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Facilitating Transformation and Competence Development in Sustainable Agriculture University Education: An Experiential and Action Oriented Approach

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Abstract: The need to strengthen the connection between academia and society has received increased attention over the past years. The importance of bringing university students closer to stakeholders in society as part of their learning process is high regarding sustainable agriculture, because of its applied approach. University programs based on experiential and action-oriented learning have been developed over the past decades, but more knowledge is needed about the impact of these educational activities. In a short course in sustainable agriculture at the University of Gastronomic Sciences in Bra, Italy, we examined the impacts of experiential and action-oriented learning on competency development as well as transformational impacts on the students. We found that students improve on several core competences as a result of their participation in the short course, and also signs of deep transformational processes among the students.

Keywords: experiential learning; action learning; sustainable agriculture; transformation; self-assessment; competence-based education

1. Introduction

> "*What a journey this course has been. It is only appropriate that a course tackling the complexities of sustainable agriculture would be inherently complex itself. For the past two months I have been learning more about my interests, skills, motivations, and myself, than I ever expected from a course with "agriculture" in the title. However, it makes perfect sense. Sustainability of the agroecosystem encompasses the whole organism, looking at the farm as the complex living being it is. So it is with great gratitude that I have come to realize this sustainable agriculture class has succeeded in going beyond my expectations of learning about farming to become a class that has challenged my vision of myself and of my life*" (Student from USA).

This reflection comes from a student in the course Sustainable Agriculture in the Master Program in Food Culture and Communication, specialization Human Ecology and Sustainability at the University of Gastronomic Sciences (UNISG) in Italy. UNISG, founded in 2004 by the international non-profit association Slow Food, is a private non-profit institution accredited by the Italian Ministry of Education and Research. Its goal is to create an international research and education centre for those working on the issues of sustainable food as a form of sustenance and of improvement of the planet's human and natural conditions.

Although theories about experiential learning can be found in ancient Greek and Chinese philosophy, they have since the 1960s generally been understood as a systematic approach to learning

catalyzed by students extracting from various experiences, within and beyond the classroom, and reflect on these. According to Dewey [1], an important task for educators is to enable students to integrate their prior knowledge with new knowledge through reflective experience.

Because of the broad nature of sustainable agriculture, we apply an experiential and action-oriented approach to learning [2]. Dolci [3] proposes that real communication is not a one-way process in which there is an active sender and a passive receiver but a reciprocal process based on inquiry, sharing, answering, exploring and creating for both. Education is not transfer of knowledge, but a dialogue to increase the creativity of individuals and groups. It focuses on the capacity of people to discover their vital interests and allows them to freely express their own reflections based on both their experiences and discoveries. According to Freire [4], in traditional education students are viewed as an empty bucket to be filled by the teacher. He notes that "it transforms students into receiving objects. It attempts to control thinking and action, leads men and women to adjust to the world, and inhibits their creative power." In a course that is based on action-learning, both students and teachers learn with and from each other in a process where they work together to improve situations in the field, and further by reflecting on their own experiences from being involved in such an activity [5,6].

Decision makers in farming and food systems are mostly facing complex challenges, encompassing bio-physical as well as economic and social dimensions that interact [7,8]. To learn how to deal with such complex and dynamic issues, students need to become directly involved, because a number of properties do not surface until one tries to change the current situation. "If you want to truly understand something, try to change it" [9,10]. The need for a multi-perspective approach [11] becomes immediately evident when a group of students from different countries and educational backgrounds together try to learn about agriculture and sustainability.

We consider experiential learning to be vital for enabling students to acquire the competencies needed for them to constructively be able to support a sustainable development of farming and food systems [12,13]. A learning process based on experiences [14] allows students to observe, act and interact. Further, we do not learn from these experiences as such, but by reflecting on them [15].

In the course in sustainable agriculture we aimed at developing students' competences in observation, participation, dialogue, visioning and reflection as well as their interactions. These competences have been developed independently by the agroecology group at the Norwegian University of Life Sciences (NMBU) [16], but overlap to a large extent with a framework for key competences in academic education in sustainability, developed by Wiek et al. [17]. Since one of our assumptions was that the shift from traditional teaching and learning to an experiential approach implies incorporation of the activity of metacognitive reasoning, a way of learning that Mezirow [18] calls transformative, we were interested in exploring such a dimension. In the autumn of 2013 the course in sustainable agriculture was run at UNISG, based on experiences from an MSc program in agroecology at NMBU [19]. Our research questions were:

(1) To what extent can a short course in sustainable agriculture based on an experiential learning approach have an impact on the core competencies of observation, participation, dialogue, visioning and reflection among the students?
(2) To what extent can such a short course have a transformational impact on the students?
(3) In addition we asked ourselves how can we, as teachers, improve such a course in sustainable agriculture, that is based on experiential and action oriented learning?

