Assessing Agroecology Education: Qualitative Analysis of Student Learner Documents

Anna Marie Nicolaysen, Tor Arvid Breland, Geir Lieblein, Suzanne Morse and Charles Francis

Norwegian University of Life Sciences. E-Mail: anna.marie.nicolaysen.nmbu.no

Abstract: Student learner documents have been used each semester for self-evaluation in a full-time, sixteen-week agroecology course in farming and food systems. These provide an in-depth reflection by each student of their learning process and personal role in classroom, discussion sessions, team field activities, and interactions with stakeholders on farms and in the community. Learner documents submitted over a period of 14 years are studied through text analysis to organize the content with a systematic classification process of coding and to interpret the documents by identifying themes. This qualitative meta-analysis can identify core consistencies and meanings from a large volume of text. The approach allows for an empirical, methodological, controlled analysis of the descriptions and expressions from students, exploring how they view the learning experience within their context of understanding and communication. Thus, the perspectives of the students' texts can be better interpreted by educators who want to evaluate student experience in understanding key systems issues, higher order conceptualizing of challenges facing clients, and building personal capacity for applications in thesis projects and lifelong learning. Results of this evaluation are used to redesign learning activities in the classroom discussions, the field projects on farms and in communities, and in assessment of learning. While students are acquiring tools and perspectives that will guide their future studies and life work, teachers are learning how to improve the educational process that will better help current and future students achieve their goals.

Keywords: Learning assessment, student self evaluation, teaching improvement, agroecology, qualitative text analysis

Agroecology
Program and Learning Outcomes

The Norwegian University of Life Sciences (NMBU) offers a two-year Master of Science in Agroecology (http://www.umb.no/study-options/article/master-of-science-in-agroecology) that attracts students from around the world, all concerned about long-term sustainability of agriculture and food. The dynamic and complex nature of agroecosystems and interactions with their environments requires that those involved in development of sustainable farming and food systems become capable graduates who are motivated for continual renewal and life-long learning. The intended learning outcomes for students is that they acquire theoretical knowledge about agroecosystems, and also gain experience with methodology and tools for describing, analysing, and improving them. The competency profile of graduates in agroecology therefore includes the capacity to achieve the following: Knowledge of farming and food systems; Ability to link real-life situations and theory; Skill and comfort in using appropriate methods; Confidence in handling complexity and change; Competent communication and facilitation skills, and Potential for autonomous and life-long learning. We further aim to cultivate the following core competencies of agroecologists: Observation, Participation, Visioning, Reflection and Dialogue (Lieblein et al., 2012).

Course Objectives and Pedagogical Approach

Agroecology: Action Learning in Farming and Food Systems is a full-time, sixteen-week, 30 ECTS course during the first semester of the master's program. The goal of this course is to develop knowledge, skills and attitudes enabling students to deal with complex situations in agricultural and food systems (Lieblein et al., 2012). The pedagogical basis of the course is experiential learning with situations "out there" placed in the centre – not as examples of theory but as starting points for the learning process, where experiences will be linked to theory and individual development. We thereby aim at bridging the frequently experienced gap between knowing and doing by initiating the learning process using phenomenology, where we begin on the farm and in the food system and the key issues emerge from the experience (Francis et al., 2012; Østergaard et al., 2010). An ability to relate discipline-specific knowledge to cases "out there" is a key capacity to develop, both for understanding the present situation and for proposing improvements. However, agroecosystems are complex, and the challenges they contain do not conform to disciplinary boundaries. The learning process thus requires a systemic approach to capture the totality of a complex situation and in which integration of several disciplines is essential to understand the whole system. Therefore, learning to learn and learning toward the future are central goals in the agroecology course. In a culture of curiosity, the students' goal is not to uncover answers already known by the teachers but to engage in a joint exploration process together with the stakeholders in the cases being investigated.

