialité de la discussion ; valoriser les opinions de chacun et définir la mission du groupe. Le

manque de clarté dans la présentation des personnes présentes peut entrainer un biais pour la discussion.

Ainsi, une participante à qui le rôle des observateurs n'avait pas été clairement expliqué, recherchait leur approbation lors de ses interventions. Oublier de préciser que, malgré la présence des caméras, les résultats resteront anonymes peut indisposer certains intervenants à prendre la parole ou modifier leurs comportements. On entend des réactions comme : « Attention, nous sommes filmés » ou « Vous couperez ça au montage ».

Un autre exemple est celui de la facilitatrice du *focus group* sur le droit de vote à seize ans qui omet délibérément de préciser le thème aux jeunes intervenants. Ceux-ci ont posé beaucoup de questions et mis du temps à entrer dans le débat.

Connaître les noms et prénoms des participants facilite aussi l'animation :

> (...) Nous aurions dû appeler nos participants par leur nom durant le débat. Notre animateur aurait dès lors pu pointer plus personnellement certaines personnes plus taiseuses pour connaître leurs opinions et ainsi susciter plus d'interactivité, ou encore contrer le *leadership* de « notre intervenant principal », en cédant poliment la parole à quelqu'un d'autre (Extrait de l'autocritique du groupe sur les jeunes en situation d'extrême précarité à Liège, année 2009-2010).

Ensuite, il faut aborder la thématique principale du *focus group* en évitant de laisser trop de temps aux présentations individuelles et amorcer ainsi la dynamique de groupe.

Citons à titre d'exemple, le premier tour de table d'un *focus group* d'étudiants dont les intervenants étaient les chômeurs de longue durée. La durée de celui-ci fut d'une heure car chaque participant éprouvait le besoin de raconter son parcours personnel – riche en termes de contenu, mais peu propice à la dynamique de groupe. L'extrait issu de l'autocritique du groupe sur le droit de vote à seize ans (2009-2010) est lui aussi éclairant :

> L'animatrice est intervenue à de trop nombreuses reprises, coupant parfois les intervenants alors qu'ils étaient sur le point de partager une idée intéressante. Lorsque ces derniers se coupaient la parole, elle n'est intervenue que trop rarement pour donner la parole à l'un ou à l'autre. Elle essayait directement de combler les blancs au lieu de leur laisser un temps de réflexion.

Cette facilitatrice désirait atteindre tout au long de la discussion un consensus sur la thématique. Elle a réitéré plusieurs fois la même question (« *Êtes vous favorable oui ou non à l'introduction du vote à seize ans ?* ») de sorte que certains jeunes intervenants ont changé d'avis. L'erreur méthodologique se situe à différents niveaux : la question

fermée, combinée au ton et à l'attitude de l'animatrice, semblait indiquer une obligation de tenir une position tranchée, ce que plusieurs intervenants ont refusé d'avoir. Mais, d'autres ont finalement changé leur point de vue.

Le groupe doit être conscient de sa mission et de sa place dans la démarche participative. Au fil de la discussion, le modérateur veillera à l'implication des participants, à la progression des interactions et de la dynamique de groupe et évidemment au bon déroulement de la discussion par rapport au guide. Enfin, la conclusion sera l'occasion d'exposer l'évolution de la démarche et de saisir les impressions des participants quant au processus de collecte d'information lui-même.

3. Rôle des observateurs

Enfin, il ne faut pas oublier le rôle clé de l'observateur lors du déroulement et de l'analyse du *focus group*. Dans un premier temps, pour ne pas influencer la discussion, il est toujours placé volontairement en retrait par rapport au reste du groupe et de l'animateur. Ensuite, sa tâche consiste essentiellement à noter tout ce qui peut échapper de près ou de loin au facilitateur. À cet égard, il convient de remarquer que, contrairement à ce dernier, il ne travaillera pas avec son expérience vécue mais uniquement sur les données récoltées lors de l'observation du groupe.

Les étudiants observateurs prennent note de trois choses. Premièrement, ils renvoient à des éléments factuels et observables comme les attitudes non verbales, les flux d'interactions entre les participants : qui participait le plus ? Le moins ? L'intérêt des participants diminuait-il à certains moments ? Deuxièmement, ils s'intéressent aux rôles que tiennent les participants durant la discussion et à l'influence qu'ils ont sur le reste du groupe. Enfin, les étudiants observent également l'influence directe ou indirecte de chacun des participants sur le reste du groupe[2].

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[2] Comme préconisé auprès des étudiants, Robert Delhez (Delhez, 2010) distingue l'influence *directe*, liée à la production même du débat, de l'influence *indirecte* en rapport avec la fonction de facilitation et de régulation :

L'influence directe : argumente-t-il longuement sa position ? Manifeste-t-il beaucoup d'assurance ? Se range-t-il à l'opinion des autres ? Parle-t-il peu ou souvent ? Maintient-il une position cohérente ?
L'influence indirecte :   • *Facilitation* : se soucie-t-il de faire s'exprimer chacun ? Résume-t-il ce qui a été fait jusque là ? Propose-t-il une procédure ?   • *Régulation* : propose-t-il des compromis ? Apporte-t-il son soutien à autrui ? Se montre-t-il soumis aux membres les plus influents ?   • *Non Régulation* : dévalorise-t-il d'autres participants ? S'oppose-t-il systématiquement aux opinions des autres ?

Phase de débriefing

Pour les groupes d'étudiants en science politique, un premier débriefing s'impose lorsque la discussion arrive à son terme. Toutes les réactions, les premières impressions des participants et de l'animateur doivent être prises en considération ainsi que les éléments factuels relevés par les observateurs. Les étudiants jugent de la réussite ou de l'échec du *focus group* en fonction des impressions des invités. Suite à ce tour de table, le corps enseignant intervient en soulignant les points forts et faibles du déroulement du *focus group*.

H. L'analyse du focus group

1. Phase de retranscription

Les *focus groups* fournissent une quantité impressionnante d'informations issue des nombreuses interactions suscitées lors des séances de discussion, constituant ainsi le principal matériel de base de l'analyse. Dans le cadre du cours, les étudiants ont l'obligation de retranscrire l'intégralité de la discussion du *focus group* en justifiant le fait qu'elle est la matière première à partir de laquelle sera fondée l'analyse de contenu. Ces informations traduisent les opinions, sentiments et points de vue des participants sur la problématique qui a été soumise à leur perspicacité. Néanmoins, le texte même des retranscriptions doit être mis en perspective par le chercheur/étudiant en fonction du contexte, de l'intonation, et de l'environnement général dans lequel les phrases ont été énoncées.

Phase d'autocritique

Plus tard, la rédaction du travail écrit comprenant l'autocritique reste un moment d'apprentissage puisqu'il est aussi celui de l'heure du bilan. La mise en place d'un groupe focalisé peut ne pas toujours se dérouler comme les étudiants l'espéraient. De mauvais choix, des réflexes inappropriés peuvent avoir une répercussion désastreuse sur la dynamique de groupe et sur la conduite des débats et, par conséquent, sur les apports du *focus group* à la thématique envisagée. Sur le plan pédagogique, il est important de mettre en évidence ce qui a fonctionné et ce qui a moins bien fonctionné afin de pouvoir s'améliorer.

Les questions à se poser sont : quels sont les éléments logistiques qui auraient pu être mieux pensés ? Quelle place a tenu le facilitateur ? Étions-nous suffisamment organisés ? Comment avons-nous fait face aux imprévus ? Quel a été le *feedback* des participants lors du verre de l'amitié qui suit la discussion ?

Étapes lors de la mise en pratique de la méthode des focus groups par les étudiants

Les étudiants divisent l'élaboration de leur recherche en trois temps : l'avant *focus group*, la conduite du *focus group*, l'après *focus group*.

L'avant focus group	La composition du groupe de travail	- Répartition des rôles entre les étudiants - Agenda des réunions
	Phase exploratoire de la recherche	- Entretiens exploratoires auprès de *stakeholders* - Recherche juridique et législative - Recherche scientifique et bibliographique - Recherche presse et actualité - *Benchmarking*
	Le groupe-cible	- Composition du groupe de discussion - Recrutement des participants : invitation et confirmation - Respect des précautions nécessaires
	Le guide d'entretien	- Élaboration à partir de la phase exploratoire de la recherche - Test éventuel - Corrections éventuelles
	La logistique du *focus group*	- Choix de la date et de l'heure du *focus group* - Choix et préparation du local - Préparation du matériel d'enregistrement - Préparation de la restauration et commodités
La conduite du focus group	Dernières préparations et accueil des participants	- Aménagement de la salle - Fléchage et panneaux - Badges et plaquettes nominatives - Prise de contact/rappel des participants qui ne se montrent pas.
	Déroulement du *focus group*	- Introduction, soumission du guide d'entretien, conclusions (rôle de l'animateur) - Possibilité d'aide silencieuse à l'animateur (rôle de l'assistant-animateur) - Prise de notes - Gestion de la logistique - Remerciement et invitation au buffet

	Débriefing post-*focus group*	- Autocritique du groupe de travail - Critiques et remarques du Professeur
	Analyse de forme	- Analyse du déroulement du débat et des interactions - Analyse sociologique des participants - Analyse émotionnelle et non verbale
L'après *focus group*	Autocritique : *ce qui fonctionné/ce qui n'a pas fonctionné*	- Autocritique sur l'organisation et la conception du travail et propositions d'amélioration - Autocritique sur le déroulement du *focus group* et des rôles de chacun et propositions d'amélioration
	Analyse de contenu	- Retranscription du *focus group* - Analyse des informations en fonction du guide d'entretien
	Rédaction du rapport final	

Les différentes tâches de ce tableau sont présentées dans un ordre non chronologique : ainsi, des chevauchements existent entre certaines étapes, tandis que d'autres peuvent être réalisées plus tôt ou plus tard dans la réalisation du travail.

Conclusions

Pour les futurs politologues, la réalisation de groupes focalisés représente sans aucun doute une plongée profonde dans ce qui fait la difficulté mais aussi l'intérêt de la mobilisation des méthodes qualitatives.

Cinq apports peuvent être identifiés. Sur le plan de l'organisation du travail, la réalisation de groupes focalisés oblige les futurs politologues à poser leurs questions de recherche dans le temps et l'espace puisque la mise en œuvre d'une telle technique exige des organisateurs qu'ils la pensent à moyenne échéance (trois à quatre mois) et qu'ils l'agencent spatialement, notamment en choisissant des locaux appropriés. Sur le plan méthodologique, la technique des groupes focalisés appartient aux méthodes qualitatives qui supposent une approche interprétative des phénomènes. Sur le plan épistémologique, les *focus groups* révèlent plutôt une posture constructiviste de la connaissance scientifique reconnaissant et intégrant l'influence et le rôle joué par le scientifique dans la construction de ses objets de recherche. Sur le plan de la science politique, le recours aux groupes focalisés illustre l'importance accordée aux acteurs de terrain (ou « profanes ») dans la production de connaissance pour l'analyse des phénomènes politiques. Enfin, sur le plan du développement personnel, les groupes focalisés représentent une excellente

197

opportunité d'expérimentation de la dynamique des groupes et des mécanismes qui peuvent faciliter ou non les échanges entre participants.

Explorant des thématiques à géométrie variable tant sur les plans juridique, sociologique, éthique, politique que philosophique, les étudiants de science politique sont souvent confrontés à l'éternelle difficulté de l'interdisciplinarité.

Cet apprentissage s'accompagne également d'une ouverture des chercheurs en sciences sociales à l'expertise d'usage (Callon, Lascoumes et Barthe, 2002 ; Blondiaux, 2008 ; Sintomer, 2008) et ce qu'elle peut apporter dans l'analyse de problématiques auxquelles nos sociétés sont confrontées. Les groupes focalisés permettent cette ouverture en « prenant au sérieux » les acteurs de terrain, qu'ils soient citoyens ou professionnels.

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ARTICLE

How not what: teaching sustainability as process

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Ever since the word "sustainability" entered public discourse, the concept has escaped definition. The United Nations has christened the years 2005–2014 "The UN Decade of Education for Sustainable Development" and has called upon universities "to make education for sustainability a central focus of higher education curricula, research, physical operations, student life, and outreach to local, regional, and global communities." Nevertheless, the indeterminacy of sustainability as a concept has challenged those designing university sustainability efforts, in terms of both campus planning and curricula. Some instructors and campus sustainability planners have chosen to stabilize sustainability concepts into a technical and ethical "greenprint" based on some agreement concerning shared (or imposed) concepts and values. Yet others have realized that this is not a problem to be "solved" but instead presents an opportunity to advance and implement alternative approaches to teaching and learning "post-normal" or "Mode 2" science. This article describes a curricular design that attempts to maintain both canonical disciplinary learning about the techniques of sustainability and training in the reflexive skills necessary to explore sustainable change through post-normal learning processes, which we delineate as three "modes of knowing." By training students to practice these ways of knowing sustainability, they come to understand the "how" of sustainable practice, process, and design, while allowing the "what" of sustainability to emerge from group interaction in a collaborative context.

KEYWORDS: education, learning, colleges and universities, design, environmental engineering, sustainability

The Challenge of Teaching Sustainability in the University Context

The United Nations declared 2005–2014 to be the Decade of Education for Sustainable Development, calling on universities to help create a more sustainable world (UNESCO, 2005). Yet, higher education may not be well prepared to fulfill this goal. Historically, the university has created knowledge with individual experts in siloed disciplines who research and transfer codified knowledge using didactic pedagogies (Jonassen, 1991; Sharp, 2002). Yet, many observers have argued that working toward a sustainable future requires educational models that go beyond teaching codified "what" facts to models that emphasize "how": that train students in the transdisciplinary, collaborative ways of knowing-how that have been recently characterized as "new knowledge production" (Hessels & van Lente, 2008), "post-normal," or "Mode 2" science (Functowitz & Ravetz, 1993; Gibbons et al. 1994; Wiek et al. 2011).

In this article, we describe the problems with defining sustainability as codified, stable "whats." We then look at new characterizations of sustainable knowing and learning as a more collaborative, "dialogic" process (Gibbons et al. 1994). These new conceptionalizations of knowledge production separate out codified didactic knowledge—what we call here "know what"—from the more contextual, tacit, and relational knowledge production we emphasize here and refer to as "know how." We then ask, can universities, as centers of codified, disciplinary knowledge, teach students how to practice this new way of knowing? Then, we use one example of an interactive learning activity we have designed to train students to be competent, reflexive producers of sustainable knowledge in collaborative group processes. Through our own collaborative process of designing this learning activity, we found that students practiced three post-normal "modes" of knowing. We describe each of these modes and show how the learning activity evolved to explicitly teach both disciplinary technical learning about sustainability along with these other three transdisciplinary, reflexive process-based "how" modes of knowing. Finally, we briefly show how we are developing ways to assess student acquisition of these process "how" knowledge competencies.