2. Materials and Methods

2.1. The Sustainable Agriculture Course

The University of Gastronomic Sciences in Italy offers a one-year Master Program in Food Culture and Communication, that attracts students from all around the world [20].

The course in sustainable agriculture was a 6 ECTS (45 h classroom activities plus team case-work and individual work over a period of 7 weeks) course during the first semester of the 2013/2014

master-degree program. The class consisted of twenty students from six different countries: Italy (8), USA (6), Canada (2), Germany (2), India (1) and Colombia (1). The goal of the course was to develop knowledge, skills and attitudes enabling students to deal with complex situations in agricultural- and food-systems development [16]. The intended aim was for students to acquire theoretical knowledge about agroecosystems and also gain experience with methodologies and tools for describing, analyzing and improving them.

The pedagogical basis of the course was experiential learning with situations "out there" placed in the center—not as examples of theory—but as starting points for the learning process, where theory and experiences should be linked [13,21]. To enable students to shift from a theory-based to an experience-based way of learning, it was important to engage and motivate the students right from the start, to place them and their learning process in the center of course activities [12]. In this course this was done by having all students present their competences and previous education and experiences during the first day of the course. They were further asked to develop an image of their course expectations and what they wanted to get out of participating in the course, individually and in small groups. When imagining their ideal course, they were introduced to the techniques of rich picturing as a way of using visual approaches to deal with complex issues [22].

During the following weeks, students worked in groups, with each group assigned to an on-going project that dealt with sustainability of farming and food. The case study encompassed the entire food-system, including a farmer interested in major changes in the farm operation. The task of the project work was to do an extensive analysis of the current and desired future of the explored case. This implied working with a farmer stakeholder with the aim of contributing to the improvement of the present situation on the farm, in a food-systems perspective.

Based on a farm visit including an in-depth interview with the farmer, students prepared a group report (stakeholder document) for the farmer. The focus for this report was on providing information to the farmer that could be helpful for developing the farm in a more sustainable direction. In addition, each student prepared an individual reflection document. As the project work is the core of the course, the students included in the learner document a condensed version of the client document, but placed emphasis on reflection on their experiences during both the classroom and the case-activities, linking these experiences to both relevant theory as well as to their own development as professionals.

The location for the casework was a peri-urban farm in England. The Sutton Community Farm (SCF) is a 7.1 acre leased farm located on the outskirts of London in the borough of Sutton. SCF is a non-profit social enterprise established in 2010. They produce fresh organically grown (but not certified) vegetables and the farm has the dual purpose of being a community space where people can learn about food production, cultivate their horticultural skills and access locally grown vegetables.

The casework contained the following steps, and the core task of the students was to conduct an inquiry to answer the following questions:

(1) Introduction and preparation in class (*who am I and who are we?*).
(2) Case-visit, with observation and communication with stakeholders. Students applied a multi-perspective approach and developed a rich picture of the situation (*what is there?*).
(3) Identification of the key themes found in the present situation (*what is important?*).
(4) Description of the desired future situation of the case: create a vision (*where do we want to go?*).
(5) Develop action plans for how to improve the situation in the future (*how do we get there?*).
(6) Presentation of two final written documents: an individual reflection paper (*what did I learn and what is my future development?*) and one group stakeholder or client report (*plans of improvements for the farmer*) with final oral presentation.

The class was divided in 3 groups of 6–7 students. Each group was asked to emphasize one of the three major dimensions of sustainability: ecological, economical and socio-cultural, keeping in mind that these dimensions are interlinked.

2.2. Methods

2.2.1. Competence Development

(1) Pre-competences and pre-experience of students

In class the students were asked to individually reflect on the following questions: What experiences and competences do you have that you can bring to the field trip to make it a success? Then they had to write them down and share in groups of 3–4. The facilitators collected the responses and clustered according to the main dimensions of sustainability to be dealt with in the case-work: ecological, economical and socio-cultural sustainability. Students received the overview of competences and experiences for their respective group-members.