Student Documents

Students work in groups, with each group assigned to an on-going project in Norway that deals with sustainability of farming and food. The case study encompasses the entire food system, including a farmer interested in major changes in the farm operation. The task of the project work is to do an extensive analysis of the current and desired future of farming and food systems. This implies working with a farmer to develop changes in their farm to better meet goals and with other community stakeholders to develop the food system in the region/municipality. Based on this specific experience, students prepare two group reports or client documents, one for the farmer and one for the food system stakeholders. Focus is to provide information to the stakeholders to help them move towards their future visions. In addition each student prepares an individual report, the learner document. As the project work is the core of the course, the students include in the learner document a condensed version of the client document, but place emphasis on reflection on their personal role and learning in the team project. An important goal of the project work is to improve their ability to link the concrete and practical situations experienced during the project work with theoretical knowledge as well as to their own development as agroecologists, and the reflection document is their opportunity to demonstrate such ability. The students' empirical material from the fieldwork, as well as their experiences from the entire course, is analysed and discussed in relation to current knowledge in the area. It is important for this analysis that they have carefully logged the experiences and facts that will be the basis for their reflection.

Analysis of student learner documents

The analysis of the learner documents is a source for assessing the student's learning, when reviewing each document as part of the grading process at the end of the first semester. We look at the degree to which they use agroecological perspectives and terms to describe the farming and food systems' structure and functioning (what), the process of farm and food systems analysis and transition planning (how), and the goals and values involved (why). Further we assess whether they are able to critically examine both concepts and methods and how these were used in their particular case study. Finally, do they reflect on their personal experience from the systems inquiry, including communication with the stakeholders and fellow group members, and its role in their learning? Being closest to their own learning development they can elaborate as insiders about their experience building competencies, and include their self-assessment of this process. In writing the learner document they therefore gain experience in the crucial competency that self-

evaluation is (Jenkins et al., 2003; Weimer, 2002), and this competency can be added to the other competencies and learning objectives to be assessed in our evaluation.

Purpose and Research Objectives

After successfully teaching this course for over a decade and observing remarkable personal learning experiences among numerous students, we have decided to do a systematic review of all the learner documents submitted. Our rationale is to explore this rich and extensive material to answer questions regarding student experience in understanding, conceptualizing, and building personal capacity for lifelong learning. Moreover it will aid us to contemplate and reflect on the logic and coherence of our own educational approach: the continuing process of redesigning learning activities and assessing learning. As students acquire tools and perspectives that guide their future work, we as teachers are learning how to improve the educational process. The relationship between assessment, teaching strategies and intended learning outcomes, the basics of coherence in curriculum design, also known as constructive alignment, was put forward by Tyler (1940). These theories have been further developed by for example Schuel (1986), and outcome-based curriculum models have been presented (Biggs, 2003), and are continually discussed (McMahon and Thakore, 2006).

We are in the initial state of the analytical process, and this brief paper therefore has focused on presenting the course and documents which is the basis for this endeavour, and below the methods that will be implemented. We conclude with some preliminary findings from the analysis, where we include descriptions and expressions from students about their learning experience.

Methods

Meta-analysis

We describe this as a meta-analysis, because we combine the data derived from all the individual reflection papers. The papers can be combined in a meta-analysis because of the continuation in the content of the fall semester seminars, and this is important for the validity of the result. We will use statistical methods in addition to text analysis, and as in a conventional meta-analysis based on individual research studies, the power of the analysis will be increased due to the large number of quality entries. Carefully conducted meta-analyses allow for a more objective appraisal of the evidence than traditional narrative reviews, provide a more precise estimate, and may explain heterogeneity between the individual papers. We include all papers and the less adequate serve as comparison and contrast to the more noteworthy papers.

Data material and coding

The learner documents submitted over the last 14 years are being evaluated in order to analyse the content. We code the material by identifying themes in the text, and our main themes are the ones related to the course goals, namely reflection, observation, visioning, dialogue and participation. These themes are further divided into sub-codes, as a way of structuring our data and allowing us to capture the full richness of the material.

From the beginning of the program in 2000, the course consisted of two parts: a course on Farming Systems, followed by a course on Food Systems. During the years from 2000 to 2008, the students wrote a client document and a learner document pertaining to each course. From these years there are 275 learner documents (142 from the Farming Systems Course and 133 from the Food Systems Course). In 2009 it was decided to merge the two courses into one, embracing both Farming and Food Systems. From 2009 to 2012, the students therefore wrote a client document

for the Farming System, and a client document for the Food System, but one learner document for the whole semester. From these last five years there are 107 learner documents.