Our example comes from a learning activity we have designed and conducted as part of the University of California (UC) Santa Cruz Sustainable Engineering and Ecological Design (SEED) consortium, a

group experimenting with reflexive pedagogical designs and learner-centered curriculum to train students to work effectively within collaborative group processes (Bacon et al. 2011) to create positive sustainable change.

Sustainability as What

A focus on sustainable knowledge and practice as simply gathering and imparting to students the right codified information has led to confusion in the classroom. Sustainability knowledge continually slips out from under these codified, standardized, cannonical definitions. This situation has led to a frustrating indeterminacy in which "[s]ustainability appears to be about 'everything' and 'nothing' all at once," (Sherren, 2006) so that "[a]t times, the plurality of angles, concerns, and interests embodied in sustainability debates devolve into a confusing cacophony" (Brand & Karvonen, 2007). The slipperiness of sustainable knowledge means that those attempting to prepare students to make informed contributions are often puzzled "in stipulating what is core to educate in something so amorphous as sustainability" (Sherren, 2006) leaving universities to become caught up in the question (to paraphrase Dave Eggers (2006)): "What is the What?" of sustainability.

Universities have so far emphasized answers to "what" questions, fulfilling the United Nations sustainability mandate by creating campus "greenprint" plans that lay out sustainability "best practices" (Heinz Family Foundation, 1995; Bulkeley, 2006), a set of advisable technology adoptions to make campuses more "ecoefficient" (Bartlett & Chase, 2004; El-Mogazi, 2005). In addition, campuses often combine these technological recommendations with new "sustainability learning" initiatives that include inculcating "values and motivations that bring about environmentally responsible behavior" (Hansmann, 2010).[1] In other words, universities teach notions of what technologies are sustainable along with what norms and behaviors lead to "good," sustainable lifestyles (Sherren, 2006). In these greenprint processes, a group of interested stakeholders on campus define sustainable technologies and behaviors and then hope that business decisions and instruction will follow suit. These processes of sustainable knowledge creation tend to be reductionist, that is, to reduce sustainability to a simple list of technologies and behaviors, both in terms of the sustainability plans for the campus itself and a set of codified facts and values that

should be taught (Bulkeley, 2006). Pedagogy also tends to be didactic, relying primarily on the lecture-test "banking" model, an approach that treats students as passive recipients receiving codified information transmitted to them from "the sage on the stage" (Friere, 1970; Sharp, 2002; Gao et al. 2007). This "codify and convince" strategy of creating sustainable change is not confined to the classroom. It is evident in a broader range of campus sustainable planning operations. Organizations such as the Association for the Advancement of Sustainability in Higher Education (AASHE) standardize sustainability into a set of "best practices"—technologies and behaviors—and then certify an institution's progress in meeting these standards through the "Sustainability Tracking Assessment and Rating System" at levels from bronze to platinum (AASHE, 2012).

Sustainability as How

In contrast to these "codify and convince" university planning and teaching initiatives, new approaches define this sustainable knowledge as "post-normal science" comprising "a multiplicity of knowledge as well as a multiplicity of *forms of* knowledge" (Brand & Karvonen, 2007) requiring new, multidisciplinary, "reflexive" research and pedagogies (Functowitz & Ravetz, 1993). These scholars describe sustainable knowledge production as "a vibrant arena that is bringing together scholarship and practice, global and local perspectives from north and south" (Clark & Dickson, 2003).

Weik et al. (2011) recognize that training students in the post-normal science of sustainability "does not imply that 'regular' competencies, such as critical thinking and basic communication skills, are not important for sustainability professions and academic programs (they are!)." However, they argue that there are several other key competencies "critically important for *sustainability* efforts" (Weik et al. 2011). To teach these post-normal key competencies requires "an alternative model of policy learning [that] points to processes of argumentative struggle between competing frames or discourses as a means through which new understandings of policy problems arise, and policy change takes place" (Bulkeley, 2006). Teaching the "how" of sustainability requires us to "replace pedagogical approaches based on (relatively 'authoritarian') *transfers of information* with more *interactive and collaborative learning processes:* citizen participation can start with the creation of a community of learners" (Simon, 2002). In addition, a growing body of research in the learning sciences has shown that courses that rely *only* on didactic pedagogic strategies are less successful in attracting, retaining, or preparing students for STEM

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[1] See, for example, the University of Colorado's *Blueprint for a Green Campus* at http://ecenter.colorado.edu/greening-cu/blueprint-for-a-green-campus, and the University of California Santa Cruz's Campus Sustainability Plan at http://sustainability.ucsc.edu/actions-planning.

(science, technology, engineering, and mathematics) disciplines (Seymour, 2002; Smith et al. 2009). For these reasons and others, this article explores research on post-normal forms of knowledge and on socioconstructive pedagogies to teach noncodified or "reflexive" ways of knowing.

UC Santa Cruz's SEED curricular design team has been experimenting with pedagogy that embraces the reflexive nature of sustainability as a field or a concept. Defining sustainability is not taken as a problem that needs to be "solved," but an opportunity to raise new ways of thinking about the world. This approach recognizes sustainability as an intrinsically unstable concept, a dynamic idea that can never be pinned down to a particular technology, set of behaviors, or even worldview and set of values. Under this scenario, the challenge becomes to design a curriculum around an unfixed concept and engage students with multiple modes of knowing without creating an unfocused strategy, agenda, and pedagogy.

Faced with this challenge, SEED curriculum designers have to date focused on training students in understanding multiple frames, problem-based and transformational learning, critical thinking, and dialogic exchange in group learning (Wells, 1999; Thomas, 2009). These emphases shift the focus away from codified knowledge toward various processes—"modes"—used to create new understanding (Barad, 2007). Our approach follows sociocultural theories of learning and teaching that focus on alternative options for participation in "joint activity" (Lave, 1991; 1996; Lave & Wenger, 1991; Rogoff et al. 2003). These efforts reflect broader transformations in the conceptualization of knowledge and understanding toward an embrace of what Silvio Funkowitz & Jerome Ravetz (1993) characterize as "post-normal" knowledge, what Gibbons et al. (1994) call "Mode 2" forms of knowledge, and revive ideas about those kinds of knowledge that escape codification, or what Karl Polanyi called "tacit" knowledge (Nonaka & Takeuchi, 1995). We characterize all of these understandings as "know how" modes of knowing. According to this perspective, leaving the definition of sustainability open, interdisciplinary, and emergent enables a focus on the "how" of technical and social processes informing sustainable designs (Brand & Karvonen, 2007).

Curriculum design that enables the "what" of sustainability to continually emerge and be redefined through group interaction around intersubjective knowledge-production practices prepares students for the kind of experimental creativity, reflexivity, and collaboration that will be required to produce new sustainable ways of knowing and living. Gibbons et al. (1994) describe this kind of knowing as always in the making. It is experiential, discursive, processual,

social, tacit, contextual, transdisciplinary, open to different worldviews, collaborative, practice-based, and informal (Martens, 2006; Brand & Karvonen, 2007; Luks & Siebenhüner, 2007). In this kind of "new knowledge production" (Hessels & van Lente, 2008), discursive processes are not seen as separate from scientific research but rather as integral to it. This leads to a more dynamic and decentered view of knowledge-creation as emergent and historically "contextualized," based in practices and distributed across agents and artifacts (Cole & Engestrom, 1993; Gibbons et al. 1994; Shove & Ingram, 2008). Such a counterview is based on acceptance of coexisting multiple ontologies, in which codified knowledge exists with other marginalized knowledge processes that are contingent on context and exist only so far as they are "in use"—that is, applied through interpretation, experience, and practice.

Ways of Knowing How

The increasing acceptance of multiple ways of knowing does not lead automatically to new forms of pedagogy. To achieve collaborative learning, students need to work through their multiple and competing ways of knowing and commit to a process of collaboration despite tacit and/or explicit commitments to different frames/worldviews: ways of understanding and of acting in the world. To teach these skills we relied on the work of educational theorists John Dewey, Paulo Friere, and others working in the Dewey tradition, such as Jerome Bruner (1990). These education thinkers have attempted to create socioconstructivist pedagogies around active, experiential, service, and practice-based learning that require not only training across fields but also in the application of collaboration skills that can span disciplinary divides/boundaries. We ultimately categorized our pedagogy into four separate modes, including the didactic strategy of teaching normal science as "facts"—knowledge that is delivered from experts to non-experts—and three collaborative, post-normal modes of knowing (Table 1).

Know How 1: Subjective Knowing

Each person learns important information through personal experience, history, and their own social situatedness. Subjective knowledge is the embodied knowledge we carry within ourselves though our histories and connections. A number of scholars have been seeking recognition for this kind of "situated" (Haraway, 1988), "local" (Geertz, 1983), and "standpoint" (Collins, 2000) or "witness" knowledge (contextually based and "true" in particular places, with particular people in particular times and contingent to particular situations). Postcolonial and critical

Table 1 Modes of knowing and pedagogical strategies.

Lab Steps	Modes of Knowing	Competencies	Processes	Ontology	Pedagogy (example)
Rank Individual	Subjective	Reflexivity	Empowerment	Interpretive	Journaling
Rank Group	Intersubjective	Deliberation	Understanding	Relational	Discussion
Analyze	Scientific	Research	Analysis	Positivist	Lecture
Redesign	Practice	Innovation	Creativity	Design	Project

race theories especially emphasize witness testimony based in particular histories, memories, identities, subjectivities, and embodied knowledges (Ahmed & Stacey, 2001). These are also the knowledges tied to a particular culture's ecologies (Cronon, 1983) or agroecologies (Altieri, 1995).

Those who take the subjective-knowledge perspective see Kuhn's (1962) notion of paradigm as restrictive. Different ways of knowing can coexist even if one form has dominance. Sustainable agriculture provides an excellent illustration of this point; because it depends on a more agroecological, and therefore place-based context, it tends to be more tacit and situated and therefore harder to teach. Industrial agriculture, on the other hand, is dominant not only because industrial economic interests heavily influence agricultural education but also because industrial agriculture knowledge is more codified and universalizable, a form of knowledge more open to didactic university pedagogies (Goodman et al. 2011).

Know How 2: Discursive Knowing

Discursive knowing is produced through social interaction and respectful deliberation among collaborators who work jointly to complete complex tasks that require coordinated action. As Tomasello and his colleagues have explained (Tomasello, 1999; Tomasello et al. 2005), coordinated action requires establishing a common purpose and a "joint focus of attention." Since complex tasks require a division of labor, individual participants who come with different histories, worldviews, and frames of understanding must learn "intersubjectivity": to communicate their individual subjective understandings through language (verbal and written), gesture, physical movement, facial expression, demonstrations, symbolic inscriptions, and so forth in ways that articulate and respect subjective framings, yet accomplish common goals.

Like personal subjective knowledge, discursive knowledge is often a combination of rational, tacit, and emotional knowledge. Rather than seeking universals, it involves how we, in society, cope with various predicaments, contradictions, and dilemmas that are intrinsically irresolvable, "wicked" problems (Rittel & Weber, 1973). Yet, despite this unresolva-

bility, we must make decisions in order to act. Discursive knowing, however, is intersubjective rather than subjective because it is carried out in concert with others, either through face-to-face deliberation or through civil discourse in public arenas. The intersubjective knowledges that result from these social interactions are neither situated in any one subjective position/standpoint nor represent a singular universal truth. These knowledges are contingent on the unique constraints and affordances of the activity underway, including the material, social, and historical context of that activity and the specific tools and resources available. It does not exist in the head of any one person or in the cultural ideas of one group of people. Instead, this type of knowledge is produced through social interaction, group decision making, debate, and collaboration. Scholars refer to this knowledge as coproduced (Jasanoff, 2004) or networked (Callon & Law, 1995).

From the discursive (or intersubjective) perspective, sustainability science is a design collaboration between various actors involved in new ways of living in the world rather than the pursuit of a prescribed end goal such as a set of sustainability greenprints. For example, new ways of looking at the history of technological design have shown that bicycle design emerged not from experts' ideas of what a bicycle should be, but from designers paying attention to the diverse visions and needs of various user groups (Pinch & Bijker, 1984). Additional evidence of the importance of discursive thinking can be found in literature on business management and innovation, which has paid increasing attention to the problem of collaborative teamwork incorporating users early on in the design process (Oudshoorn & Pinch, 2003). Researchers have shown the importance of studying situations in which people bring different disciplinary, codified knowledges together to innovate a particular technology or product (Nonaka & Takeuchi, 1995). Nonaka & Peltokorpi (2006), for example, look at how engineers involved in designing the batteries, brakes, and electrical systems of the Toyota Prius had very different disciplinary viewpoints about the automobile as a system, and yet learned to work together to create one car that emerged through collaboration rather than the fulfilling of a single vision. These engineers succeeded

not by moving toward one worldview but by working through particular kinds of group processes that enabled them to synchronize their differences as they made decisions about the design of the product.

Know How 3: Practice-based Knowing

New theories of social behavior have stressed various kinds of practice-based "know how" (see, e.g., Hargreaves, 2011). In a related way, Cultural Historical Activity Theory (Cole, 1985; Cole & Engestrom, 1993), Communities of Practice Theory (Lave, 1991; 1996; Lave & Wenger, 1991) and Actor Network Theory (Latour, 2005) emphasize the interrelations that organize decentered networks of activity, including physical and social actions, shifting the focus from individuals to a dynamic "supraindividual" unit of analysis (Cole, 1985). Work in strategic management also emphasizes processes of trial and error in innovation and competent "know how" practice (Von Hippel, 1994; Nonaka & Takeuchi, 1995). Science studies scholars look at scientific knowledge production as more than the creation of codified knowledge through experiment and hypothesis testing, but as a form of situated activity—or practice—that is distributed across the tools-in-use, users, and material and social context in the field of discovery (Latour, 1987; Rheinberger, 1997). These scholars show how particular combinations of all of these elements are intrinsic to any performance and not merely variables among others. From this perspective, what we *know* (and how we come to know it) is not separate or distinct from what we *do*, and furthermore the particular ways we set about doing things will shape and orient what we know and understand at any point in time (Shove & Ingram, 2008). Since what we do, and the ways we go about doing the things we do, are constantly changing as we encounter new situations with different people, different materials, different social norms, and so forth, we must also assume that our knowledge base is continually being modified and adapted with each new performance.