(2) Students self-assessment of competences at the beginning and end of the course

As Galt [23] points out, self-evaluation is not just an act, but furthermore a philosophy that is rooted in critical pedagogy. At a more pragmatic level, self-assessment is also in most cases the only available opportunity for educators, because of the labor-intensiveness of external assessment. In accordance with Galt, we hold the position that regardless of resource demands of different ways of assessment, self-assessment is a sound approach, both theoretically and pedagogically [23]. In addition to providing information about how students assess themselves, it contributes to increase their self-awareness. Consistent with Galt [23] we are aware of the fact that there is not necessarily agreement between students' own assessment and what would be the result of an external evaluation or the extent to which these competencies are put into practice. However, we also relate to the work by Pfeffer and Sutton [24], who found that knowledge generated though experiences more easily lead to action than knowledge purely gained from reading or listening to lectures. Further, self-assessment is a competence in itself, of importance for meta-cognition and self-development, and practice is important to enable improvements.

The twenty students assessed themselves at the beginning (mid-September) and at the end of the course (mid-November), using an approach developed by Lieblein [25]. They were asked to express a judgment of their skill-level ranking from 1 to 9 within five stages of skill development for the following competences: observation, participation, visioning, reflection and dialogue. These competencies were described as follows [16]: *Observation* is the competency of carefully examining situations in the "world out there" with which you are confronted, before you make any judgements about the situation. This has the intention of an unbiased examination. *Participation* is the competency of participating in work in the field, not as a distant observer, but rather with personal commitment and dedication in interaction with different stakeholders. *Visioning* is the competency of not just repeating what already has been thought, but to think "outside the box" in new and creative ways. It is about the ability to visualize a desired future so concretely that you would recognize it if you came across it. *Reflection* means the ability to link own experiences to theory in sustainable agriculture and to personal development. *Dialogue* is the core competency of performing a two-way communication. The willingness to be influenced by the views of others, to set your own beliefs and opinions aside is key to the development of this competence.

For each competence, different specific sub-competences were listed and the definition of the different level of development was given (Figure 1). The students did not have access to the results of their initial self-assessment scores when they did the final self-assessment. The approach to skill-development was based on the model developed by Dreyfus and Dreyfus [26], which has five stages—novice, advanced beginner, competent performer, proficient performer and expert, a similar approach to what was used by Galt et al. [23]. Lieblein had also developed an explanatory text for the self-assessment, that was read and handed out to the students prior to the self-assessment activity [25]. The final data was analyzed with descriptive statistics and a paired *t*-test.

	Level of development								
	NOVICE		ADVANCED BEGINNER		COMPETENT PERFORMER		PROFICIENT PERFORMER		EXPERT
	1	2	3	4	5	6	7	8	9
OBSERVATION									
Carefully observe a situation in the field									
Display such a situation as a rich picture									
Allow for examination of the whole situation before drawing conclusions									
PARTICIPATION									
Recognize values and goal conflicts of different stakeholders in society									
Participate in work "out in the field" with commitment and dedication									
Empathise with the goals and feelings of stakeholders in the field									
VISIONING									
Envision situations that do not yet exist									
Articulate innovative ways of approaching challenges met by stakeholders in society									
REFLECTION									
Knowledge about sustainable agriculture									
Connect situations in the field to theory in sustainable agriculture as well as to personal growth									
Connect experiences and theory to own personal development									
Self-guided learning									
Awareness of the role of reflection in personal learning and development									
DIALOGUE									
Understand and respect other people´s views									
Set formal roles and competencies aside when needed in a conversation									
Distinguish between a debate and a dialogue									

Figure 1. Questionnaire and competence level description used for the self-assessment given to the students at the beginning and end of the course. Note: **Novice**—As a novice, the individual experiences a given problem and a given situation in a given task area for the first time. At this stage the person follows rules and feels no responsibility for anything other than following the rules; **Advanced beginner**—The beginner advances from the novice level by achieving real-life experience, in contrast to the often protected learning situations of the first level. The basis for action becomes more context-dependent; **Competent performer**—The competent performer has considerable experience in the field. The individual at this level is still overwhelmed by the complexity of a concrete "real-life" situation, but starts to be able to find key factors for how to deal with such situations. Competent performers are personally involved in their actions; **Proficient performer**—At this level, the individual becomes emotionally involved, the proficient performer is not only thinking about the situations he/she is involved in, he/she is also emotionally connected to the situation. The proficient performer works with both head and heart, and start to intuitively understand situations, thereby transcending rules and guidelines; **Expert**—The expert will by intuition "do the right things at the right time". Expertise is the level of virtuosity. Expertise is largely an intuitive mode of operation that relies heavily on deep, implicit knowledge but accepts that sometimes at expert level analytical approaches are still likely to be used when an intuitive approach fails initially.