As a first step in the analysis of this voluminous data set we start by looking at a subsample of 34 learner documents, one or more from all years 2000-2013, with the exception of the year 2001, where we did not have any of the learner documents in an electronic version. This sample includes some of the best students throughout the years. We will return to include all 382 at a later stage, when all documents have been scanned and converted.

Table of Learner Documents for Analysis

Learner Documents	Farming System	Food System	Farming and Food System	Total # Learner Documents
All documents	142	133	107	382
Current sample	7	12	15	34

The total group of learner documents are mostly between 15 and 30 pages long, while a few reach beyond 80 pages. With a low estimate of what is relevant text, this body of information comes close to 10.000 pages. The documents in the subsample are written by 23 female and 11 male students from 14 different countries. These documents are between 4001 and 21920 words long, on average 23 pages, based on Arial font 12, single spaced = 450 words per page.

In the coding process, we gave the documents a unique name composed of a case number and coded the year and course, as well as the gender and citizenship of the student author. These names are used to identify the student authors and the documents quickly, while anonymously, and are not to be understood as variables of analysis.

The cases were entered into HyperResearch and linked to a source file where the documents are kept. For this paper we limited the preliminary analysis to two central aspects of the analysis, namely experience and reflection, which can tell us something about how and to what extent students are able to connect the realms of experience and theory, and how they integrate their personal reflection with critical analysis and action. We started out by doing an autocode operation to identify paragraphs where the words 'experience' and 'reflect' appear.

Findings and Discussion
For the 303 documents in electronic version, and therefore included in the autocode operation, 'experience' appears 4913 times, and 'reflection' appears 4434 times. In a few documents these words do not appear at all, while the maximum count is 60 times; the average is 15 times per document. The reports that include these words would then amount to over 1000 pages each. In our subsample, 'experience' and 'reflection' appear in all documents, but with a slightly lower maximum and mean (se table below). The reports produced containing paragraphs related to these themes still make up over hundred pages each. These numbers are mentioned here because at the very least, and these initial stages, they tell us that these themes are central topics in the student papers, and both being mentioned in their papers roughly 15 times in a on average 23 pages paper. These are only occasions where the exact words are used, while we will find additional examples of these themes being discussed using related terminology or in other words.

Table of Coding Themes

Theme	In total # of (electronic) documents: 303				In documents in subsample: 34			
	Total	Minimum	Maximum	Mean	Total	Minimum	Maximum	Mean
'Experience'	4913	0	61	16.2	749	4	58	13.9

'Reflection'	4434	0	57	14.6	712	3	50	12.5

Autocoding is of course only an initial step in evaluation, and the next step is to explore the selected material in the reports and do a more thorough investigation of what is the content, and code more detailed, with sub-codes, before testing theories with a combination of codes and variables based on this. Both 'experience' and 'reflection' are words common in 'general language', and their use in the documents is therefore mostly not related to course specific learning material. However, there are plenty of instances directly related to for example experiential learning or reflection as a tool in the learning process, some of which are discussed here.

Experience

In linking theory to experience, one Swedish female student (2000) refers to how "the basis of learning is experience, and the best kind of experience for learning is that which evokes feelings" (Wilson and Morren, 1990). She relates from her own experience: "I have been occupied by similar thoughts–in the very beginning of this course I visited some old friends in Sweden. This meeting brought quite strong feelings to me; and when I returned to Norway and the new course, I was a bit sad that I couldn't feel any passion for the course. I wanted to be as personally engaged in the subject of Food Systems as I was in my relations to these friends. Actually, I thought that the subject of the course was extremely important and relevant for what I would like to work with in the future, and I really wanted to learn much about it. The problem was maybe that my approach to the subject at that point was so theoretic: I was lacking experience. It is maybe a bit odd to compare private relations to the requisites for learning in a course at the university; but I believe that I develop my social skills in these private situations, and that is also a way of learning. However, later on during the course I got the opportunity to experience practical situations related to the subject; this has also evoked many feelings, even quite strong ones now and then – mostly concerning the group dynamics. I think that what I will remember most from this course are the interviews and the situations where we had engaged group meetings."