Hargreaves (2011) explains the advantages of using practice-based theories to understand and promote proenvironmental behavior and sustainable social change. Practice-based perspectives abandon deficit models that focus on particular behaviors as "maladaptive," "irrational," or "ungrounded" and shift attention to the tensions and interplay among social conventions (e.g., patterns of consumption), immediate needs (e.g., staying warm) and the attributes of the material world that constrain and/or afford different possible actions (e.g., opening a shade in a south-facing window vs. turning up the heat) (Shove & Ingram, 2008). And unlike theories that focus on individual decision making as constrained by various

contextual and/or conceptual barriers that need to be identified and removed, practiced-based theories of knowing emphasize how it is only through robust and continuing engagement that individuals build a coherent understanding of the complex relations that define the world around them.

SEED Lab Activities as Scaffolds for Reflexive Learning

The SEED curriculum trains students in reflexive thinking through peer support and collaborative pedagogies, often using Internet applications and other computer-based information technologies. The curriculum includes didactic learning of codified knowledge through lectures and readings as well as collaborative, active, group- and problem-based interactive exercises—which we call "labs"—and service-learning components. A lab series generally covers such technical concepts as life-cycle analysis, carbon-footprint calculation, and sustainable supply-chain analysis and examines topics ranging from raw materials and technology used in solar photovoltaic systems, to biofuels such as ethanol, to the marketing of commodities as consumer goods.

Individual labs are used in several classes, including general lower-division engineering courses on renewable energy and sustainable design; an upper-division sociology course entitled "Sustainable Design as Social Change"; and a senior capstone course open to all majors called "Impact Designs: Engineering and Sustainability through Student Service" that supports interdisciplinary teams of undergraduates in completing community-based sustainable design projects. Readings focused on technical content are paired with readings on communication strategies, sociological analyses of technical change, business-management theories of innovation, and histories of design. Lectures, readings, and prologues to the labs introduce students to codified information on different topics in sustainability. For instance, students learn about the technical concept of life-cycle analysis in assigned readings, through lectures, and with a lab activity on ethanol formulated to teach the role of reflexive analysis in understanding various ways to design life-cycle studies.

Each lab in the series is structured around the notion of *scaffolding* (Wood et al. 1976), a concept in education theory that explains how individuals meet new challenges, appropriate new skills, and develop new understandings during interaction. Scaffolding has been broadly defined as the process by which a teacher or more knowledgeable peer provides assistance that enables learners to accomplish tasks or succeed in problem situations that would otherwise be too difficult to resolve on their own (Wood et al.

1976; see also Palincsar, 1998; Stone, 1998). For example, rather than telling a sibling where to put a puzzle piece, an older sibling might point to the straight edge on a puzzle piece to help the younger child recognize that it does not belong in the middle of a puzzle.

On a larger level, these interactive learning activities also function as scaffolds for the more complex and often confusing challenges associated with real-world problem-solving that students face as part of the project- and service-learning component integrated into most SEED courses.[2] Service learning involves students working and reflecting on their participation in projects that meet identified community needs. In these activities, students benefit not only from the opportunity to apply course content to actual practice, but also from an enhanced sense of public engagement (Dewey, 1986; Butin, 2003; Bringle & Hatcher, 2007). Service learning can provide pragmatic and authentic problem-solving contexts and broaden the student's learning community beyond the classroom. These projects can be a powerful way to build a sense of student investment, motivation, and ownership. Through the application of academic content to tangible situations, service learning can support student appropriation of challenging technical skills and the understanding of complex ideas (Kezar & Rhoads, 2001). However, without a shared understanding of project goals, service learning can also be distressingly unproductive, wasting the time and "spinning the wheels" of both students and collaborating community partners, leading to an unwillingness to partner. The labs are designed to function as practice sessions, to prepare undergraduates to participate fully in collaborations with community partners to solve real-world challenges. It is important that they first practice key skills in a controlled setting and then are supported through the process of translating these skills into the applied context.

Example: The Packaging Lab

To demonstrate how a collaborative, active-learning curriculum design can support multiple modes of knowing, we will describe the first activity in the SEED series of interactive activities. Commonly known as "The Packaging Lab," this initiative was originally developed as an opening activity in 2009 for Sociology 115: Sustainable Design as Social Change, an upper-division seminar that included an

emphasis on student-led service-learning projects. The activity has since undergone several revisions and has been adapted to at least four other courses. Altogether, the activity has now been completed by approximately 500 undergraduates. In each case, The Packaging Lab was one of the first instructional activities presented to students.

This activity requires students to rank a set of consumer packages provided by the instructor, then reflect on and discuss their initial ranking before providing a "group" ranking, and then revisit their initial individual ranking to decide if they want to add changes to an individual "reranking." After viewing the selection of consumer packages, students are asked to rank the way they were packaged. In some of these classes, students are simply asked to rank packages from "best" to "worst." In some other versions, students are asked to rank packages specifically in terms of their sustainability: from "most" to "least" sustainable. Students are also asked to state reasons for each ranking, and then to boil down each reason into criteria they used to make their ranking (e.g., plastics can be recycled, plastics recycling reduces dependencies on petroleum, vs. plastics have been shown to disrupt ocean ecology). Students next defend their criteria to a small group of their peers and finally are given the opportunity to rerank the items, integrating any new considerations resulting from the small-group discussions.

The sequencing of successive "steps" within the activity is designed to help students work gradually, adding layers to complicate a working definition of sustainability as applied to different exercises in the lab. The idea is that students will learn the criteria they considered important in the definition of sustainability and, by discovering that other students have different criteria, learn that sustainability is a discursive concept not open to a single definition. The activity concludes with an instructor-facilitated whole-class discussion and some questions, typically assigned as homework, to give students further opportunity for reflexive practice.

Step 1: Subjective Knowing

We assume that most students will come to the lab with some notion of sustainability, such as ideas about recycling or conservation of energy and resources. We also imagine that a few students with more sophisticated ideas will include criteria related to more comprehensive views of sustainability such as the "triple bottom line" (economy, environment, equity). We expect that students will also bring their own priorities to their decision criteria—including economic feasibility, convenience, efficiency, aesthetics, social justice, and, of course, ecology—representing their different backgrounds and training.

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[2] The SEED Curriculum includes a number of different service courses that involve students in problem solving of sustainability issues in the Santa Cruz community, including both lower division and upper division SEED courses.

Accordingly, the first step in The Packaging Lab is designed to help students reveal and then think reflexively about their pre-existing frames of understanding (both tacit and explicit). Students begin by individually ranking the packaging of selected consumer goods from "best" to "worst" or in terms of their degree of "sustainability" (with these concepts left undefined in the lab) relative to the others. Students invariably ask us to define these terms but are consistently reminded that it is part of their job to do so. After ranking each commodity, students are instructed to provide a reason for the ranking assigned. From this set of reasons, students are asked to identify and articulate the more general criteria they use to define sustainability (such as aesthetics, economics, reusability, recyclability, dematerialization). Students are able to see how different criteria, including some based on tacit assumptions or framing understandings, lead to very different rankings. For example, some students ranked a metal tin as sustainable because it could be reused while others questioned the assumption that it would be reused and gave it a lower ranking.

Student subjective knowledge includes the assumptions, expectations, and even the emotional or visceral reactions that each individual accumulates over time through different lived experiences. The lab prompts each student to understand (and thereby be prepared to articulate in Step 2) her or his criteria for sustainability. Rather than imposing a singular definition, the first step in this lab is intended to help students to realize their own working definitions of sustainability and to compare with others by asking them to make and articulate concrete choices, and then reveal and reflect on their criteria. The goal is not only to awaken and expose students' subjective knowing but also to prepare students to gain reflexive awareness about their own frames of understanding. Reflexivity—understanding how one's own ways of knowing are based on who one is and that collaboration requires that we respect others who see the world differently—takes practice. This step is designed to give students some initial experience along these lines.

Step 2: Discursive Knowing

This step is designed to help students learn more reflexive knowledge practices, by compelling them to engage with the multiple subjective frames that different participants bring to a problem. Reflexivity as a practice is greatly enhanced by interaction with others who have different ideas about the world, in this case as expressed through focused discussion of the different criteria students individually assign to their rankings to support their working definitions of sustainability. In Step 2 of The Packaging Lab, stu-

dents work in small groups and therefore must come up with consensual rankings despite different individual criteria. In the process of deciding on a final group ranking to present and defend to the rest of the class, the individuals in each small group consider and deliberate over the different rationales and criteria offered by other team members to decide which criteria justify their collective ranking. It should be emphasized that, during this activity, students were not encouraged to strive for absolute consensus or to agree on a singular vision but to bring their different worlds together through deliberation. Step 2 therefore compels students to go beyond merely articulating explicit criteria and to build intersubjective understanding through debate and argumentation with group members, even as they also come to understand how others might have different frames.

These small-group discussions are therefore a process by which students, through their reflexive understandings of their own "situatedness," learn to make emergent decisions with others through a group process that does not try to come up with one "ideal" definition. Students further understand sustainability as a discursive concept and expand their own comprehension by adding new transdisciplinary, transframe layers to their prior definitions of the term.

Yet, this kind of discursive knowledge building can lead to problems in multidisciplinary design teams as people talk past each other, confuse one another, and disbelieve each other because each participant has a different frame. Therefore, to support discursive modes of knowing, our pedagogical approach includes not only scaffolds for students to reflect individually upon a more expansive definition of sustainability but also scaffolds for them to articulate their individual perspectives and to listen carefully to others' articulations. To promote receptive/reflexive exchanges and deliberation, professors instruct students to read sources and to use careful listening techniques taken from nonviolent communication, a process skill designed to help groups resolve conflicts through increasing abilities to listen to others, to articulate one's own frame, and to look for the common interests behind what look like intransigent positions. This training helps students to learn collaborative practices that are an intrinsic part of interdisciplinary teamwork.

Step 3: Codified Knowing

For subjective and discursive modes of knowing to become productive they must be infused with technical, codified knowledge production and practice. Throughout the course, all four modes of knowing, including the codified information produced by specialists, were recognized as important learning processes. However, instead of didactic

methods of teaching knowledge from "the sage on the stage," the lab prompted students to seek out this knowledge on their own through joint research. While it may seem incongruous to plan for gaining technical knowledge as a third step in this largely diagnostic and reflexive activity, we found that, typically, it was indeed at this very point in their learning process that students began to ask technical questions to ascertain whether or not particular packages in fact met their subjective criteria ("Is this plastic recyclable?," "Is less packaging that is less recyclable really better than more but recyclable packaging?"). Realizing the importance of the technical questions they were beginning to ask, students were then self-motivated to do their own research to support their arguments for or against the features of particular packages as representing the more sustainable choice. In the earlier versions of this lab, we found students spontaneously turning to the Internet and library searches, beginning a kind of investigatory research despite the absence of this step as a required feature of the exercise. As it seemed to be an activity worth encouraging, we have now formally added this new step, with some scaffolding to help students hone and apply research skills in ways appropriate for training in key technical research competencies that enable them to take part in cogent sustainability planning and practice.

Step 4: Practice-based Knowing

Knowledge gained through practical action is fundamental to human understanding: we come to understand concepts by putting them to use in the world. Students participate in practice-based meaning-making from the start of the lab activity. The subjective knowledge they offer and technical information they query and gather becomes more meaningful because they are actually using it to do something—in this case to make decisions (i.e., establish a ranking) and later to defend those decisions to an audience of their peers.

Like the learning activity itself, our design of this lab was a collaborative experience, using student evaluations and our observations to better design the activity. As noted above, we added a technical research component to the exercise because we found that students were turning to this activity on their own. In a future version of this lab, we plan to add a new step that asks students to design a new object based on the criteria that they have been exploring, thereby putting to work the process skills they have just learned. This step will further train students to apply this process knowledge to plan and justify design components of their service-learning projects. Our expectation is that students will gain a deeper knowledge of the subjective and discursive criteria

they are using to distinguish "sustainable" from "unsustainable" materials and/or practices to perform the practical work involved in completing their larger service-learning projects.

What We Learned from the Packaging Lab

We examined the results from students completing this lab in two courses, Sustainability and Social Change (Sociology 115)[3] and Sustainability Engineering and Ecological Design (EE80s). In both courses, we found that the activity generally accomplished what it was designed to do, namely: 1) expose students to multiple frames of understanding when it comes to distinguishing *unsustainable* from *sustainable* practice, 2) thereby increasing the number and broadening the scope of the kinds of criteria that any one student might apply (or at least consider), and 3) challenge and engage students through problem-based dialogue to work effectively with people who hold different sustainability worldviews, in order to 4) present sustainability as a complex rather than reductive concept and one that is fundamentally discursive in nature.

We found that initially, it was common for students to rely on one or two reductive characteristics in their first attempt to justify a rank order. For example, in the version of the lab that asks students to rank packages "from best to worst," multiple students used a simple binary heuristic: was the package recyclable or not? Other students remained narrowly focused on the recyclability of a package, but went a bit further to consider the amount of and types of materials used. However, working within small groups to agree on a collective group ranking in Step 2, students exposed each other to other possible decision criteria. For instance, one student, an environmental studies major, reported that when she joined her group, she was surprised to find that other students described "best" in terms of convenience and safety. Conversely, another student in a lab that asked students simply to rank packages from "best" to "worst" and who evaluated her packages by how easy they were to open noted that "I didn't think of sustainability and most of the group had this option." In the version of the lab in which we asked students specifically to rank packages according to their "sustainability" (rather than a more general idea of "best"), students also found themselves thinking more broadly about the meaning of this term after com-

[3] Sociology 115 was carried out both at UC Santa Cruz and as a version of the academic program at the University of California Washington Center (with DuPuis as instructor). In both cases, the students were involved in service learning internships and represented many majors, including science, engineering, social science, and humanities.

pleting the exercises. For example, one student initially focused on whether or not a spray bottle was recyclable and/or "reusable," but after completing the group discussion and reranking exercises the same student introduced her own notion of a "waste to functionality ratio" to justify her ranking, arguing that the increased amount of material made the bottle more reusable.

Irrespective of the initial prompt ("rank packages from most to least sustainable" versus "rank packages from best to worst"), it was less common for students to integrate multiple types of decision criteria into their first set of rankings. The number of students showing that they integrated multiple characteristics into their reasoning increased after students discussed their individual rankings with a group of their peers and then completed the group and individual reranking phases of the activity.