2.2.2. Transformational Impact

(1) What characterizes good reflection?

In class the students were asked to reflect on the following questions: What is reflection? What characterizes good reflection? They had to pick one experience that was important for their own

learning, reflect on why this was important for them (5 min in silence), share in groups of 4 (15 min) and then in plenary (20 min). According to Mezirov [18], "Transformative learning is learning that transforms problematic frames of reference—sets of fixed assumptions and expectations (habits of mind, meaning perspectives, mindsets)—to make them more inclusive, discriminating, open, reflective, and emotionally able to change." Because reflection is such a core competence for transformation, the described session on understanding what it is was conducted early in the course.

(2) Comparison of the initial expectation of the course and the final questions

During the first class the students were asked to reflect in silence for 5 min and then write their initial expectation of the course (*what would I like to learn in this course?*). This list of expectations was compared with the list of questions (*what questions am I still asking myself?*) that the students were asked to develop during the last day of the course.

(3) A reflection document

The students were asked to write a reflection document during the last weeks of the course. In the manual for how to do this, they were recommended to reflect on all their course experiences in relation to relevant literature as well as to their own professional and individual development. These documents have been analyzed with the aim of finding reflections that indicate transformational learning.

2.2.3. Course Improvement

In addition to our overall reflections on the course, including its context, we conducted a feedback-session with the students during the last day of the course. The session was called "wrap-up", with the intention to have a final reflection on the whole learning process. One exercise in this session was to answer the following questions: a. What are the three things you really liked about this course, that you found useful, inspiring and interesting? b. Imagine that you were the one to be completely in charge of the next course in sustainable agriculture. What would you do differently? Students were asked to reflect on these questions individually, in silence, then write their responses on a sheet of paper and finally share in a plenary session. We collected their responses as well as the additional comments that came forth during the plenary session.

3. Results and Discussion

3.1. Competence Development

3.1.1. Pre-Competences and Pre-Experience of Students

The students represented a range of interesting and useful backgrounds, competencies and personal attitudes. Table 1 shows one example from each of the three student groups.

The class was high in diversity considering country of origin, academic background, course expectations and past experiences. This session pushed them towards a deeper knowledge of each others' competences and previous experiences, that helped strengthen the group cohesion and trust among group members. They could form a real interdisciplinary group of people with a shared interest: the analysis and improvement of the case that they explored.

Our aim was to support each student learning about how to grasp the complexity of the case, and then assist them in their endeavor to move their learning efforts into the social domain, between students, and between students and case stakeholders.

Table 1. List of pre-competence and pre-experience of three students in the 2013 class in sustainable agriculture at UNISG.

Friz from the ecological sustainability group: • I have worked 6 months in London and have a good access to British culture and thinking; • I have worked on an organic farm from time to time and know some of the problems they are dealing with; • Good experience in teamwork and realization of complex task assignments in groups, • Project management experience—e.g., structuring, recapitulation, delegation. • The ability to see the bigger picture. • A good sense for other people's feelings and motives. • The willingness to take nothing personal and to accept mistakes. • Common sense and a good portion of humor. • Basic principle: "Smile and people will smile back."
Silvia from the economical sustainability group: • Abilities to understand the economic aspects of the business (I graduated in economics.) • Capacity to analyze the community involvement (I've been a grassroots intern.) • Interest in designing possible solutions (I had a permaculture design course and I've been involved in a transition town small meeting.)
Louise from the socio-cultural sustainability group: • previous field work in Mozambique where I formulated a questionnaire and interviews for youth groups on the current situation in urban setting for the youth of Mozambique post civil war. • interned as research assistant at the OAS (Organization of American States.) • worked as Executive Assistant and Assistant Program Manager at the Latino International Theatre Festival of New York, Inc. for two years. • studied Cultural Anthropology = gave me tools, theory and methodology to apply and put into practice when conducting field work. • lived in 6 countries (including Nicaragua, El Salvador, Mexico, Canada, US and now Italy) = cultural relativity, empathetic, good listener/observer.