The linking of theory to experience is one of our stated learning goals, and if not all link this as eloquently as above, many students show mastering of that in their learner documents. A Canadian female student (2000) also makes the connection to "link facts and personal reflections, and provide a transparent view of the learning process" such as: "my personal goal for this learner document has also been to research not only what is relevant to the case study, but also useful beyond, both in time and space, to gain tools which I can use when I return home …". "In particular, it has been my goal to gain a better understanding of how to approach the complexity of a food system and facilitate change or improvements, to work towards sustainability." She goes on to describe how experience from the case studies contributed to their findings: "Through lectures or theme days, readings, and direct experience with the case study of the regional food system, I have recognized that the role of direct marketing must be considered beyond the benefits or drawbacks for consumers and producers; it must be considered in the context of the whole food system. My proposal for investigation of direct marketing is thus expanded to consider the issue of scale in the food system, one of the key issues identified by our group in the regional case study." Her findings indicate that maybe this type of experience is what is needed to correct current knowledge: "Perhaps what I have experienced is a proliferation of organic development in the capitalist marketplace, where, according to the literature, the original ideologies of organics are basically lost." Both experience and reflection are integrated components of the agroecology course. She explains: "Thus the learning process followed the cycle of concrete experience, reflective observation, abstract conceptualisations and active experimentation, although not necessarily in that order, moving between these modes, to review and renew or enrich past steps. The learning modes were used to develop patterns of themes from literature, theme days and interviews, to link theory to the case study in terms of describing the current situation and thinking about the future, and addressing key issues as well as other questions which arose for me from

reflection on the case study." "Overall, I feel that the tools, process and experiences gained from this regional food system case study will be valuable in my future studies, career and life-world in general. Moreover, I will build on this learning process as part of a continuous, lifetime learning cycle."

Personal experience is emphasized by a Canadian female student (2003) as a necessary tool for understanding; "Within the different ideas proposed, much significance was placed on exposing individuals to concrete experiences within the food system, as this was seen as a powerful catalyst for developing a real 'internal' understanding of the situation, through personal experience." Together with a holistic view: "One of the central areas where I hoped to improve was with regards to 'field work'. At the time, I believe I essentially had in mind getting more exposure on farms. This case study however has in many ways been one giant field experience, though focusing on the food system as a whole, instead of the farm. I remember something one of our lecturers mentioned, when speaking about traditional reductionist sciences: in focusing on the parts, individuals are left both without the confidence to tackle complex problems, or the feeling of responsibility of needing to put the parts back into the whole. As I leave this course, I feel I have gained both this confidence (through the new knowledge and skills) and the sense of responsibility (attitude)."

The learning style applied has proved worthwhile for many, as expressed by a Canadian male student in 2004: "I will say one thing about learning however: these six weeks have convinced me that experience-based learning is the most powerful method for building knowledge that is useful in the world." It has also created a desire for lifelong learning: "What I firmly believe is that I will not be an agroecologist just because I passed this class or graduate with a degree. In experiential learning, it is, after all, the experience which counts. I am looking forward to more experiences", declares an American male student (2005).

Experience and reflection on the experience are often intertwined, but we also make use of structured reflection sessions, and this could have influenced the frequency of its mention.

Reflection
There are several reflection sessions during the semester. These focus on incorporating reflection as part of the learning process, but are also employed to give space for quiet thinking in between discussions, on a certain topic or question, individually or in groups. Reflection sessions were new to many of the students, and after an initial scepticism by some, many found these sessions valuable, and started using them in their group work and on other occasions. "Reflection sessions can be helpful tools to avoid tensions in groups. By reflection sessions, frameworks are created where everybody, also those who mostly hold back and are quiet, have the possibility to express their feelings", says a German female student (2010). "Our differing skills complemented each other in a good way and there was always someone taking responsibility… since the beginning of the group work we had reflection sessions upon our work and the group dynamics." The reflection session can also be employed as a tool when sharing the tasks in a group while keeping each other updated, as she explains: "Often we split the group in order to run two interviews at the same time. We always prepared ourselves for the interview by creating an interview guide, one person was interviewing, and the rest of the group was taking notes. As post-processing we were clearing our notes and presenting them to the others during regular reflection sessions so that everybody had approximately the same amount of information about the situation." Student-led reflection sessions also provide a way to educate students in presentation skills and leadership, and several students felt this had helped them explore these roles. Argues the German female student: "Now, after having attended the courses, I do have some useful tools for description, analysis and improvement of complex situations as well as for facilitating groups to make a change. … also leading a reflection session was helpful to learn how to work as a facilitator."