In some versions of the UC Santa Cruz electrical engineering course (EE80s, Sustainable Engineering and Ecological Design), we also used the lab as a pre- and post-assessment to evaluate what students learned in the class. Students completed the entire lab on the first day of class and again at the end of the course on the final exam. In this case, the same students were asked to rank and justify their rankings for a different set of packages and each of them wrote multiple statements ("entries") to justify the rank order of each packaged item. Table 2 compares our assessment of a sample (n = 59 students) of student entries on the first day of class to their entries on the final exam. Student entries were characterized as being *low-level*, *mid-level* or *high-level* responses depending on their overall complexity and scored accordingly. Unsophisticated responses showed awareness of only one or two reductive characteristics without including specifics or qualifying statements, or noting any contingencies. Sophisticated responses 1) were characterized by multiple types of considerations, 2) showed more specificity within a theme (e.g., "mineral extraction" vs. "manufacturing"), 3) included more qualifying statements (e.g., the idea that waste should be measured against functionality), 4) showed awareness of contingencies (e.g., an item is reusable but only if well-preserved by the consumer) and 5) did not treat the package as a unified whole but rather as a composite of different

materials. As Table 1 indicates, we found that from pre- to post-instruction in the electrical engineering course the proportion of high-level responses increased dramatically while the proportions of low- and mid-level responses slightly decreased.

We also analyzed whether the net differences shown in Table 1 could be attributed to the gradual improvement of many students rather than the dramatic improvement of just a few and found the former to be the case. Specifically, we found that on the final exam, the number of students in our sample (n = 59) that included one or more high-level entries in their response increased by 21 as compared to their performance on the earlier individual ranking exercise. We also found that, while only three out of 59 students (5%) produced responses that included more than three high-level entries prior to instruction, 11 out of 59 (19%) included more than three high-level entries on the final exam. It is also encouraging that the number of students giving responses characterized by a majority of low-level entries (5 > entries) decreased by 15% from pre- to post-instruction. While these results are evidence of student learning in only one particular course, they reflect the kind of improvement different instructors reported seeing across all courses using this lab.

After completing the ranking exercises and in-class discussions, students answered a series of reflective questions to compile a post-lab report. The work on these lab reports served to further improve their learning about sustainability as a complex concept, and also allowed us to better assess whether students were engaging in the multiple modes of knowing described in Table 1. Indeed, in reflecting on the lab, many students noted the discursive nature of sustainability. For example, one student wrote:

> Since there are so many different definitions of sustainability it makes it difficult for society to agree on one specific one. I think a sustainable society has to come from baby steps. I believe that more likely than not, similar priorities of sustainability exist and it's at these overlaps that we need to promote change. If someone were to just generalize all of sustainability into one giant definition, people would most likely be upset at

Table 2 Low-, mid-, and high-level student entries.

	Total entries in sample	Low-level responses	Mid-level responses	High-level responses
Preliminary individual ranking exercise	633	54%	37%	8%
Final exam	788	48%	31%	20%

the statement made. That's why we need to find the common ground between the definitions and work from there.

Other students were able to comment on the subjectivity of their own position and how they learned reflexively through exchanges with others. One student explained that "through discussion and compromise, I learned about a product's benefits/ negative elements that allowed me to reflect and change my ranking." Another student found that she shared many of the criteria with others in her group, "but recyclability weighed more in the group than it did for me individually."

Taken together, these results show that after instruction students considered a broader range of criteria and did so with greater sophistication. We are aware, however, that the activity, as well as our scoring criteria for student performance, is more suited to capturing changes in the "breadth" of students' thinking than in its depth or sophistication about any one topic. For that reason, it is important to mix an activity like this one with others that focus in more detail on the specific skills and knowledge tied to particular facets of the larger sustainability question.

For the SEED team, the development of the lab was itself an interactive and reflexive design process that required understanding the outcomes of successive changes. To solicit student feedback on the activity as a learning experience, we administered exit surveys, which also changed as the labs developed. When asked about their general experience with the SEED pedagogy, all of the students (n = 39) participating in one iteration of this lab indicated that they either agreed (47%) or strongly agreed (53%) with the following statement: "Through collaboration within my lab and design teams, I learned things I cannot learn in a lecture-based class." When asked to rate the effectiveness of The Packaging Lab specifically for advancing their learning and skill development, 75% of these respondents rated their experience with this activity as "strong" (rating 4 or higher on a five-point scale). In a comment section, several students reported that this activity in particular helped them to "weigh both sides" of a problem, understand how different people might "think/see things," and helpful for "putting problems in another perspective."

However, fewer students saw the connection between their learning and their service-learning activities; only two of 39 students responding to our survey rated their experience with The Packaging Lab as "highly effective" (rating 3) in preparing them for their out-of-class responsibilities, while 38% of the students indicated that it was moderately helpful at best (rating 3 or less). Overall, students did not view the central idea that design can emerge from collaboration in groups with different criteria and different worldviews about sustainability as critical to the success of their action-research projects or internships. Those who did not grasp this point judged the activity as unnecessary but "fun." With our addition of Step 3, the practice step where students design their own package, we hope to help students connect their learning in class to their service-learning activities.

Overall, we learned that reflexive learning requires substantial class time, although with less lecture time. When students are struggling to find effective ways to collaborate, the professor needs to have some way not to rush the process, to let things go. At other times, the instructor needs to know when to intervene to move things along so that students see the value of the class-time work. When students do productive classroom work, it is also important to devote class time to recognize what has been learned.

We also learned that evaluating the acquisition of uncodified, reflexive knowledge is difficult within standard codified assessment systems. Our multimodal pedagogy requires a different approach to understanding and evaluating student learning. In The Packaging Lab, no one rank order was considered correct. Indeed, we were less concerned with the actual rankings than with how students arrived at different conclusions based on their stated criteria. These challenges compound the difficulties of assessing reflexive, noncodified student learning. It is by definition challenging to codify process learning. Also, if students feel that they have learned something on their own, they do not necessarily credit the pedagogical scaffolding tool that got them there. In addition, in professional assessment (and in articles like this one) researchers must show that the tool (and the professor) has been effective. These difficulties make it tempting to move back to didactic mode, where the professor "gives" the information to the students and is therefore clearly the source of the information.

In other words, collaborative learning requires that the instructor take on a significantly different role in the course, one that is sometimes difficult when one is used to the traditional role of being the authority. In classrooms where the professor is coaching collaborative learning processes, he or she may appear superfluous. In institutions where instructor merit is based on ratings by students, collaborative learning processes put the instructor's reputation at risk.

Making the world more sustainable presents a formidable challenge for the future. As this study has shown, the challenge is more than just designing the right campus greenprint. Universities that seek to

provide sustainability education must face up to the challenge of training students to become dynamic, reflexive, and collaborative in how they arrive at new understandings and how they participate in multi-modal knowledge-production processes. As we have suggested above, this has strong implications for teaching practice as well as for the overall organization of learning within a university setting.

These challenges will not be easily met. In order for a university to research and teach sustainability through an interdisciplinary, dispersed, multimodal learning pedagogy, curriculum designers will need to overcome a long and entrenched history of presenting knowledge as "what": as immutable information held by experts and segregated into siloed disciplinary tracts. Universities that succeed in supporting faculty to create and implement these new types of curricula will better prepare students for the sustainability challenges ahead. UC Santa Cruz's SEED program designers will continue to design—and redesign—learning activities to meet this goal. New collaborative and reflexive pedagogies to train students in post-normal modes of knowing will hopefully not just impact learning about sustainability, but also transform the university into a learning institution that gives students the competencies to meet the broader challenges of an increasingly complex world.

Acknowledgement

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Lab 1: Defining Sustainability

The Packaging Lab

Step #1

- For every part of this exercise, you will first make a decision. Next, you will reflect on what you are doing and articulate your reflections in your lab report.

- On the table you will see a set of packages. For the first part of this exercise, you will pick five packages and rank them according to your definition of sustainability. (You are ranking the packages themselves and not what is in them!) Please rank the packages:

- Best:
- 1.
- 2.
- 3.
- 4.

- Worst:

Step #2

Secondly, reflect on why you made these choices. For each package, list the reasons why you ranked that package the way you did in terms of your definition of sustainability:

- 1.
- 2.
- 3.
- 4.

- Worst:

Step #3

- Reflect now on your reasons. Can you boil down each of these reasons into your sustainability criteria?

1.

2.

3.

4.

Worst:

Criterion: "a standard on which a judgment or decision may be based" – Merriam-Webster Dictionary

Step #4

Now, go back to the whole group of packages again, this time pick four, ranking the three best and one worst in terms of other criteria you might consider important. Add the criteria you used to make this ranking:

- 1.
- 2.
- 3.
- 4.

- Worst

Step #5: Compare your Choices

Best Criteria   **Most Sustainable Criteria**

- How do your criteria of sustainability relate to your criteria of "best" in the first ranking? Was it the same or different? Explain:

Triple Bottom Line

Some argue that sustainability is a system with three "spheres." Meeting the criteria of all three spheres is called meeting the "triple bottom line." Think about your criteria – where does it go in terms of these three spheres? Write both sets of your criteria into the diagram, in terms of where you see them fit.
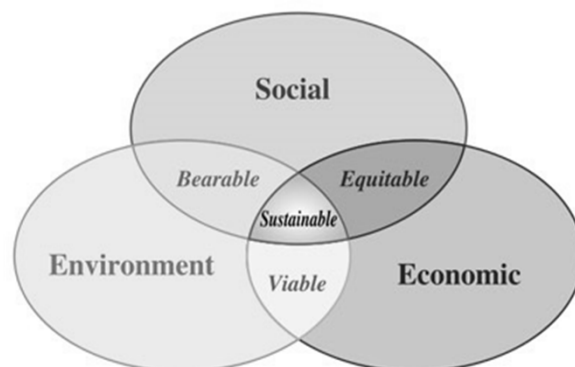
Step #5: Joint Ranking

- Now, in groups of three, work together to come up with a joint ranking of your packages. To do this, you need to decide what criteria from both rankings are important to your joint ranking. Before you start, look over these <u>negotiation tools</u>.

- 1.
- 2.
- 3.
- 4.

- Worst:

Step #6:

Together, reflect on this joint ranking. Take notes and use these reflections in your answers to the final lab questions.

This classroom activity came about as a product of

- Muddling plus money (NSF)
- A year in dry cleaners regulatory negotiation
- Two years listening to organic strawberry farmers talk to each other
- Some history of science and engineering design
- Exploring frameworks of understanding (theory)
- Practice with students
- Reflexive Iteration

Muddling

Exploring
Frameworks

Reflection

Prototyping
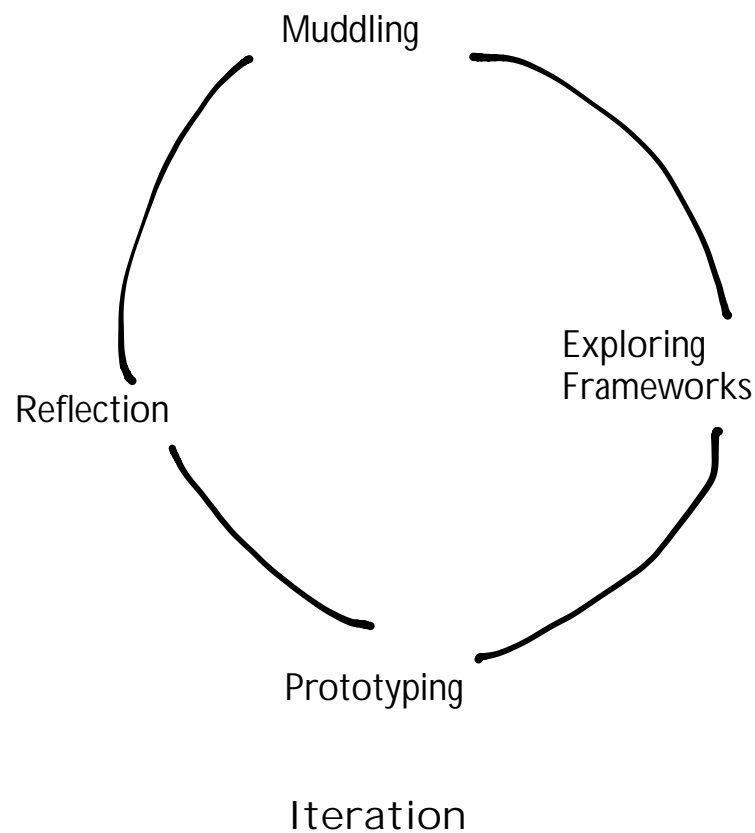
Iteration

Discovered Gibbons, Nowotny on Mode 1 and Mode 2 knowledge.
Discovered Funtowitz and Ravetz on Post-normal science

Post-normal

Information is uncertain
Issue oriented knowledge
Requires opening up to "extended peer review"

From these iterations, four types of knowledge emerged:

1) subjective: what you know from your personal experience
2) discursive: what you know through collaboration -- process
3) technical: what you know through technical and scientific process
4) practice: knowing by what you try to do
Parallel to design steps in software engineering:

1) pick a problem
2) user centered design
3) vision
4) prototyping
5) iteration

Reflexive design of governance

Multilevel design

Wicked problems

• Problem defined differently by different stakeholders according to different
  worldviews
• High uncertainty
• No defined end solution, only better or worse ones
• No clear stopping point
• Every solution has unintended consequences, and/or trade offs

Wicked problems are made for multiple modes of knowledge which emphasize
process

The article represents one moment in time for this particular project, which is ongoing -- a process rather than a product that will probably never stabilize. Since this article, also, this lab has spread to many other classrooms at a number of other universities

In each case, the lab has been contextualized, adapted to the particular class and the particular group of students. But with a basic structure: individual ranking of objects, reflection on that ranking and articulation of that reflection into a set of design criteria, then a joint ranking which requires that students discuss the various rankings and the criteria through which the rankings were made, and then a discussion of the process by which students made the group ranking. There is no correct ranking. The students are graded on the quality of their articulation of their reflexive processes. Quality in this case is defined as a student's ability to recognize that other students use different criteria to rank the sustainability of packages, and therefore that these other students define sustainability in different ways. In the "lab report" students are asked to reflect upon the differences in criteria among the group and to articulate why or why not that criteria should be part of the group's definition of sustainability.

Frameworks

The first lab iteration was informed to some extent by constructivist education theory that was part of the conceptual background of the postdoctoral partner, Tamara Ball. My own work at the time involved ideas of discourse and nonviolence communication training I explored in the process of working on issues of violent hate assaults in my hometown, melded with multicultural theories of social justice from feminist and critical race theory. Our initial lab design was also informed by the ideas behind the social history of technology., in terms of how an object, such as the bicycle, was the product of different persons and their varied interests in how to use the technology.

Our conceptual background in theories of knowledge only developed as we began to write the paper, over a period of five years. In other words, we started the practice of designing this lab before we knew what we were doing. Consequently, the conceptualization of sustainability as composed of different modes of knowing and as "post-normal" only emerged in the literature as we were attempting to articulate what we were doing in the classroom. Finally, we eventually discovered Harriet Bulkeley's work on Modes of Governance and joined this work to the Modes of Knowing literature.

