# A Nordic Net-based Course in Agroecology - Integrating student learning and teacher collaboration

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## Abstracts

### English Abstract

This article reports the experiences from designing and running a Nordic net-based course, *Ecology of Farming and Food Systems*, during the spring of 2004. Our aim was two-fold: to design a course which uses an explicit experiential learning approach, and to design a clear structure for faculty collaboration across national boundaries. Kolb's learning cycle was chosen as the basis for the course design as well as organizing teacher collaboration. Ten teachers from five different institutions/countries collaborated in developing and teaching the course. Six students representing a very wide cultural and geographical span, from China to the United States, participated in the pilot course. Quantitative and qualitative feedback in mid-term and final course evaluations indicates that students were generally very satisfied with the course. In particular, the use of a case study as starting point for learning agroecology was highly valued. Teacher collaboration organized around phases of Kolb's learning cycle received a favourable evaluation from both students and teachers. However, improvements need to be made in terms of continuity when responsibility is transferred from module to module. We feel that our experience using Kolb's learning cycle to structure course process and teacher collaboration may be useful to others, when student centred learning is the focus and cooperation among instructors across institutions and national borders is a challenge.

### Norwegian Abstract

Denne artikkeln omhandler erfaringer med design og gjennomføring av et nordisk nettbasert kurs, *Ecology of Farming and Food Systems*, våren 2004. Våre to mål var: Å lage et kurs som eksplisitt bygger på erfaringsbasert læring, og å utforme en tydelig struktur for samarbeid mellom lærere på tvers av faglige, institusjonelle og nasjonale grenser. Kolbs læringssyklus ble valgt som et grunnlag for såvel kursstruktur som lærersamarbeid. Ti lærere fra fem forskjellige institusjoner og land samarbeidet om utvikling og gjennomføring av kurset. Seks studenter, som representerte en stor bredde mht. kultur og geografi, fra Kina til USA, deltok i pilotkurset. Kvantitative og kvalitative tilbakemeldinger i evalueringer midtveis og ved avslutning av kurset viser at studentene generelt sett var svært tilfreds med kurset. Bruk av en case-studie som utgangspunkt for å lære agroøkologi ble høyt verdsatt. Både studenter og lærere var svært fornøyd med organisering av lærersamarbeidet var organisert i samsvar med fasene i Kolbs læringssyklus. Likevel, forbedringer må gjøres mht. kontinuitet når undervisningsansvaret roterer mellom lærere ved overgang fra en modul til den neste. Vi tror at våre erfaringer med å bruke Kolbs læringssyklus til å strukturere både kursopplegg og lærersamarbeid kan være nyttige for andre, når studentsentrert læring star i fokus og når samarbeid mellom lærere på tvers av institusjoner og landegrenser er en utfordring.

## Keywords

E-learning, student-centred learning, learning cycle, experiential learning, systems thinking, agroecology, case study

## Introduction

Agricultural and veterinary universities in the Nordic countries established in 1995 the *NOVA University Network* (http://www.nova-university.org) as a platform for efficient and innovative Nordic cooperation. In a time of increasing resource constraints at the national level, the aim of this Nordic initiative is to strengthen and develop scientific and educational networking among the universities. Cooperation of this type, between educational institutions and across national boarders, is becoming more and more necessary in a globally-connected educational world. It also presents many real challenges with respect to methods for collaboration and teaching. Within this context, a group of researchers and teachers dealing with the emerging discipline of agroecology formed a network (http://www.agroasis.org) to develop a Nordic program in Agroecology.

One key question we wanted to explore within the group was, "How can we utilize the Internet to enhance the development of the Agroecology Program?" More specifically, our questions were: Can we foster at least some degree of student-centred, experiential learning that we have already working in agroecology now in a distance mode? How should such learning be designed in terms of content and process? Given the need for multiple perspectives within agroecology, how are the opportunities for organizing teacher collaboration across disciplinary and institutional boundaries? Is it possible to find a model to facilitate the pursuit of both the didactic, subject-specific and organizational goals?

In this article we report the experiences from designing and running a net-based course, *Ecology of Farming and Food Systems (PAE301)*, during the spring of 2004. All steps in preparing for the course and the implementation of the prototype using distance education methods were informed by the Kolb's (1984) learning theory. We have experienced the potential as well as the challenges of running a course using electronic media. Here we share our experience as teachers of a course given by means of electronic media, and we report the results of the students course evaluations.