The importance of social interaction in experiential learning is known since the publication of Dewey's book on experiential learning [15]. Learning in Dewey's world is primarily socially constructed, meaning that learning is an intellectual and emotional energy generated from the quality of interactions between students, and between students and teachers. The students' case work was especially useful for understanding the linkage between knowledge and context; it directly addresses the question of whether knowledge about human activity can be context-independent [27].

3.1.2. Students' Self-Assessment at the Beginning and the End of the Course

Table 2 shows that the overall level of students' self-assessed competency increased significantly from an advance beginner (4,8) to a competent performer (6,2) for the five core competences (observation, participation, visioning, reflection and dialogue). The students assessed themselves to be competent performers in regards to dialogue and participation already at the start of the course, and although there was indication of improvements during the course, these changes were not statistically significant. The only competences that were significantly improved during the course, according to the students themselves, were within visioning and reflection. One possible cause for these results might be that dialogue and participation are terms more familiar to the students at first sight, belonging to daily life activities. In comparison, reflection and visioning are more complex activities, and they were also given more attention during the course through class exercises and the writing of a reflection document.

Table 2. Students' competence self-assessments at the beginning and the end of the course in sustainable agriculture.

Competencies	2013, All Students (n = 19)				Rank
	First Day	Last Day	Change	Sign.	at End
Observation	4,5	5,6	1,1	n.s.	
Carefully observe a situation in the field	5,1	5,7	0,6	n.s.	13
Display such a situation as a rich picture	3,8	5,3	1,5	**	15
Allow for examination of the whole situation before drawing conclusions	4,6	5,7	1,1	n.s.	13
Participation	5,3	6,2	0,9	n.s.	
Recognize values and goal conflicts of different stakeholders in society	4,9	6,1	1,2	n.s.	9
Participate in work "out in the field" with commitment and dedication	5,5	6,2	0,7	n.s.	8
Empathize with the goals and feelings of stakeholders in the field	5,4	6,3	0,9	n.s.	7
Visioning	4,3	5,9	1,7	*	
Envision situations that do not yet exist	4,4	6,0	1,6	**	10
Articulate innovative ways of approaching challenges met by stakeholders in society	4,1	5,8	1,7	**	12
Reflection	4,1	6,2	2,1	***	
Knowledge about sustainable agriculture	3,1	5,4	2,4	***	14
Connect situations in the field to theory in sustainable agriculture as well as to personal growth	2,9	5,9	3,0	***	11
Connect experiences and theory to own personal development	4,5	6,5	2,0	***	5
Self-guided learning	4,6	6,4	1,8	**	6
Awareness of the role of reflection in personal learning and development	5,3	6,7	1,4	*	4
Dialogue	6,0	6,9	0,9	n.s.	
Understand and respect other people's views	6,5	7,1	0,6	n.s.	1
Set formal roles and competences aside when needed in a conversation	5,8	6,8	0,9	n.s.	3
Distinguish between a debate and a dialogue	5,7	7,0	1,3	**	2
Average	4,8	6,2	1,4	***	

Levels: 1–2 = novice; 3–4 = advanced beginner; 5–6 = competent performer; 7–8 = proficient performer; 9 = expert; All average changes are in positive direction; Levels of statistical significance: * means $p < 0.05$; ** means $p < 0.01$ and *** means $p < 0.001$; n.s. means not significant.

In particular, the reflection competence increased substantially. This competence had 5 sub-levels that describe specific proficiencies and each of them got the highest increase from the start to the end of the course: (a) Knowledge about sustainable agriculture (+2,4); (b) Connect situations in the field to theory in sustainable agriculture as well as to personal growth (+3); (c) Connect experiences and theory to own personal development (+2); (d) Self-guided learning (+1,8); (e) Awareness of the role of reflection in personal learning and development (+1).

The results of the pre- and post-course self-assessments demonstrate that the students in this course regard themselves as considerably more competent along a range of competences as a result of participating in the course, corresponding with findings in in an undergraduate Sustainable Agriculture and Food Systems major at a U.S. land-grant university [23]. We find the largest change during the course in observation, reflection and visioning, all competences that in most cases are not trained in conventional courses at universities. We can also see this from the angle that these competences were the ones ranked the lowest at the start of the course. It seems that the unfamiliarity with these competences, provide the greatest potential for improvement, when adequately supported by teachers through experiential learning activities.