We found two knowledge frameworks useful for the development of the lab and of the paper: first was our discovery of Functowitz and Ravetz's idea of sustainability science as "post normal.." We had already started with xx's idea that sustainability science was intrinsically transdisciplinary: going beyond simply interdisciplinary collaboration to a true breaking down of borders to engage ideas across disciplines. For that reason, we had tried to make the class open to all disciplines but especially to dialogue between engineers and social scientists. We were trying to create transdisciplinarity in the classroom through this lab. FNR took this a step further, arguing that the complexity and uncertainty of the path to a more sustainable way of life does not open itself to the traditional modes of scientific discovery through laws and hard facts. Recently, Ravetz has entered the climate change controversy as a observer of how uncertainty of prediction in climate change models has led scientists to defend claims about the normality of climate science which only opens them up to the politics of climate change denial. Ravetz argues that science needs to be more open about its uncertainties and while opening up their models, allow more citizen participation in controversies such as c

The second knowledge framework that we found useful was Nowotny et al's idea of Mode 1 and Mode 2 types of knowledge. Nowotny et al are not talking about sustainability specifically. Instead, they are making a point about science in general, that the boundary between society and science, so tightly policed since The Enlightenment, had broken down. They argue that science, to be "robust" requires the participation of the public. Both FNR and Netal discuss the reasons for this

Do students universally learn how to do reflexive process practice by the end of this training?

Wildlife conservation practitioners' skills, between official goals and real practices.

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Abstract

Wildlife conservation projects mobilize players with primarily scientific and technical backgrounds. These practitioners, who operate far from laboratories and the academic world, deploy a very diverse range of skills to cope with the challenges of field work. A debate has emerged over the past few years in the scientific literature in general and Conservation Biology in particular about "skills for conservation." How should conservation practitioners be prepared for their work? How should they be trained better? And, farther upstream, how should their tasks be redefined to be able to meet the challenges that they actually face in the field more effectively?

The notions of skills and competence span several well-identified issues in the social sciences that are not easy to reconcile, although they all participate very concretely in the same reality out in the field. To fuel this debate, we propose to take an anthropological side trip to study some projects and the skills that are actually deployed by practitioners in their work. To this end, we interviewed the protagonists of nine projects devoted to the protection of threatened animal species and observed some of them at work. These "first-hand" data were completed by an analysis of documents, some documentaries, and the literature. We then pinpointed four areas of competence and action in which all the players in these individual experiences were engaged. This inductive approach to develop generalizations from the specific leads to better knowledge and recognition of the true practices, skills, and competence of these essential players at the interfaces of science, nature, and society.

Resumen

Los proyectos de conservación de la fauna movilizan prioritariamente actores con perfiles científicos y técnicos. Lejos de los laboratorios y del mundo académico, estos practicantes desarrollan competencias muy diversas para responder a los desafíos del campo. De parte de la literatura especializada, y de la revista Conservation Biology en particular, un debate emerge desde hace varios años a propósito de las "competencias para conservar". ¿Cómo preparar a los practicantes de la conservación? ¿Capacitarlos mejor? Y más allá ¿Cómo

redefinir sus misiones para responder mejor a los desafíos que ellos seguramente enfrentarán?

La noción de competencia recubre varios desafíos muy bien identificados en ciencias sociales. No es fácil conciliarlos a pesar de que todos participan concretamente de una misma realidad de campo. Para alimentar este debate, proponemos hacer un recorrido antropológico por los estudios de proyectos y de competencias concretas desarrolladas por los actores en la acción. Nos hemos entrevistado con los protagonistas de nueve proyectos consagrados a la protección de especies animales amenazadas y hemos observado las prácticas profesionales de algunos de ellos. Los datos de "primera mano" han sido complementados por un análisis documental y bibliográfico. De manera inductiva, nos hemos acercado a experiencias singulares definiendo cuatro dominios de competencias y de acción que comprometen a todos los actores. Tal generalización abre la vía a un reconocimiento de las prácticas y de las competencias reales de los actores ineludibles de la interface entre ciencias naturales y ciencias sociales.

Introduction

"I am struggling to translate my professional training into a life well lived that in some way contributes to preserving the natural world and not just documenting its decline…My professional training did not prepare me well for this task" (quote in (Orr 1999)). Putting wildlife conservation objectives into actual practice is a job that is still fraught with mystery. It entails a very diverse knowledge set about how to do things, *i.e.,* know-how, that has a hard time being recognized and taught (Van Dyke 2008). These professionals, who are "working at the intersection of conservation and human improvement with courage and stamina, and often with little public acknowledgment" (Orr 1999), are essential intermediaries at the heart of projects to conserve biodiversity. All of them are conservation practitioners, and yet their working conditions, training, and skills are extremely heterogeneous, despite common general objectives. What do we know of their actual practices? Of their skills? In the literature, the general categories that identify scientists on the one hand and stakeholders on the other often leave this third group in the shadows. Do their commitment to action and the complexity that surrounds it lie at the root of a problem of recognition (Knight et al. 2008)?

One achievement of labor studies is to have placed the core of these practitioners' activity in the gap between "assigned work" and "real" or "actual work" (Daniellou 2005). In the French-speaking tradition of analyzing occupational activity, the "prescribed work" (or the task or assignment) is what *is to be* done, whereas the "real" or "actual work" (or activity) is what *is* actually done (Dejours, 1998). Now, French-speaking ergonomists showed that this real work could not be reduced to the assignment, or, to state it differently, that one's activity necessarily "spilled beyond" the task (Daniellou et al. 1983). As a result, "...organizations operate [only] because individuals in actual situations of work mobilize their practical intelligence to ensure that everything works despite prescribed rules and procedures that are often impossible to implement in their current state" (Chanlat, 2012, pp. 37-38). Planning an activity and actually doing it must thus be considered to be two different aspects of the same job that are in a dialogue and always likely to inform each other. We should remember that action unfolds in a situation and can never be reduced to implementing a plan (Suchman, 1987). Acting means adapting to circumstances; coping with contingencies; and seizing opportunities present in the environment.

Such a perspective takes the ambivalence of the French word "*compétence/compétences*" seriously. This notion effectively contains a wealth of meanings, referring to tasks at some times and to a panoply of skills and abilities at others (in English it translates as skills, competence/competences, abilities, or powers). These are all aspects of the same job, aspects that must be considered and discussed. We believe that such an exploration is an

interesting key for unlocking ideas about the gap between the general aims of conservation and a form of disenchantment with its results (Hoffmann et al. 2010). We shall thus start fuelling this debate by taking stock of the various avenues raised by specialized conservation journals. Starting from the malleability of the notion of *compétence* (skills and/or competence), we shall show how it is commonly understood according to three approaches. We shall then put these points of view in perspective thanks to the qualitative survey of practitioners that we conducted. Our essay thus takes the shape of a dialogue between literature (in labor studies and conservation science) and anthropological field research. We hold that analyzing skills and competence *in situ* adds depth to the three approaches identified; it enables them to "speak to each other." This dialogue can help to garner recognition of the work that practitioners effectively accomplish out in the field.

1. Three ways of talking about skills in conservation

Conservation journals offer a wealth of contributions that take stock of the directions that conservation must take as both (a) science and (a) practice (Cook et al. 2013). Given conservationists' continued mixed results, it is necessary to conceive of more powerful conservation models. Some of the avenues raised concern the field conservationists' skills and competence. They associate them with general objectives that must be redefined in order to guide the practitioners better. They relate the subject as well to training and learning issues, *e.g.*, how to train conservation practitioners who are able to handle efficiently the multiple issues that are inherent in all conservation projects? More rarely, the authors emphasize the singular dynamics in which these practitioners are involved in the course of action, that is, dealing with real-life problems. These approaches question and answer each other from one publication to the next. Their variability reflects social science's finding that the notion of competence is malleable and vague. Rather than considering this feature to be a sign of confusion, we take it to be a starting point that is useful to explore.

A managerial approach: planned multidisciplinarity
Conservation science has been striving to achieve an ambitious goal, that of defining the principles and tools required to preserve biodiversity. This path proved to be studded with a host of obstacles right off the bat: "The multidisciplinary nature of conservation science has long been recognized (Soulé, 1985) but seldom achieved, and compartmentalization of disciplines and sectors responsible for conservation are [sic] an impediment to effective conservation (Ehrenfeld, 2000; Mascia et al., 2003; Balmford & Cowling, 2006; Robinson, 2006)" (Reyers, Roux et al. 2010). This search for effectiveness is thwarted by a lack of

control over the human dimensions. By this one must understand "the diversity of public interests in wildlife conservation" (Teel & Manfredo 2010); understanding "the psychological bases of individual behavior to predict the behavior of communities" (DeCaro & Stokes 2008); and opting for "social learning" and "adaptive management" (Cundill 2011). The social sciences are being called to the rescue in a wave of great enthusiasm for interdisciplinarity (Mascia, Brosius et al. 2003) and the entire field of conservation must be redefined as a result. Many new conservation issues are also being identified and studied; they concern communication, project management, and conflict resolution (DeCaro & Stokes 2008). In this same perspective, redefining the practitioners' tasks through interdisciplinary research has become a priority and multiple levels of expertise are planned as the horizon that everyone must try to reach.

An "educational" approach: interdisciplinary curricula riding to conservation's rescue
Strengthened by this momentum, the authors wonder about the academic curricula that are required: Universities must give future conservation professionals training that includes human skills (Jacobson & Duff 1998). Biologists' scientific knowledge and technical tools are not sufficient to cope with the problems that they encounter in the "real world" (Orr 1999) and teachers and professionals of conservation alike must be able to have their say in the new curriculum to promote (Muir & Schwartz 2009). The need for strong theoretical foundations is reasserted, but they must not be limited to the natural sciences. Hence the constantly more numerous attempts to open up the curricula to the humanities and social sciences (Brewer 2006). Moreover, the authors underline the efforts made to give field work an important place in the curricula, given its value as a source of learning more transverse skills, know-how, and behaviors. They include among such new abilities "knowing how to work in a group," "knowing how to engage in dialogue," or "being willing to adapt" (Cannon et al. 1996; Brewer 2001). The proposals coming out of the world of teaching are thus two-pronged: They concern content (which knowledge, which "know-how," and from which fields?) but also learning methods (academic theory and field work), with the question of whether we run the risk of overloading the curricula (Lidicker 1998).

A "hands on" approach: always singular experiences
The majority of the individuals who are recruited into conservation programs are scientists and technicians. They nevertheless make up an extremely heterogeneous group with a host of special skills (Muir & Schwartz 2009). They confirm the difficulties of dealing with their arduous tasks that researchers and teachers have underlined (Blickley et al. 2013). They regret having to play parts that are very different from the ones for which they were hired and, in their view, have nothing to do with their missions. They assert that they were not

trained to deal with such challenges and deplore the fact that it is so hard to get their experience recognized (Noss 1997). As a result, each of their testimonials sounds like a specific case and this third approach is by far the most discreet one in the literature. What the managers and teachers identify as a gap or void (in terms of goals and training programs to improve) is timidly claimed to be a "rich continuum" or "treasure-chest" by a few field practitioners. However, it is a cumbersome treasure-chest that is encumbered by experiences and ways of doing, by details and anecdotes that nevertheless make up a large and very real part of their hands-on work.

Three approaches: their postulates, their limits
When efforts focus on setting new objectives, the matter of skills and competence is subsumed by general considerations about each discipline's contributions. The implementation of such skills is not considered beyond the tasks and recommendations formulated upstream from the action and is very seldom examined as a theoretical issue. This approach echoes a managerial discourse about these skills, one that sees them from the standpoint of what is expected by the organization. They are incorporated in the plans and a player is competent when s/he is able to carry out the brief entrusted to her/him. In this approach, no attention is paid to the distance between the briefs and actual practices. When this gap is ascertained, it is interpreted as a sign of failure on the part of the players. The proponents of this approach want the prescribed and actual work to be superimposable.

The educational approach sees skills and competence from an individual standpoint: a person is considered to be competent if s/he can implement a certain number of resources in a consistent way and act effectively in a class of situations. From this perspective, skills are learned and transmitted in the brief period of the academic curriculum. They are objectivizable resource elements, items of knowledge, and types of know-how that must be defined, be limited in number, and pre-exist action. Of course, practical experience is increasingly present in today's academic curricula, in order to foster creativity and the ability to work cooperatively (Kainer et al. 2006). However, rather than being seen as true starting points for learning, they are usually included to illustrate stabilized knowledge (Masciotra, 2010).

In contrast, action takes up the bulk of the practitioners' discourse, far from theoretical knowledge and learning objectives, sometimes even out of step with them. However, the singularity of the situations that they recount is a barrier to sharing their experiences. These field practitioners express in practice what labor studies have identified as the heart of the notion of competence, *i.e.*, the distance between real work – what makes up an art or trade –

and prescribed work, *i.e.,* the objectives and assignments (Star & Strauss, 1999). This distance stems from the fact that working always means grappling with the "real," that is to say, a certain number of obstacles and difficulties. So, according to C. Dejours (1995), the real is "that which, in the world, makes itself known by its resistance to technical mastery and scientific knowledge" (p. 41). The real manifests itself "in the form of experience in the sense of what one has lived through" (p. 42) and which is always "a subjective experience of failure, uncertainty, powerlessness, and doubt" (Dejours, 2006, p. 128). Far from purely technical considerations, the practitioners' testimonials question, in their own way, the world of research. Can the reality of conservation practitioners' work be taken as a subject of study? How can one identify general terms to describe and give value to their singular experiences, their hesitations, trials and errors, and "extramural" life-long learning?

These different ways of envisioning conservation practitioners' skills can be brought closer in terms of their postulates but also when it comes to their respective limits, which make it necessary to move from one to the other. Convinced of the need to value and make use of the practitioners' experiences, we propose to continue the discussion by analyzing their skills "*in situ."*

2. Survey of conservation professionals

Between 2006 and 2013 we conducted a study of wildlife conservation professionals according to the principles of grounded theory *(*Glaser & Strauss, 1967*)*. In this approach, the researcher suspends her/his use of established theoretical frameworks in favor of interpretation grids that arise from field data. In other words, s/he refuses to impose an explanatory framework on the data right off the bat. Our idea was that practitioners' skills could be redefined from the challenges that they had to meet in their action and the decisions that they had to make in the field. Testing such an idea called for some solid empirical work based on in-depth examination of several case studies (see Table 1). We thus conducted a series of comprehensive interviews of the protagonists of various wildlife conservation projects, namely, park wardens, NGO officers, and the members of various administrations, in a series of countries. In order to grasp what their daily work entailed, we supplemented the interviews with direct observation of their work. The written traces of their activities (reports, publications, and autobiographies) added some historical depth to these field data. They also revealed relations that engaged them but were not visible in our "snapshots" of their situations at work. We used the combination of these three investigative techniques to triangulate three types of information, namely, the practitioners' statements, their actions,

and their activity reports. In following the practitioners as they worked and in trying to account for the issues such as they cropped up in front of us, we ended up identifying four areas of skills and of action that were shared by all the practitioners whom we met (Denayer, 2013).