## Learning Agroecology – Conceptualizing the Learning Landscape

Through close collaboration among four universities, a Nordic Master of Science in Agroecology was established in 2000. We define agroecology as the ecology of farming and food systems, in which humans and nature are viewed as integral parts (Francis et al., 2003). In our approach to teaching agroecology, we build on the students' experiences while giving priority to the process of developing knowledge, abilities and attitudes. Agroecological theory plays a supporting role. This is an attempt of coming to terms with the concept of student-centred learning. Moreover, while developing the MSc. curriculum, it became evident that systems thinking and practice (Wilson and Morren, 1990; http://www.open2.net/systems/thinking /index.html) was a very useful framework to deal with the complexity of agroecological issues, necessitating multi-perspective and interdisciplinary approaches (Rickerl and Francis, 2004). We need to help students deal with complex issues as "wholes", which is the crux of systems thinking, rather than reinforcing the disciplinary tendency to reduce systems to their component parts and study these in isolation. According to our experience, this is most effectively done by involving the students as participants in the process of improving real-life cases, which they are encouraged to consider as learning systems that should be dealt with according to the so-called "Soft Systems Methodology" (Sriskandarajah et al., 1989).

We envisioned this introductory on-line course as meeting a number of learning objectives for students as well as long-term goals for the AGROASIS Network. Among the latter was a desire to attract potential students to the regular MSc Program and in particular to the intensive courses in *Agroecology and Farming Systems* and *Agroecology and Food Systems* that are keystone courses in the Program. These courses are taught in the autumn semester each year in Norway, and the introductory course would provide both useful information for incoming students and a tool for locating new students to participate in the programme. We also conceived of the introductory course as a stand-alone module that could be used as an introduction to the systems approach and as a complement to specific courses for students in other disciplines.

An important result of conceptualizing the learning environment during the planning of the course was specification of the following learning objectives:

- Understand the key concepts and principles regarding structure and function of farming and food systems - agroecosystems
- Know how to deal with goals and value bases of farmers and other stakeholders involved in such systems
- Be familiar with methodology, methods, and tools for describing, analysing, and improving farming systems and food systems; and
- Know how to connect theory of learning and theory of farming systems to a practical case through a simulated field experience.

In addition to having a course content focusing on whole systems, we found it essential to address the question of how the educational process should be run. It was important that the teaching of agroecology should mirror the key properties of agroecosystems. During the conceptualizing phase, we agreed on the basis of past experience that the inductive learning approach would be very compatible with agroecology. In inductive learning, the phenomenon to be studied is the starting point for the learning process. In our concept of studying agroecology, the human activities taking place on a farm, thus 'farming' becomes key phenomenon. The inductive approach to learning is based on several theoretical traditions, where experiential learning has a central position (Kolb, 1984). The roots of experiential learning are found in the theories of John Dewey on learning and experience (Dewey, 1963).

## Designing a course using Kolb's learning cycle

The teacher team brought rich and varied experience to the conceptualizing process. In addition to their agroecological expertise, the teachers represented a wide range of disciplines, including physiology, food quality, veterinary medicine, cereal chemistry, soil microbiology, plant breeding, agronomy, and distance education. We grounded our initial discussion about the *Ecology of Farming and Food Systems* course on several years of experience in design and implementation of PhD research courses that combined biological and social science methods for better understanding of whole agricultural production systems (Lieblein et al., 1999). We had also joint experiences from planning the structure and content of a Nordic MSc in Agroecology. New to us this time was the use of e-learning in a subject where linkages between practice and theory are vital. Moreover, we reckoned that a closer collaboration between teachers within the Nordic agroecology network was needed to successfully run such a course. In the initial planning phase, we first tried to design the course in a fairly traditional way, with a certain amount of literature assigned to each of ten topics.

A major didactical goal was to make the course process compatible with what we, as outlined above, consider key characteristics of agroecology. The key question then was how to incorporate the inductive learning approach into a net-based course. We decided to develop a case based on a real farm that would be the basis for the student learning in the course. We chose a Danish organic dairy farm as a case, and case development involved collection of farm data as well as quite extensive interviews with the farmer and the farm family. We had earlier experiences in using farm cases in courses in agroecology, but it was new to us to integrate this element in an e-learning environment. We were mindful that methods used in an intense resident course with face-to-face interactions would not necessarily be the best for a course using electronic communication over distance and across cultures.

Already well acquainted with experiential learning, the group decided to apply Kolb's (1984) learning cycle not only as a general perspective on the learning process, but also as a framework for the design of the course and the students exploration of the case studied. The core idea of Kolb's experiential learning process is that knowledge is created through transformation of experience, and that the transformation consists of four interrelated activities: divergence (observation), assimilation (thinking), convergence (planning), and accommodation (action). Further, it is vital that the learning process is more than cognition, since the process moves from the real world into the conceptual world and emerges back in the real world in the action phase. In the experiential learning process, the learner has priority over the subject matter knowledge held by the teachers. The result of the planning is presented in Figure 1.