3.2. Transformational Impact

3.2.1. Session on "What Characterizes Good Reflection?"

Students considered good reflection to partially depend on individual competences:

- skills and experience in reflective thinking. The ability to reflect is a learned behavior that is cultivated by the individual over a period of time.
- pre-knowledge of the content area. The ability to reflect on a specific topic depends on how much one already knows.
- motivation. Internal and external sources of motivation affect the quality of reflection.
- degree of self-confidence. When there is self-confidence, the amount and quality of reflection is enhanced.

Students also identified interpersonal/environmental characteristics:

- good social interaction. Social interaction may enhance motivation and bring more information and ideas that could be shared and perhaps result in deeper thinking about the subject. This interaction might take place during the learning activity or it may occur later in formal or informal group discussions.
- sufficient time, good space. The opportunity for the learner to establish an appropriate mental setting for reflecting is related to the nature of the physical environment in which reflection is expected to take place.
- reflection necessitates the need for slowing down, not to rush the activity, to allow for careful considerations.

Finally, some characteristics refer to the nature of what might cause reflective activities:

- realizing limits.
- disappointment and failure.
- new experiences, new opportunities, challenging situations.
- being outside of one´s comfort zone

In the traditional classroom, reflections are usually repetitions within the subject matter that the students are studying and repetition dominates over reflection. For example, students may be required to offer a personal reflection during examinations to assess how successfully he/she can interact with a text or a statement. This, in contrast, was an exercise in meta-cognition, where the students were

prompted to reflect on characteristics of reflection, in order to enable them to improve on their abilities to reflect. It is interesting to note that in a short session they were able to identify characteristics of good reflection that are in agreement with those already described in literature [28,29].

3.2.2. Students' Initial Expectation of the Course and Their Final Questions

The comparison of the student's initial expectation of the course (*what I would like to learn?*) with the questions they ask themselves at the end of the course (*what am I still asking myself?*) demonstrates a fundamental shift from a primary interest in filling gaps of knowledge on content regarding sustainable agriculture towards a much more complex approach to agriculture. The students have developed from a focus only on the knowledge dimension to also include action, engagement and participatory dimensions within their scope of curiosity (Table 3).

Table 3. Initial expectations and final questions among the students in a course on 'Sustainable agriculture'.

Start of Course: What Are the Questions I'd Like the Course to Provide an Answer to?	**End of Course: What Are the Questions I'm still Asking Myself with Regards to the Topics and Processes Dealt with in the Course in Sustainable Agriculture?**
What is sustainable gastronomy? The link of food production, distribution and consumption The impact of food transport and energy Sustainable agriculture in south of the world Historical approach in sustainable agriculture Sustainable agriculture & climate change Urban agriculture Sustainable agriculture and Food security Critics to sustainable agriculture Practice step to develop sustainable agriculture Education in sustainable agriculture Consumers prospective Organic agriculture is really sustainable?	How do we take this knowledge home, and communicate it in an easy to understand way? How do we put it all together and incorporate the experience into our life? How do we address the poor reputation that organic agriculture has developed? How to transform knowledge into real practice? More examples of success/failures in agricultural practice elsewhere? At what level do we put ourselves to enable change? How can we set really trusty relationship with producers? The role of water in sustainable agriculture? What are the ways in which countries like India/China could push more to sustainable agriculture? What are the limits of sustainable agriculture in the future? How can I integrate sustainable agriculture principles into practices?

The increased complexity in terms of how the students view their own position towards sustainable agriculture can be described as transformations of points of view, described by Mezirow [30]. as an indicator of transformational learning. The transformative dimension was described by one of the students as follows:

> "*With hindsight, the mission was clear. We started with Geir's lectures that had nothing to do with farming but all to do with the whole ecosystem. One of the main problems with agriculture today is people's mind-set toward it. The land is there for human use and human gain. We are missing the big picture. We cannot see beyond the limited scope of producing more and spending less. We need a paradigm shift before we can even begin to think about the food part of agriculture, and that is why it was perfect to start with a new paradigm in this class*" (Student from USA).

Another feature we recognized among the students, was the emergence of their abilities for meta-cognition, the ability to think about one's own thinking. The relevance of metacognition for sustainable agriculture is stated by Bawden [31] as follows: " . . . in the face of complexity, it is not just a matter of participant stakeholders learning and knowing more but also of learning and knowing differently. And that highlights the importance (. . .) of the need for learning about learning and about knowing and about the nature of knowledge itself." According to Mezirow [32], transformational learning itself takes place in the realm of meta-cognition.