Generating knowledge

Wildlife conservation is based on knowledge of natural dynamics. This usually entails taking stock of the situation and monitoring developments thereafter. But the animals constantly move out of the practitioners' field of vision. How many are there? Where are they? How are they doing? Out in the field, generating knowledge that is rooted in situations is a feat in itself, one that has its own challenges. Such knowledge cannot but remain provisional and regularly involves the participation of cogenerators of varied walks of life: hunters, fishers, motivated citizens, and volunteers. What is more, while the project is rooted in natural field conditions, it is also permeable to its social, historical, and civic human environment. A surprising diversity of knowledge is useful, even indispensable, for wildlife conservation practitioners if they are to carry out their tasks successfully. This knowledge ranges from the most technical and scientific to the most open and pragmatic, and because it is above all "relative" knowledge, most of it remains hard to use in the scientific channels of conservation. The types of knowledge in this situation are effectively local in scope but rich with the relations that produced it and relevant for joining the project's concrete toolkit.

Taking care of/Caring for

Direct measures can be taken to protect species that are exposed to certain threats. So, animals can be reintroduced, raised, fed, or simply guaranteed a minimum of quiet. These interventions, whether direct or conducted at a distance, constantly raise questions: When and how to intervene? What is natural? There is no single answer to these questions. When it comes to acting, technical-scientific rationality always cohabits with a sensitive, ethical approach. The former sees the animals as representatives of a species, the biology and needs of which can be studied and thus forecast. It relies on general knowledge and mobilizes standard protocols of intervention. Yet it is difficult for this approach to disregard the sensitive approach that is induced by physical proximity with and extended interactions between living beings. Beyond the species and its requirements, the practitioners worry about inventive individuals that follow their own paths, are sometimes recalcitrant, and always unpredictable. They take action in the name of an ethic of nature and living things that the project could not impose on them. Wildlife conservation is built in part on the tension that is described in the relationship between medicine and nursing, *i.e.*, treating people is not the same as taking care of them. Taking care of the animals does not boil down to purely technical actions, and the practitioners themselves are often transformed. It comprises a

relationship with a being whose autonomy – wildness in this case – must be respected not as an "ideal state" to achieve but as a constantly open-ended and thus uncertain process.

Living with

Many measures are taken to improve the cohabitation of human beings and animals. In so doing, conservation practitioners must work with a variety of partners. Who are their allies and how can they gain new ones? They cannot answer all these questions once and for all, especially since each party can be changeable in the course of action. Such an assessment also concerns the animals themselves, which are the first not to do what one expects them to and to jeopardize hard-won compromises by their very own behavior. So, even when a project bears fruit, conflicts are not rare. Far from the principles of "win-win" and "the common good," constructing a situation of "living with" is not tantamount to implementing a harmonious balance. The project takes a unique collective course, one that is sinuous and loaded with tension. Even as the conservation practitioners strive to change this course to achieve their objectives, they are caught in a process that they do not fully control. As disagreements follow agreements and failures success, each of them remembers the striking moments along the way. "Living with" is much more than a chronology of events. It builds a storehouse of stories that one can dip into for reasons to consider oneself a winner at times, a loser at others, and sometimes one and the other at the same time.

Reporting

Conservation practitioners have to report on their work in a wide variety of formats. They must do so formally and often informally as well. Their scientific publications and activity reports must cement the project's legitimacy. Information and awareness-raising are also always on the menu of their activities. Each report must be conceived of separately, contain a specific message, and aim for a target audience. Each report is thus "socialized." However, once delivered, it is taken up by actors who use these messages for their own purposes. So, while the reports build confidence and legitimacy, they can also expose the practitioners to a host of misunderstandings, all the more so as it is always difficult to avoid contradictions between messages that always remain incomplete. The format of scientific articles erases the singular nature of the generation of knowledge and relations with people and animals in which this knowledge generation takes place, while the messages that are put across to raise awareness tend to simplify reality greatly, under the pretext that people cannot or do not want to hear the full story. In both cases, speaking necessarily entails translation and betrayal. It means enriching and often impoverishing reality. And yet, no professional is free not to report on her/his work.

Tensions and synergy

Our study of conservation practitioners' actual skills led us to identify four areas of action and skills that involve them all. However, it is also important to stress that these categories break down differently according to the projects, priorities, and skills of each practitioner. In other words, these areas form an analytical grid for us that does not obliterate the reality of each project but, rather, gives it more meaning, makes cases that at first glance seem very heterogeneous intelligible and comparable. Each person we met has to cope with the same tensions that cannot be solved once and for all upstream from their action, to wit: One must generate knowledge, but how does one cope with uncertainty? To what extent is the wildlife that one wants to take care of natural? How does one report on things when saying means betraying? Beyond the principle of the "common good," why and how does one stand behind those humans *over there* and these animals *over here*? Each of these questions reveals the confrontations between the conservation practitioner and a real world that resists her/his project… The practitioner thus does not make do with implementing smooth objectives. S/he has constantly to allow for local contingencies as s/he advances. Between the assignment and actual work, these four areas of skills carry in themselves a unique challenge, but one that is not for all that completely independent from the other three. The practitioner regularly asks several of these questions simultaneously as s/he acts, and in connection with very tangible problems. So, s/he throws his/her scientific training, but also sensitivity, ties, ability to carry and to withstand, etc., into the battle. The answer for which s/he is looking is practical.

3. Discussion: an intermediary proposal in dialogue

Wildlife conservation is like most human activities: one of its main concerns is to understand the persistent gap between theory and practice. By meeting conservation practitioners, we wagered that it would be possible to paint a meaningful picture of their skills without preconceptions (Sandberg & Tsoukas, *op. cit.*). How our analysis can enter into a dialogue with the three approaches identified in the scientific literature?

From an action planning perspective, the aim of "adaptive management" is that of "fostering a new relationship between environmental science and social institutions, a relation that embraces uncertainty and possess the flexibility necessary to incorporate that uncertainty into management actions involving natural systems" (Benson & Stone 2013, p. 1). That is a crucial aim, one illustrated by many authors (Holling et al. 2002), that strives to be a compromise between the strategic objectives of conservation and reality in the field. Yet this

perspective is still struggling to be implemented even today (Benson & Stone, *op. cit.*). Moreover, it is worthwhile investigating this difficulty when we see that the life courses of people and animals out in the field are indeed intimately connected. When it comes to carrying out their decisions on the ground, we see that the practitioners "make do" with this inseparability. Even the most purely scientific strands of the projects do not escape such intertwining. So, as we have said, species monitoring operations are highly dependent on the ways that the human networks that conduct them operate (Law & Hassard, 1999) and it is difficult to keep them separate from the information that relates to human activities. "Generating knowledge" is not dissociable from "living with," no more than it is from "reporting," and while knowledge can help to validate, raise awareness, and ordain trust, it can also create suspicion. Our proposed four areas of skills overlap. They sometimes separate human beings from animals, but they bring them closer as well, and are part of a world that is constantly changing. There were no stable moments in the projects that we observed, no overhanging shelf from which it would be possible to come up with appropriate practical knowledge and a relevant strategy once and for all. On the other hand, it is clear that conservation practitioners are constantly forced to make decisions and settle things. Moreover, as they try to achieve general objectives, they end up having to set themselves new, more operational, goals, in the course of their action. They make singular decisions *in situ.* Might they only have "*the opportunity to be wrong*" (Benson & Stone, *op. cit.*, p. 12)? They must come to terms with nature and the social, specific conditions and the whole picture, the local and the global; they must "shuttle" back and forth between a project that is supposed to be robust, scientifically validated, and legitimized politically, and a cloudy, moving, sensitive reality in which they are stakeholders. Our study does not lead solely to an umpteenth additional question underscoring the need to take all of these dimensions into account. Rather, it is meant to be an appeal to take note of the fact that these dimensions are irremediably tangled up with each other at the core of their work on the ground.

In the literature, many authors stress that practitioners' experiences must be able to support the knowledge and know-how defined in the academic curricula. These experiences are seen as contents of a special kind that are extensions of conventional teaching discourse. However, out in the field we can pick out situations that prove to be new starting points rather than illustrations of what was previously learned. The practitioners are forced to learn in real time, in unique, changing contexts, and to strike compromises between what they previously learned and ongoing processes. In the projects that we studied we regularly came across individuals with striking personalities who were involved in very large socio-technical networks (Latour, 2005). Their individual talents mixed with procedures that were as strict as they were cobbled together. The practitioners' competences are the outcomes of historical

and social developments. As such, they can be connected, even if implicitly, to "social learning" (Wenger 2000), an objective that is also regularly brought up as a way to improve environmental management from a planning perspective (Ison & Drennan, 2007).

Finally, we logically place ourselves in a continuum with the third perspective, that of the "hands-on approach," that we identified in the literature. Here we concur with the authors who document the fact that conservation practitioners' practical engagement is recognized little by academic institutions (Cundill et al., op. cit.). However, our proposal goes one step beyond this reasoning, for underscoring the concrete, contingent nature of their practices is not enough. To be effective, their recognition requires a precise description of what is engaged in the specific situations. In this connection, the grid that we propose is an intermediary concept (Becker 1998) that means to produce generalizations from specific cases without obliterating reality. It hopes to attest to the specific stakes riding on the job while remaining close to its questions and hesitations.

Conclusions

Generating and ordering all sorts of knowledge; disseminating it as widely as possibly or keeping it under wraps; redefining as much as feeling what wilderness may be and what it is becoming; bargaining with people, but with animals as well; imagining the future with them and remembering the past; and, finally, making decisions that are always temporary and case-specific: Such a profession involves setting objectives that are open to discussion in the field and learning to learn about situations. Such a profession is rooted in practices that cannot be restricted to their scientific dimensions, be they natural or social. Finally, if there is one and only one cross-cutting competence to single out to reflect these conservation practitioners' work, it should belong to the realm of connecting, adjusting, compromising, or negotiating. However, this last term must not be taken simply as refereeing among groups of players whose interests remain different. Negotiating means adjusting the four areas of skills that we have identified to each other and trying to solve, always in a situated and temporary manner, the challenges and tensions that run through them. Supporting this argument means joining a topical management trend that sets out to build its own theory based on practical reasoning. In the wake of our study we believe that wildlife conservation programs would benefit from being backed up not just by biological monitoring, but also by socio-anthropological monitoring of the practices that are necessary to implement them. Such an approach mobilizes the social sciences in other ways than analyzing the interactions of the players' diverging interests and possible clashes does. It aims to provide its own tools for building bridges and filling in the gap that is so regularly decried between what is planned

and what is actually done. It makes an invaluable contribution to the recognition of these field practitioners' specific roles. Seen in this light, we should speak of a full larder that we must continue to explore, rather than a void.

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University of Liège, Arlon Campus – Environment (ACE)

Teaching complexity and uncertainty on Environmental Issues

Practices, Theories and Products

International Interdisciplinary Conference

May 20-21, 2014

Navigating in the uncertain world of controversies – A pedagogical wind rose

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A controversy-based pedagogy

The Arlon conference brought together lecturers willing to share and discuss aspects of their practice of "controversies", seen as a teaching/learning method suited to the contextual needs and demands of higher education environmental studies.

The present note contributes to this joint reflective effort by providing conceptual tools helping to interpret the practice, to question what it puts at stake and to detect, from a pedagogical viewpoint, key issues and upcoming questions.

This note falls within the Seminar's aim n°2: "share theories or conceptual propositions that make it possible to equip the teaching approaches and to give them theoretical and methodological foundations" (Program Arlon Conference 2014, p. 2).

The note takes a traditional stance, looking at the contributions to the conference through "constructive alignment"(Biggs, 1996), a basic principle meant to secure the pedagogical validity of any given learning situation by establishing a triple consistency (Kovertaite & Leclercq, 2006; Leclercq, 1995; Petit, Castaigne, & Verpoorten, 2007; Tyler, 1949) between objectives, methods and evaluation. A high-end layer is also examined: the general paradigm. These four dimensions compose the "wind rose" (Fig. 1) used here to nurture the conversation about a bunch of innovative instructional experiences aimed at "recognizing and taking account of the controversial, complex, and uncertain nature of environmental issues and their management" (*ibid.* p.2).
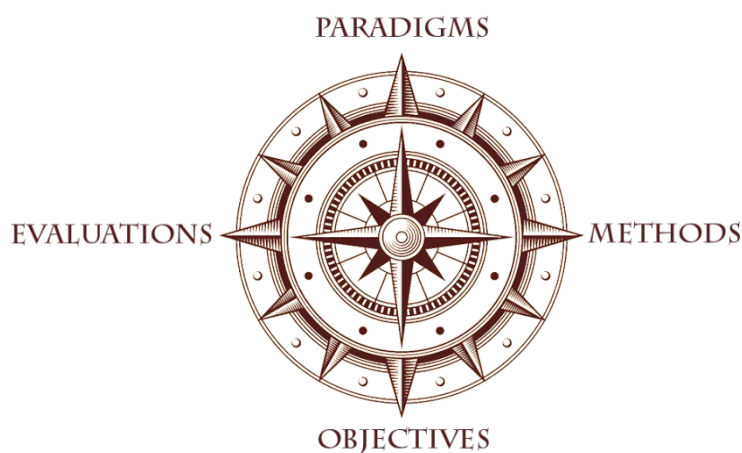
Figure 1 – A four-pronged interpretation grid of the teaching/learning experiences shared during the conference.

Paradigm

Huba and Freed (2000) provide one possible overarching descriptor (Fig. 2) of what is deployed in methods taking controversies as a resource for learning: a shift from transfer knowledge from faculty to students to a production of learning through student discovery and construction of knowledge. Indeed, the adoption of a student's centered approach leaves many options open. Working on controversies is one of them. The hallmarks given in the right column of Fig.2 can easily be recognized in the empirical foundations laid and presented by the participants to the conference. The paradigm centered on learning encompasses influent trends in education like Active learning, Experiential learning, Action learning / Research learning, Problem-based

learning, Practice-based learning, Inquiry-based learning, Learning by doing. Huba and Freed's categories can also be seen as a sophisticated presentation of the popular catchphrase "Sage on the stage versus guide on the side". (One missing feature in the table might be that controversies-based pedagogy work with situations which are producers of insecurities for tutors and students).