Not all students appreciated this learning style, as described here by an American female student (2008): "Every day this semester I have read or learned interesting pieces of information that I hoped to remember. What I find though, is that without making the time to review this information many of the details get lost. I remember reading *Omnivore's Dilemma* a few years ago wanting to hold onto every fact Pollan mentioned and I was surprised when I picked the book up this semester by how much I had forgotten in such a short time. This is one of the reasons that the reflection sessions were probably useful for some of the class. People can ask questions in a casual environment if there is something in the reading that wasn't clear, or it can simply serve as an information refresher. This form of "group reflecting" is not how I personally learn (or re-learn) best and I found the whole sharing process uncomfortable and unproductive."

Conclusion

Although these are only preliminary results of the analysis, we observe that student descriptions provide a rich resource that helps us understand the learning experience from their personal perspectives. We provide some of the observed trends here.

Most students are really excited with the fieldwork based on real world cases, and describe how they are likely to remember what they learned in the cases because they are real, and because they were working together with peers and communicating with stakeholders in farming and food systems. Many students said this was their first learning experience that began in the field, and which then moved to explore theory as found it needed in their specific project cases. The farm and community cases provided context for understanding abstract theories, and putting new knowledge together with lived examples where they could incorporate this information. At the same time, the apparent potential for linking real life experiences to theory seems weak in a number of students. A shift in where to start learning can be described, with reference to Aristotle in the Nicomachean Ethics (Bostock, 2000), as 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 (Lieblein et al., 2012).

The extent to which students are able to reflect on their own learning experience also varies, from eloquent descriptions of the cognitive process of thinking about thinking, to those that are almost purely descriptive of the activities undertaken during the course. Some admitted being overwhelmed when realizing the complexity of a food system, and how this makes changes seem challenging. At the same time this realization indicates an understanding of systems, relationships between the whole and the parts, and resistance to change.

There are numerous interesting reflections of learning from interactions within the group. Some learn from initial frustrations and are able to create productive cooperation, while others seem to use those difficulties as an explanation for how they performed in the course. Several indicate the feeling of being ready to take on the world. After this experience of working in an environment of multiple perspectives dealing with complex problems, they feel confidence in communicating with stakeholders and well prepared to take on other challenging tasks. On the whole, experiential learning based on the students' own solving of real-life cases proves to be a meaningful and valuable experience.

References

Biggs, J. (2003). Teaching for Quality Learning at University. Buckingham: The Society for Research into Higher Education & Open University Press

Bostock, D. (2000). Aristotle's Ethics. Oxford: OUP

Francis, C., T.A. Breland, E. Østergaard, G. Lieblein, and S. Morse. (2012). Phenomenon-Based Learning in Agroecology: A Prerequisite for Transdisciplinarity and Responsible Action. J. Agroecol. Sustain. Food Sys. 37(1):60-75.

Jenkins, A., R. Breen, R. Lindsay and A. Brew. (2003). Reshaping teaching in higher education: Linking teaching with research. Routledge, London and New York

Lieblein, G., T.A. Breland, C. Francis, and E. Østergaard. (2012). Agroecology Education: Action-oriented Learning and Research. J. Agric. Educ. Ext. 18(1):27-40

McMahon, T. and H. Thakore, (2006). Achieving Constructive Alignment: Putting Outcomes First. Quality of Higher Education 3:10-19

Schuel, T.J. (1986). Cognitive Conceptions of Learning Review of Educational Research 56:411-436.

Tyler, R.W. (1940) Basic Principles of Curriculum and Instruction University of Chicago Press, Chicago

Weimer, M. (2002). Learner-Centered Teaching: Five Key Changes to Practice. San Francisco: Jossey-Bass

Wilson, K. and G.E.B. Morren. (1990). Systems Approaches for Improvement in Agriculture and Resource Management. Macmillan, New York.

Østergaard, E., G. Lieblein, T.A. Breland, and C. Francis. (2010). Students Learning Agroecology: Phenomenon-Based Education for Responsible Action. J. Agric. Educ. Ext. 16(1):23-37