3.2.3. Students' Course Reflections

In keeping with Mezirow [18], "Transformative learning is understood as a uniquely adult activity of metacognitive reasoning". As such it implies a shift from a passive to an active position, as described by one of the students:

> "*This class has caused me to think more deeply about the issues with conventional agriculture and how to come up with solutions rather than accept the system as is, and although I may not have come up with concrete answers, it is now constantly part of my thought process when reading and thinking about food production*" (Student from Italy).

Mezirow [33] further proposes that "By far the most significant learning experience in adulthood involve critical self-reflection—reassessing the way we have posed problems and reassessing our own orientation to perceiving, knowing, believing, feeling and acting." Signs of such a reassessing was found in the reflections of several students:

> "*Realizing that in a real life situation all of what we learn can't work in every outlet of agriculture was paramount. This end of the spectrum greatly benefited me with the structure of my learning processes to be able to recognize that my ideas and philosophies aren't the generally accepted norm and may not benefit certain individuals and meet their overall needs. My time with fellow group members also molded the way in which I accept the learning process because of my new ability to consider all opinions and continue to allow information and new ideas to shape the way I address situations*" (Student from USA).

The same student also stated that:

> "*Our communication with the stakeholders at SCF helped me grasp a better understanding of the knowledge of sustainable agriculture in that we saw the hands-on application of the topics we discussed within the course from individuals directly connected to them in the field of agriculture*" (a student from USA).

Another student further pointed at the key role of reflection and its role with regards to action:

> "*The critical point is the reflection, action alone does not make sense unless you put thought behind it. The actions of SCF really optimize this idea. They are constantly thinking of new ways to lower their impact on the earth, produce good food, and benefit the community. Their transparency allows anyone to critique them, which it turn gives them more ideas to think about for their action plan. They are never simply just talking about their hopes and dreams, they are taking thoughtful action to achieve them*" (Student from USA).

Mezirow [34] also states that "We define transformative learning as learning experiences that leave a significant impact on the learner, a paradigm shift that shapes the learner and affects subsequent experiences". Such a deep change was expressed by one of the students as follows:

> "*As a student of this course my vision of sustainability has been challenged and consequently reinforced through my exposure to new perspectives and experience*" (Student from Canada).

An ontological and epistemological reorientation as a result of participating in the course was further elaborated by another student:

> "*This was not what I considered a typical sustainable agriculture class to be. While briefly covering the different types of agriculture and their evolutions, food security, soil, water, compost, pests, and the many roles of agriculture in society today, the core of this class was to approach farming from the viewpoint that a farm is a complex living system, an organism. In this approach the class also addressed the student as a whole system combining multifaceted methods of learning that not only taught farming theory, but also conveyed a new paradigm from which to see the agroecosystem and put the student out in the field to combine the theory with hands-on experience*" (Student from USA).

Another student described the eye-opening effect of the course as follows:

> *"This course has been enlightening for my master and for my life. I've changed idea about a lot of issues and I learned a lot of things about the world I'm living in. I saw that organic farming could not be the only one solution but one of the solutions and I learned that not everything in that world is good: who are defined organic without considering the water saving, the organic matter in the soil, the distribution cost (economically speaking and environmentally) are not at all aware about the world they live in. I learned how to work better in a group, how to relate all the idea that I have with a real life situation, how to make the right questions and how to forecast as well as asses the sustainability of a farm. With all the skills I've learned, I'm definitely a better learner now"* (Student from Italy).

We do recognize that these student reflections come from one single class, but still find that they provide clear evidence of transformational learning in a course in sustainable agriculture that is based on experiential and action-oriented learning.

3.3. Feedback from Students on How to Improve Such a Course

The student perception of positive aspects of the course (Table 4, left column) was mainly related to the innovative learning approach, the acquisition of tools and process that they can apply independently also to other subjects, the practical knowledge that they can use once back home and to become a more engaged person. Those aspects imply that they have reduced the distance from "knowing" to "doing/acting differently" in agreement with our main goals for the course, transcending the knowledge domain to also include competence development.

The student perceptions of negative aspects of the course (Table 4, right column) were related to organizational aspects such as the (short) amount of time this course had and its place in the schedule in their master program, the need for more exercises using some of the tools and approaches presented, such as rich picturing, multi-perspective analysis, visionary thinking and sustainability analysis, and further to bring in conventional farms as cases.

Table 4. Suggestion from students.