Teacher-Centered Paradigm	Learner-Centered Paradigm
Knowledge is transmitted from professor to students.	Students construct knowledge through gathering and synthesizing information and integrating it with the general skills of inquiry communication, critical thinking, problem solving, and so on.
Students passively receive information.	Students are actively involved.
Emphasis is on acquisition of knowledge outside the context in which it will be used.	Emphasis is on using and communicating knowledge effectively to address enduring and emerging issues and problems in real-life contexts.
Instructor's role is to be the primary information giver.	Instructor's role is to coach and facilitate.
Teaching and Assessing are separate.	Teaching and assessing are intertwined.
Assessment is used to monitor learning.	Assessment is used to promote and diagnose learning.
Emphasis is on right answers.	Emphasis is on generating better questions and learning from errors.
Desired learning is assessed indirectly through use of objectively scored tests.	Desired learning is assessed directly through papers, projects, performances, portfolios, and the like.
Focus is on a single discipline.	Approach is compatible with interdisciplinary investigation.
Culture is competitive and individualistic.	Culture is cooperative, collaborative, and supportive.
Only students are viewed as learners.	Instructors and students learn together.

Figure 2 – The traits of controversy-based pedagogy to be found mainly in the Learner-Centered Paradigm as delineated by Huba and Freed (2000).

Methods

The 8 Learning Events Model (8LEM) is designed to help teachers describe complex scenarios by facilitating the identification of their components[1]. In contrast to the paradigm level (see section above), the application of the 8LEM is relevant at the finer-grained level of learning activities

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[1] The need for such a rigorous pedagogical approach is rightly emphasized by DuPuis and Ball (2013, p. 66), especially in an unsettled domain like environmental studies: "This approach recognizes sustainability as an intrinsically unstable concept, a dynamic idea that can never be pinned down to a particular technology, set of behaviors, or even worldview and set of values. Under this scenario, the challenge becomes to design a curriculum around an unfixed concept and engage students with multiple modes of knowing without creating an unfocused strategy, agenda, and pedagogy".

(Leclercq & Poumay, 2005; D. Verpoorten, Poumay, & Leclercq, 2007). The 8LEM is a learning/teaching model. It means that each event is documented in terms of actions of the learner and corresponding actions of the teacher. Both actions are complementary and interdependent[2]. Three learning events (receives-impregnates-exercises) come under tutor's initiative while the others are on student initiative's side. Quite logically, these latter events are more often represented in the instructional design of learning sequences based upon controversies[3].
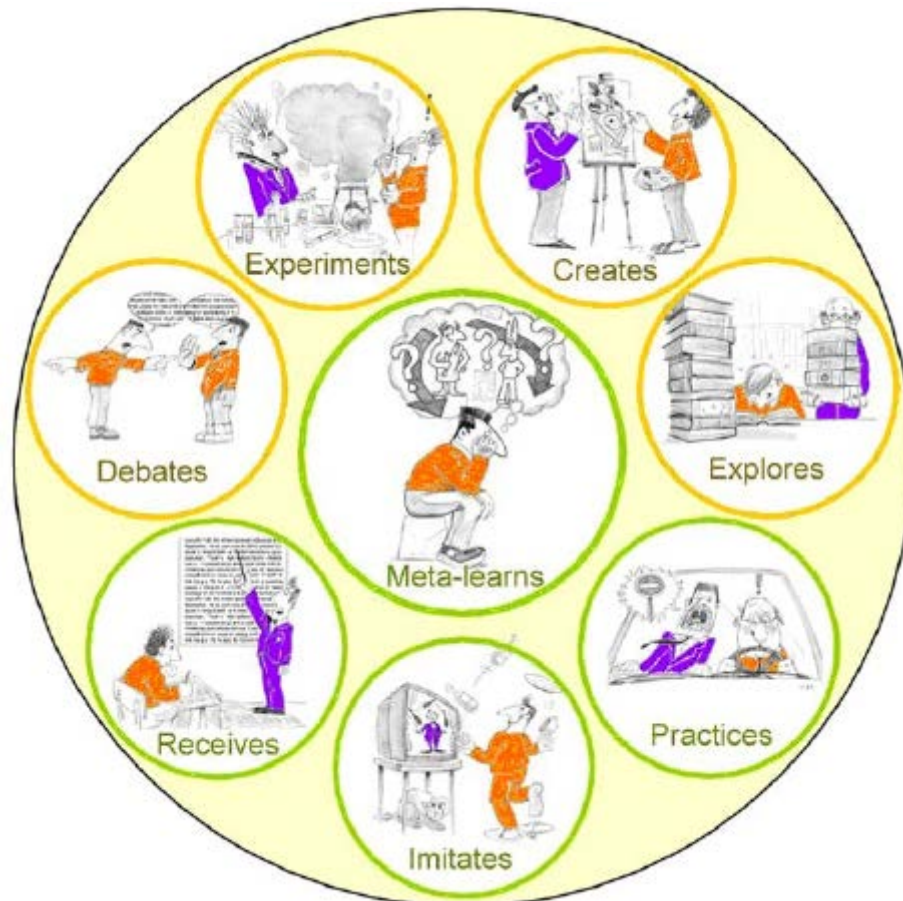
Figure 2 – In controversy-based pedagogy, the student mainly explores, debates, experiments, creates and reflects.

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[2] The variations on these pairs could be described with many details, but this wouldn't be very efficient since the 8LEM wants to provide educational practice with a model "you can think along with". If the model greatly exceeds human working memory capacity, it will lose one of its essential qualities: that of remaining in educators' mind at all times. The 8 events model remains within the limits of human capabilities and helps providing a rough but complete vision of the learning experiences traversed by the students.

[3] Nevertheless, the tutor-led events never vanish, even in the most "constructivist" sequences. This is the reason why opposition systems like those in Huba and Freed's categories or in the 8LEM, albeit insightful, must always be used with caution. In spite of its seduction, the learner-centered education cannot do without some dosage of instructivism. Transmission remains an unescapable dimension of the learning process, even where its intensity is reduced (Blais, Gauchet, & Ottavi, 2008, 2014). A good example is given by DuPuis and Ball (2013, p. 66) whom wisely observe that an efficient pedagogy is achieved through an interlace of instructivist ("didactic") and constructivist ("post-normal") learning events ("modes of knowing"): "We ultimately categorized our pedagogy into four separate modes, including the didactic strategy of teaching normal science as "facts"—knowledge that is delivered from experts to non-experts—and three collaborative, post-normal modes of knowing".

Objectives

A competence can be described as: "a complex know-how drawing on the effective mobilization and combination of a range of internal and external resources within a class of situations" (Tardif, 2006, p. 20)[4]. At first sight, a competency-approach is suited to a controversy-based pedagogy because both call for integrative, complex, combinatorial, contextualized, evolving learning. Several contributions to the conference explicitly mention objectives/skills/competences/key learning outcomes:

- Lieblein, Breland, Francis, and Østergaard (2012, p. 37): "to improve student skills in dealing with complex situations, and on visionary thinking". "During this activity, the students have the opportunity to develop what we see as agroecological key competencies: deep reflection, rich observation, creative visioning, responsible participation and dialogue-based communication".

- Denayer (2014, p. 12) identifies[5] 4 areas of competence (generating knowledge, caring for, living with, reporting) and one meta-competence "cross-cutting" (negotiating): "If there is one and only one cross-cutting competence to single out to reflect these conservation practitioners' work, it should belong to the realm of connecting, adjusting, compromising, or negotiating. However, this last term must not be taken simply as refereeing among groups of players whose interests remain different. Negotiating means adjusting the four areas of skills that we have identified to each other and trying to solve, always in a situated and temporary manner, the challenges and tensions that run through them".

- DuPuis and Ball (2013) underline 4 competencies (tied to modes of knowing): Reflexivity, Deliberation, Research, Innovation.

- Aebi (2014) defines course objectives as follows : « apprendre à percevoir et analyser les « problèmes environnementaux » par une approche interdisciplinaire, en respectant toute leur complexité et dynamisme ». Competencies to be acquired are: « identifier les acteurs principaux, comprendre les cadres biologiques, juridiques, administratifs et sociaux de leurs actions, mener des observations et des entretiens avec eux, ainsi que effectuer des analyses en laboratoire ou des revues de la littérature scientifique et des médias où cela s'avère pertinent »

- Mélard, Semal, and Denayer (2014, pp. 7, 13) coins a « public-based learning » approach that develops several transversal and specific competencies: « La démarche contribue à mettre les étudiants en situation de développer un esprit critique, un certain savoir-être et des compétences qui seront mobilisables pour affronter avec succès de nouvelles situations et épreuves, et qui continueront à être développées au cours de l'exercice professionnel ». « La capacité à gérer la tension entre complexification et résolution de problème du processus de gestion de la situation est une compétence-clé. Elle s'accompagne de nombreux corollaires : la posture exploratoire non-essentialiste, le savoir-être d'un praticien réflexif, le renoncement à la disqualification et à la hiérarchisation des points de vue, la capacité à capitaliser les expériences situées, la capacité à « faire avec l'incertitude et l'insécurité», la faculté de s'adapter, le courage de faire place de plein droit à la délibération, à la confrontation et à l'apprentissage collectif, la compétence à négocier les limites de

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[4] « Un savoir agir complexe prenant appui sur la mobilisation et la combinaison efficaces d'une variété de ressources internes et externes à l'intérieur d'une famille de situation ».
[5] To document these competencies, Denayer (2014) apply, through interviews of professionals, an approach called "profils de sortie". It is intended to ground the curriculum design in the skills observed onto workers (Roegiers, 2011).

son intervention avec les acteurs ». Very interestingly, slowing down[6] and hesitating are also considered as skills to train and develop.

While salient during the conference, the ability to deal with uncertainty is not really elaborated as a full-fledged competency. This trail could find inspiration in the work of Tauritz (2012, p. 299): "Nine competences are distinguished that help a person to tolerate and to reduce knowledge (un)certainty: being able to accept not knowing what will happen; reflect on one's own or other's beliefs and being able to change personal beliefs; find and evaluate information; judge the credibility and cognitive authority of information sources; reason; respond in accordance with the underlying probabilities; assess one's own ability to achieve a desired outcome; engage a supportive network; formulate a plan of action to deal with uncertainty".

All reviewed contributions (including Fallon, 2014) also put emphasis on developing students as researchers. This effect of controversy-based learning might be further investigated and benefit from the "research-based teaching" literature (Healey & Jenkins, 2009). As can be seen in Fig. 3, one junction point could be the different role granted to students (audience versus partipants) both in controversy-based pedagogy and in research-based teaching.
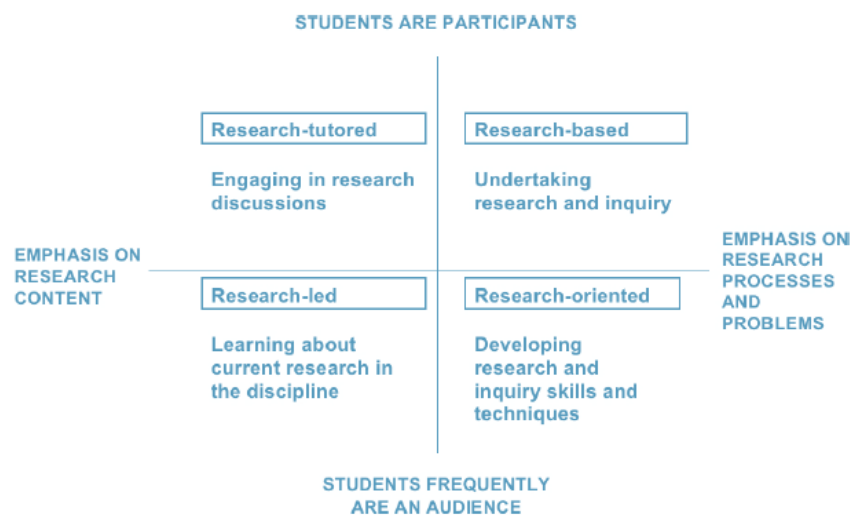
Figure 3 – Healey (2005) defines 4 flavours of research-based teaching, an orientation that might share concerns with controversy-based pedagogy.

Evaluation

Competencies have always a two-fold aspect. As learning objectives (see section "objectives"), they help piloting the instructional design of a learning sequence. As evaluation criteria, they inform the

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[6] Davies (2012, p. 294) also examine the importance of slowing down, in relationship with the practice of reflection : "Evidence suggests that reflective practice can enhance sustainability education by enabling students to slow down and think more carefully, deepen their relationships with nature, communities and people, encourage them to think more systemically, and face their feelings of being overwhelmed, sad or fearful about the scale and severity of sustainability problems". Likewise, DuPuis and Ball (2013, p. 73) underline the need to decelerate but sometimes also to... accelerate: "Overall, we learned that reflexive learning requires substantial class time, although with less lecture time. When students are struggling to find effective ways to collaborate, the professor needs to have some way not to rush the process, to let things go. At other times, the instructor needs to know when to intervene to move things along so that students see the value of the class-time work".

assessment procedures. Some contributors to the conference mention difficulties tied to assessment (dilemmas individual/collective marks, scoring rubrics, weighting of content-related skills and soft skills[7], dilemmas between assessment of processes and products, troubles in assessing "reflection"[8], accounts for progression, scoring of intermediary productions, ipsative assessment that incorporates a reflection on individual differences…). A need for new assessment methods pervades also through some contributions. On this topic, Bloom's taxonomy of cognitive objectives (Bloom, 1956) can still be helpful. The taxonomy was created for categorizing different levels of thinking processes that form part of the learning skills. They remain useful to determine and ensure that students are assessed beyond factual recall and comprehension. Other models of assessment studying evolutions of mental representations or attitudinal outputs of learning would be worth investigating to counterbalance purely cognitive effects.

6. Evaluation:
Discriminate between ideas, assess value of theories.
Examples: Student appraises, assesses, or critiques on a basis of specific standards and criteria.
Key Words: assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

5. Synthesis:
Generalize from given facts, draw conclusions.
Examples: Student originates, integrates, and combines ideas into a product, plan or proposal that is new to him or her.
Key Words: combine, integrate, modify, rearrange, substitute, plan, create, design, invent, what if?, compose, formulate, prepare, generalize, rewrite.

4. Analysis:
Identification of components, organization.
Examples: Student distinguishes, classifies, and relates the assumptions, hypotheses, evidence, or structure of a statement or question.
Key Words: analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.

3. Application:
Use methods, concepts, theories in new situations.
Examples: Student selects, transfers, and uses data and principles to complete a problem or task with a minimum of direction.
Key Words: apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.