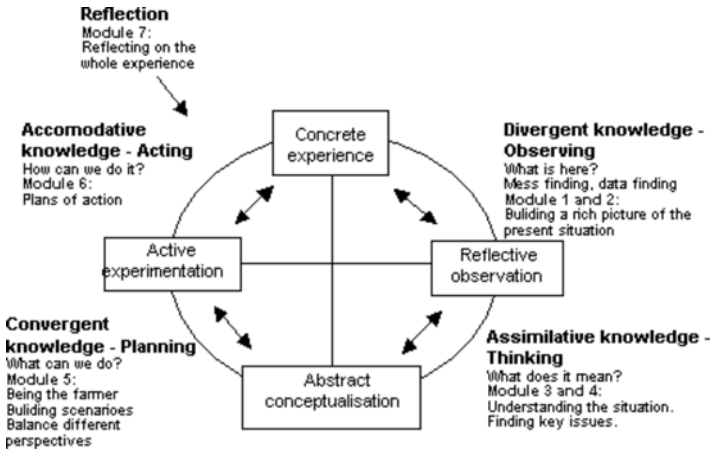


**Figure 1**. Design of the E-learning course "*Ecology of Farming and Food Systems*" with key questions framed in the context of Kolb's learning cycle (Kolb, 1984).

Following the cycle, we were able to structure course activities with respect to student learning. In each phase, we asked key questions to guide student progress. To facilitate the awareness of their individual learning process, students were asked to keep a log of their experiences. In addition, we introduced tools to help students make sense of and structure their experiences. These tools were chosen specifically to invite diversity and variety in the way students could present and discuss their assignments.

### Phase 1: Divergent knowledge

The initial question was: What is on the farm and how does the farm function? The task for the student was to get acquainted with a very complex and messy situation, and locate relevant data through a study of the case farm. In *Module 1*, students were to become familiar with the course goals, and to gain an understanding of Kolb's cycle. In *Module 2* the core activity was the exploration of the case farm via the net-based description. From the virtual farm visit, students were expected to gather information on the goals and aspirations of the farmer and family, the physical and economic resources, and the current production situation. Learning goals for this module were to gain experience with the construction of a rich picture of a complex situation, and to become familiar with the tool of mind-mapping (Buzan and Buzan, 1993). Mind-mapping is a visual way to present ideas, and a helpful tool to develop an overview of a complicated system. To facilitate learning, other learning tools were also used. For example, readings on both tools (e.g. mind-mapping) and on food and farming systems were given to the students, as a way of assisting their understanding of the case study presented. In addition, students were encouraged to learn from each other, through peer evaluation and feedback on each other's work.

### Phase 2: Assimilative knowledge

In *module 2*, the students created a rich picture of the case farm through a diverging process. In *Module 3* the goal was to start making order and sense of that rich picture. Introduction of the concepts of systems thinking and agroecology were important for the understanding process and for the learners to become aware of different scales and hierarchies of systems (Francis et al. 2004). In *Module 4*, multi-perspective approaches (Gamble et al. 1996) and goal conflict issues were introduced to further clarify the case. To assist in the learning process, a variety of tools was used including readings to support the learning goals, application of visual models to illustrate different system scales and hierarchies, role play in which students took on the roles of various consultants, group work and evaluation of other students' work.

### Phase 3: Convergent knowledge

The key question in this phase was: What can we do to make sound recommendations to the farmer? It was important to design strategies for action to be taken. Students were instructed to bring together all of their information and begin to understand how the farm actually functioned, as they refined the rich picture constructed after reading about the virtual case. To make the shift from analysing the farm in the assimilation phase and to start thinking about what can be done to improve the case situation in the convergent phase; the students were asked to assume the role of the farmer. In *Module 5*, they became the farmer, Mr. Krog, and had to address questions such as: Based on the knowledge you have of the case, how would you weight and balance the different perspectives? Perspectives would include social, environmental, agronomic and economical dimensions. Students were divided into groups and asked to consider the goal conflicts of different perspectives, and develop a SWOT-analysis (Bee and Bee, 1998) of the situation. Readings were provided to support the group work, and the students were asked to evaluate each other's work and to continue making entries into their personal log.

### Phase 4: Accommodative knowledge

Our key question here was: How can we apply this information and analysis to improve the farm? During the activities in *Module 6*, students were still in the shoes of the farmer. Their task was now to use their creative abilities to develop solutions for the issues that were identified in the previous module and make a plan of action for the farmer. As in the previous module, the tools of group work, evaluation of fellow students, and the recording of one's own learning experiences were used to facilitate student learning. In the finale Module 7, the students were asked to do the final individual assignment, each preparing a learner document that should be based on the student's personal log entries. This document was their personal reflection of the methodology and content of the course and how these affected the students learning experience.