Which Are 3 Things, Which You Really Liked about This Course, that You Found Useful, Inspiring and Interesting!	**Imagine that you Were the One to Be Completely in Charge of the Next Course in Sustainable Agriculture. What Would You Do Differently?**
Giving tools and methods instead of basic knowledge;	
How methods of social sciences are used in agroecology;	
Action research approach;	
Practical approach and use of case study;	More out in the field;
Soil fertility and compost to be applied to my home garden;	30% more in this course in the master program;
Enjoy and learned a lot from discussion in class and outside class on sustainable agriculture and organic certification;	More time to dedicate to garden and practical aspects;
Comparison of farms (visit to the local organic farm and London case study);	Compulsory to have a course in gardening;
	A lecture against sustainable agriculture;
Systems thinking approach and rich picture;	Less repeating content;
Experiential learning and knowledge was not clear at the beginning but very nice at the end;	More feedback during project;
	Facilitate more discussion and debate;
Learning theory at the beginning seems silly but helped me to become a better learner;	To visit a conventional farm and discuss about it;
	Improve the Manual;
Agroecology in Latin America	Smaller groups, 3–4 students;
Visiting the organic farm and challenge on paper about reflection;	Teacher from outside EU to hear their perspective;
All input section about farming systems, idea about food systems with scientific approach;	More exercises in how to develop a project;
	More time in the local organic farm were we experience the tools and then apply them in the study trip;
Sustainability assessment and indicators: how to evaluate it?	
Moral obligation to apply this concept in the future;	
Become a useful person;	To do a entire analysis of a farm instead of split it in 3 aspects;
Continuity over time and dynamic;	
Mix of methodology (field-trip, excursion, lecture, exercise);	To have this course at the beginning of the year.
Different professors, different background, expert in teaching;	
Biodynamic agriculture;	
Ability to identify different aspects of sustainable agriculture.	

3.4. Planned Course Improvements

Although the development and implementation of this novel program was a positive experience overall—for teachers as well as students—there are a number of challenges that require thoughtful attention.

Firstly, students are undoubtedly at different stages in their own identity development, thus making it difficult to meet the needs of all students to a full degree. Some of the students found the content of the course difficult to grasp and others found it to be "not academic". Educating a diverse group of people necessitates a diversified approach so that in sum there will be some useful activities for all, if not at the same time. It will be important to be explicit about this at the very beginning of the course.

Another important lesson learned in this regard was the need to provide more structured support for students, like improvement of the manual or improved organization of the field experience. The last was one of the most challenging, since there are several field trips in the master program and we incorporated a part of one of them into our course. The main problem was that we were not responsible for the management of the field trips, nor did we choose the destination or had sufficient time to develop activities to help students reach their learning goals.

One major feedback from the students during the last day of the course was their interest in becoming more exposed to "the world out there" including the practical work that takes place in the field, within the frame of an academic course. The main component of our redesign of the course is within this area: more time will be spent on farms, and the farm visits will also include doing practical work together with the farmers. We see the involvement of practical work as providing an additional window into the complex phenomenon that a farm represents.

At the institutional level, a major challenge is how to enable an experiential and action-oriented approach to learning that transcends this single course and become an integral part of the whole master program, and as such incorporate more of the faculty into this way of teaching. This challenge are partly caused by the fact that UNISG is a small university that to a large extent bring in visiting professors who not always prioritize the necessary joint planning work needed for changes at the program and process level of teaching. The course was highly appreciated by the students, but in general there was the need of more coordination between the different courses and case visits in the master program. As such, the experiential and action-oriented approach used in the course discussed in this paper does not represent the standard within the whole master program. Several alternative plans for improving faculty involvement are being explored, including an experiential learning approach that require a strong institutional support. We hope that an improved version of the course in sustainable agriculture will represent an added push in the quest for further use of an experiential learning approach at UNISG.

4. Conclusions

Our findings suggest that basing a course on experiential and action oriented learning even in a short course can support development along a range of competencies that are vital for professionals who wish to support agricultural development in a sustainable direction. Our experience with the course in sustainable agriculture shows that the mentioned approach can serve several purposes. In addition to improvement of key competencies it can support transformational learning among the students, where fundamentally new perspectives are developed. These are perspectives that in our view are vital for sustainable development within the agricultural domain. A key part of the plans for course improvements is to move more of the course activities out from the classroom and into the extra-university domain. The activities should also include working alongside with stakeholders "out there."

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