2. Comprehension:
Understanding, translate, compare, interpret.
Examples: Student translates, comprehends, or interprets information based on prior learning.
Key Words: summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend.

1. Knowledge:
Observation and recall of information.
Examples: Student recalls or recognizes information, ideas, and principles in the approximate form in which they were learned.
Key Words: list, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.

Figure 4 – For Bloom, the ultimate goal is that students reach high order levels of thinking, which enable to them to become adaptable and creative individuals in society as a whole.

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[7] "This article describes a curriculum design that attempts to maintain both canonical disciplinary learning about the techniques of sustainability and training in the reflexive skills necessary to explore sustainable change through post- normal learning processes" (DuPuis & Ball, 2013, p. 64)
[8] Boud, Keoogh, and Walker (1985) assign 4 measurable outcomes of reflection: new perspectives on experience, change in behavior, readiness for application, commitment to action.

Regarding the progressive aspect of evaluation, it is relevant to proceed with intermediary assessments of specific and narrow resources[9] (of all types), followed by mobilization of these resources in "simplified" situations, followed by the assessment of "real-world" situations.

Challenges

This section pinpoints some aspects of controversy-based pedagogy that deserve further study.

Definition of the approach

The variety of practices that this note puts under the label of "controversy-based pedagogy" makes it difficult to assess what falls within or without the definition and whether an observed setting is a "real instance" of such a pedagogy. Are there features that must be present or absent in order for an instructional activity to be considered CBP? Are there enough similarities to allow the construction of generalizations, if not a hand-out for colleagues willing to explore this educational orientation?

Authentic situations

Contributors to the conference strive to confront their students to "authentic situations", that is situations wherein student experience a kind of general rehearsal of the professional tasks they will have to perform once graduated[10]. This respectable wish postulates the existence of "family of situations". Students well-trained to situations owing to a family would be able to transfer knowledge and competencies to similar situations of the same family. This axiom is part of the definition of a competency-approach and has received criticism (Chenu, January 2004). At the same time, different articles highlight the uniqueness of each situation "out there" [11] or see each situation "out in the field" as fresh material[12]. There is probably here a paradox to be explored[13]. Are not all learning situations both artificial and authentic? For what reasons should a traditional course or theory teaching (less "situated" methods) be considered as unauthentic? Isn't there any "practice of theory"? What does the effort to align teaching on authentic situations convey in terms of relevance and limitations? Related to pedagogical purposes, isn't it a risk tied to "too much" authenticity?

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[9] "It is important that they first practice key skills in a controlled setting and then are supported through the process of translating these skills into the applied context" (DuPuis & Ball, 2013, p. 69)

[10] "Le cas singulier étudié est supposé représentatif des problématiques environnementales et de leurs modes de gestion en général ». « Les étudiants développent aussi des compétences transversales comme le travail en groupe et l'argumentation, dont on sait qu'elles sont recherchées sur le marché de l'emploi » (Mélard et al., 2014, pp. 12, 14).

[11] "As professionals, our students will later face unique and complex situations out there, and we see it as our main task to prepare them for dealing with such situations" (Lieblein et al., 2012, p. 37)

[12] "However, out in the field we can pick out situations that prove to be new starting points rather than illustrations of what was previously learned. The practitioners are forced to learn in real time, in unique, changing contexts, and to strike compromises between what they previously learned and ongoing processes" (Denayer, 2014, p. 12)

[13] Other hesitations seem discernible in some contributions. They touch upon difficulties a) to affirm expertise in settings that tend to reduce the teacher/student, the specialist/amateur asymmetry, b) to accept a closure in settings valuing open-endedness, c) to give a definite interpretation of situations in settings willing precisely to respect all the complexity and dynamics of situations. Risks of knowing and not knowing, of certainty and uncertainty…

Contributors to the conference also demonstrate, thanks to the variety of their instructional settings, that instilling authenticity can be done in different temporalities and with different intensities, from the student who works at a farm (Lieblein et al., 2012) to activities bringing the world in the classroom (the "packaging lab", DuPuis & Ball, 2013, or listening to invited experts, Mélard et al., 2014).

Lastly, nuances to this "authenticity" of situations are rightly brought up by different contributors who stress that such situations are, on instructors' side, the result of sharp pedagogical constructions: "Les EI ne reproduisent pas la situation réelle. C'est une situation artificielle, minutieusement organisée. Car le principe des EI, c'est l'émergence : il s'agit de susciter quelque chose d'inédit, donc non totalement prévisible mais néanmoins cadré, entre les « acteurs » des EI" (Mélard et al., 2014, p. 4).

Practice of reflection

Learning includes changes in knowledge, understanding and skills brought about by experience, and reflection upon that experience. Reflective practice encourages learning from one's own experience, rather than from a teacher or a text. Most contributions to the conference stress on the importance of reflection as an input and an output of the work on controversies. This reflection is conducted in dialogue with actual situations. An interesting point concerns the reflection about what has been learnt[14]. In complex instructional settings wherein gains in learning are sometimes hard to measure, planning time slots (Meirieu, 2014; Verpoorten, Westera, & Specht, 2012) wherein students themselves let emerge what they have matured deserves consideration.

Documenting problems and benefits

On the whole, the papers gathered for the conference do not describe many problems in depth. For a workshop on controversies, there is eventually a great deal of agreement. It comes probably from the fact that all cases are success stories, and indeed they are in an educational context of still devoted to rather traditional approaches. However, documenting difficulties would be a path to extra improvement. This would also make salient the pedagogical complexities that are affronted in controversy settings. Examining problems in details should go along with examining more closely the benefits of this type of pedagogy. Most contributors make excellent and probably true suggestions about different types of learning gains flowing from controversy-based pedagogy. However, DuPuis and Ball (2013) excepted, systematic attempts to gather evidence about fundamental questions – do they learn and what ? – remain a modicum. This might be a next step. It implies to establish a gist of assessable competencies / skills and to describe the various components (including scaffolding and feedback) of effective learning environments using controversies as resources. So doing, participants will make one step further on the two parallel research tracks indicated by Lieblein et al. (2012, p. 38): "As teachers, we are doing two types of action research, to be able to support the students in their learning process: we participate and reflect jointly with the students as part of their project

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[14] "During the first weeks of our course many students, as a result, have the impression that they 'learn nothing'" (Lieblein et al., 2012, p. 37). "When students do productive classroom work, it is also important to devote class time to recognize what has been learned". (DuPuis & Ball, 2013, p. 73). "However, fewer students saw the connection between their learning and their service-learning activities" (*ibid.*)
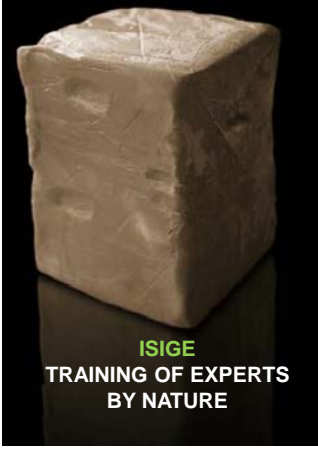
work, and in parallel we explore and reflect on our own practice as educators with the aim of improving the overall learning process".

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**Pedagogical innovation :
from practices to teaching methods :**

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**TRAINING OF EXPERTS
BY NATURE**

Frédérique Vincent

Teaching complexity and uncertainty on environmental issues : practices, theories and products
Arlon 20-21 may 2014

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- Located in **Fontainebleau**

- Founded in **1992**

- Training of **high-level experts to tackle** environmental issues using a comprehensive approach

- **Three Advanced Master's** in Environmental science and management and Sustainable Development

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Target audience for Advanced Master's degrees
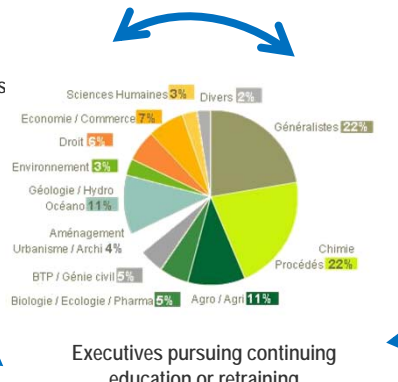
students with complementary backgrounds (engineers, political or social sciences, managers…)that produce mutual benefits.

Engineers
young graduates

Academics
young graduates

Executives pursuing continuing
education or retraining

Sciences Humaines **3%** · Divers **2%**
Economie / Commerce **7%**
Droit **6%**
Environnement **3%**
Géologie / Hydro
Océano **11%**
Aménagement
Urbanisme / Archi **4%**
BTP / Génie civil **5%**
Biologie / Ecologie / Pharma **5%** · Agro / Agri **11%**
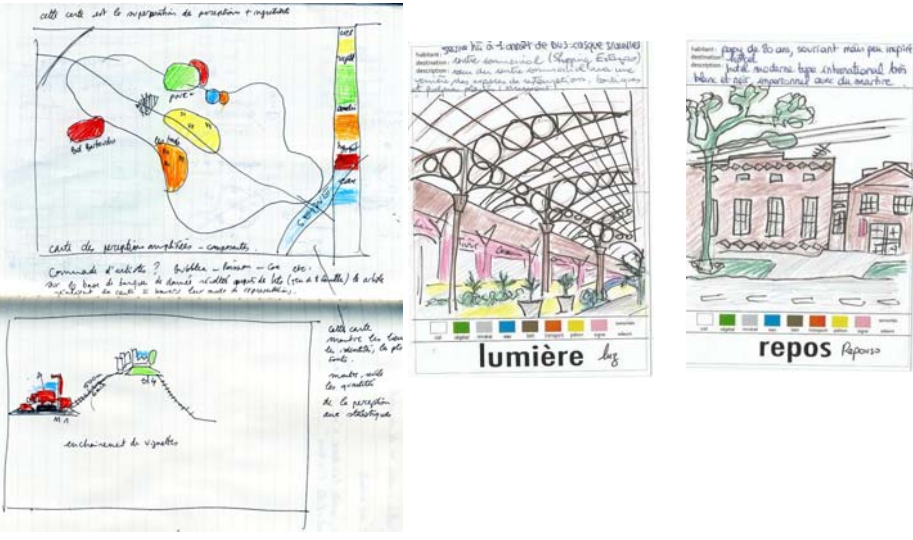Généralistes **22%**
Chimie
Procédés **22%**

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What do we want to teach or train for :

• Multidisciplinatry and transversal approaches to environmental issues

• System thinking (holistic) on complex issues, reshape boundaries

•Have a life-cycle approach
(don't neglegt ressources and end-products)

• Critical and creative thinking

• Have a prospective view (imagine a desirable future)

• Go beyond it's initial background and the lisible information

• Being innovative

•Integrate others point of views, being open minded

•Negociate rational solutions

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Try to apply the pedagogical goals to the programme itself

An implicit pedagogical approach, flexible, based on case studies and practices
Being innovative, open to external proposals
Use evaluation to improve methods
Get inspire by disciplines that have no apparent direct links to the treated topics
(art, litterature, history, design, journalism, architecture)
Former students become trainers

Major difficulty : train environmental **generalist**s with **expertise**

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Pedagogical objects : case studies (real or artificial) , role playing, games, field trips, exercices, projects…

For different scopes

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Controverses analysis

Nonville, la ville qui dit NON aux hydrocarbures de schiste (Seine et Marne)
Groupe Roullier : le marchand de sable qui réveille Lannion (Côtes d'Armor)
Plan de Prévention des Risques Littoraux de l'île de Ré : après Xynthia, la tempête?
Une décharge dans le Versailles du cheval (Nonant le pin, Orne)
Projet minier dans la Sarthe : le retour de la « Rouez » vers l'or ?
Nice Ecovallée: étiquette ou réalité ?
Les phoques de la discorde (Baie de Somme)
Le projet de scierie ERSCIA : le Bois Energie sème la discorde dans le Morvan
L'écoquartier « Jardins des maraîchers » à Dijon : 50 nuances de vert.

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International Conflict Management
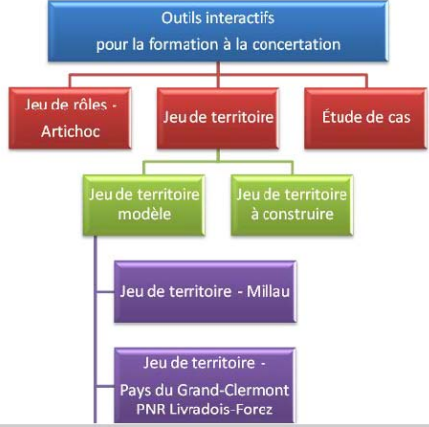
International Water Conflict Management

International perspective

Beyond technology, cultures and values

Hands-on experience in negociation

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Field trip case studies

Agro-ecology

Urban development

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Jeu de VILLE
à Curitiba -BRESIL

17 février 2014
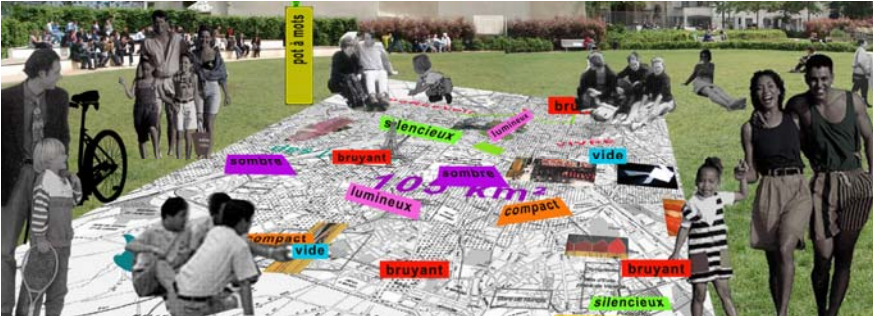
avec les étudiants du Mastère Spécialisé en Ingénierie et Gestion de l'Environnement- ISIGE- encadrés par Frédérique Vincent

Un jeu élaboré par Anne Durand et Astrid Verspieren

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Responsible innovation :
Why and how integrate sustainable development into the innovation process

Ecoxia House : ideas for the future

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Transferability ?

- Adaptation to different cursus

- Transfert to society : local inhabitants, schools

- e-learning

- Documented case-studies and methodologies

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http://www.uved.fr/

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← →

transferability

How do you transfer experience?

Who is going to use your case study?

How do you deal with non linear subjects and complexity?
(no unique answer, iteration process, changing your mind

How do you maintain or improve the case?

How do you answer to questions?

*Nothing will replace experience, sensitive approach of the world and the people,
on both dimensions : natural systems and social (actors perception)*

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How do you adapt methodologies to new type of students :
-more connected
-multi-activities (zapping minded)
-Anxious about future
-Not well prepared to scientific issues
-Mostly female
-Lack of creative and innovative attitude

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