For course assessment purposes, students were asked to do a mid-term and a final evaluation of the course, which included both closed and open-ended questions.

## Teacher collaboration across institutions and national borders – Kolb's learning cycle as a tool

Having conceptualized and planned the course, we were still left with the issue of how to collaborate in

running the course. Although the group members represented a wide range of disciplines, we rejected early the idea of splitting the responsibilities along conventional disciplinary lines. To stay closer to the learning cycle used to design the course and strengthen the systemic, interdisciplinary approach throughout, it was instead decided to place responsibilities according to the phases of the learning cycle. Teachers in groups of two or three would then have the responsibility for one quadrant of the cycle (see Figure 2). In deciding which individuals in the group should take responsibility for which phase, emphasis was placed on personal interests and previous experience. Using the learning cycle not only as a tool for course design, but also as a template for teacher collaboration, implied that all teachers would be dealing with the whole farm case, but with different aspects of the learning process, according to where in the cycle they had their main responsibilities.

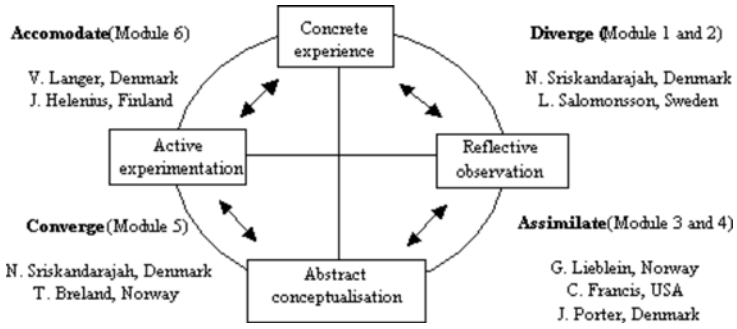


**Figure 2**. Using Kolb's learning cycle (Kolb, 1984) as platform for teacher collaboration on a net-based course in agroecology across disciplinary, institutional and national borders.

## Results – The potential of Kolb's learning cycle in E-learning

How successful was the Kolb's learning cycle as a tool for designing and running the introductory E-learning course in Agroecology? Clearly, our aim was to develop a net-based course that would actively involve faculty from 5 different countries and have a focus on student-centred learning. We illustrate the outcomes by providing student comments as well as our own evaluation.

## Student experiences

When analysing the individual student experiences, it must be kept in mind that there were only 6 people involved in the pilot course. At the same time, these few students represented an enormous cultural and geographical span: from China, Australia, Finland, Spain and the United States. Based on the written evaluations and the feedback received during the course, the students were overall very satisfied with the course. The following quotations are typical of the responses from students:

*"What is particularly good about the course is using the case study, getting to see the other students' ideas and learn from them."*

*"What was particularly good was importance of group work, working with a diversity of individuals and the case study."*

*"I liked working from the Kolb cycle and to have specific tasks that help you to do the work in each stage of the course."*

*"It was really good that we got to process our own ideas about an organic farm and its development."*

*"The interactive process was fundamental to the course, and students are at the same level as the teachers."*

We found the students to be active and positively engaged throughout the course. However, when comparing the mid-term and the final evaluations we found that student satisfaction increased during the course. In particular, it appears that students developed a greater appreciation for the learning methods used as the course progressed. The use of a concrete farm case as basis for learning agroecology was clearly valued by the students. Learning from each other in many stages of the course, and especially during the group work phase, was seen as vital to the success of the course. As such, learning was not only individual, but also a result of a social process. In addition, students took initiative to arrange two chat sessions with a number of the faculty, which added a synchronous dimension to their learning and demonstrated an active involvement by everyone in the learning community.

The overriding challenges that had to be addressed during the course were related to the large cultural and geographical differences found among the students, as well as the particular subject matter of agroecology itself. Geography played an important role in setting the "point of departure" for students. Not surprising, the students did not start the course with a uniform set of knowledge and experiences. Initially, this caused some frustrations among the students. The curiosity and willingness to learn from fellow students began after everyone realised that they would not only be learning from the teachers in this course, but that they could also benefit from each other's diverse knowledge. In fact, one student felt that being given the opportunity to learn from fellow students was one of the best aspects of the course. The individual's knowledge and experiences contributed to a rich, multi-perspective learning environment. For example, the main issues of agriculture in China are greatly different from those in Denmark. In China, food security is of utmost priority, and less attention is paid to environmental goals. The opposite is the case in Denmark. There is a challenge for students to be open to different situations, different goals and to the underlying reasons for these goals.

In evaluating the backgrounds of students in the course, we observed that the majority had travelled and experienced agriculture in other countries. For this reason, these students were open-minded, and most did not have much difficulty in relating to a Danish case study. However, for those who had never experienced a different type of agricultural system, the challenge to understand a Danish agroecosystem was much greater. Until students were willing to dig deep in order to reveal the underlying reasons for the structure and functioning of the particular agroecosystem, they remained confused and often negative. Facilitating improved understanding in students of foreign and often mystifying agricultural systems is generally a hard task in classroom situations. Enabling this in a distributed learning context thus becomes a true challenge for the educators and we believe that engaging the learner in active communication about

their home farming systems offers a useful way out of this challenge.

The cultural background of students also plays an important role in their relationship to education, figures of authority, and language. In this course much of the learning was designed to be derived from the student's own experiences with the case, sharing of these within their small groups, commenting on each other's work, and thus co-creating knowledge. This is quite different from the usual lecture-based transmission mode of learning which many students are used to. For example, one student was quite surprised by the approach used in this course, and wondered when the lectures would begin. When students have only been exposed to discipline-based education, dealing with complex and whole systems such as agricultural systems will be confronting, even when working with teachers face-to-face. To add to this difficulty, there is vast difference among even a small group of international students in their ability to question teachers or others in position of "authority". The mentioned student did not feel comfortable voicing her opinions and ideas, and expected the correct answer from the teachers. Also increasing the students' skills in constructive criticism towards each other, making them confident enough to go beyond praise, will need some attention.

Half the students had English as a second language. We tried to anticipate this by giving students tools and assignments that were not solely text-based. Although English speakers had a clear advantage in their writing skills, neither teachers nor the students themselves voiced any problems with carrying out the assignments. In several instances, the fact that students expressed themselves using unusual terms in English led to valuable discussions and enhanced learning in the group.

## Teacher collaboration

Using Kolb's learning cycle as the main template for teacher collaboration proved to be a very effective. Ten teachers from five countries/institutions collaborated in running the course during its eight weeks. Using a real-life case (a Danish dairy farm) as the starting point for the learning processes in the course and having Kolb's learning cycle as the model for the course process were vital for the success of the collaboration. When teachers aim at collaborating across institutions and country borders, it is often a challenge to establish a culture for collaboration because of differences in personal and scientific backgrounds, as well as differences in their pedagogic beliefs. In this course, the teachers were not necessarily responsible for specific disciplinary components of the course, but they had to deal with different phases of a learning process tied to the analysis a case. As such, the case and the learning cycle provided the basis for a common "language" for the ten teachers and the chosen process a common pathway for guiding the students.

Clearly, it was also necessary that the teachers valued student-centred learning as an active and social process. The teachers involved in this course, had a long history of collaboration with regard to agroecological education and adopting student centred approaches. Besides, many members of the teacher team were familiar with the farm used in the case, following a visit during the planning phase of the course.

The major challenge with regards to collaboration was in our ability to assure continuity when responsibility was transferred from one teacher team to the next (see Figure 1). Teachers could not adequately advise students in one module without becoming acquainted with the students and their work in previous modules. This as a problem had not been fully anticipated by several in the teachers group, and time allowed for it. Those who came in as facilitators in the second half of the course had more difficulty allocating the required quality and amount of time to supporting the learners in this course, while fulfilling their own regular schedule. Both students and teachers voiced a need to ensure a better continuity between learning phases and faculty responsibilities. One assured form of continuity in the course was the graduate student who acted as the course coordinator. Her dual role as the logistical co-ordinator and facilitator of learning and her timely intervention at important points in the course was valuable to the successful completion of the program.

## Conclusion

Our overall impression from student feedback about the online course, *Ecology of Farming and Food Systems*, was that the learning experience was engaging and that it exceeded their expectations. We attribute this success mainly to the usefulness of Kolb's learning theory, both as a framework for the learning paradigm and as a methodical template for structuring the course and organising teacher collaboration. It has helped us maintain a clear focus on student learning. Of key importance in the course design was the link between experiential learning, the real life case farm and the associated need for a systems approach.

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## Acknowledgements

We thank professor Torstein Rekkedal, NKI for valuable discussion. The course planning was supported through a grants from The Norwegian Agency for Flexible Learning in Higher Education (SOFF)/Norway Opening Universities (NOU) (http://norgesuniversitetet.no/), Nordplus (http://siu.no) and NOVA University Network.

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