Enhancing Active and Interactive Learning Online - Lessons Learned from an Online Introductory Agroecology Course

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Abstract

While web-based course offerings are growing rapidly across various institutions and disciplines, there is an emerging need to enhance student interactions and active learning for online learning environments. An Introduction to Agroecology online course was developed at North Carolina State University purposefully with the intention of maximizing student interactions and active learning through diverse instructional strategies to create a collaborative, virtual learning community. This paper will describe the course development, outline the specific strategies to promote active learning and student interactions used, and share student evaluations and lessons learned; complied after eight semesters of teaching this online course. From course evaluations and post-course surveys, students valued the opportunities to interact with each other and the instructor and stressed the importance of making time and treating their online course like their face-to-face courses. The instructor used the evaluations and surveys each semester to continually assess student experiences and impacts of specific course components. The instructional strategies, evaluation process and lessons learned described here are general and diverse enough to be easily utilized by a variety of online courses in various stages of development. This purpose of this paper is to stimulate further communication on successful pedagogical strategies for collaborative and interactive online teaching and learning.

Online Education and the Need for Active Learning

The growth of web-based educational technology and the increasing demand to offer distance education courses has led to the rapid development and diversity of courses offered online. More than two-thirds of all higher education institutions offer web-based courses and in fall 2006 there were more than 3.48 million students enrolled in online courses representing close to 20% of the total student enrollment (Allen and Seaman, 2007). Online courses and programs can extend the reach of the university; providing learning opportunities to new audiences that would otherwise be limited by time or distance. As online education continues to quickly develop across many disciplines and institutions, instructors are seeking innovative approaches to improve the online learning experience for students.

Teaching an online course requires more than a mastery of the subject knowledge sufficient for a traditional classroom-based course. Faculty not only must learn new technologies, but consider effective instructional strategies to enhance student learning and interactions in a virtual environment (Gaytan and McEwen, 2007). Web-based courses and advanced educational technologies can improve instructors' abilities to expand information to new audiences, but these alone do not guarantee effective teaching and learning outcomes. A variety of studies have found that instructors teaching online share similar concerns that include lack of institutional support and incentives, increased time needed for online course development, potential technology problems, and effectiveness of student-instructor interactions (Born and Miller, 1999; Gammill and Newman, 2005). The lack of interaction among students and instructors in online courses is a concern also shared by students (Flowers, 2001; Schmidt and Gallegos, 2001). Although a number of studies have found online students to perform equal to or better than their classroom counterparts (Dutton et al., 2002; Schroeder-Moreno and Cooper, 2007), the failure to complete courses is much more frequent for online students than for traditional classroom-based students (Dutton et al., 2002). Although the reasons students withdraw from online courses are often complex (Garland, 1993), the lack of real-time interaction and stimulation from online course materials can often cause learners to feel isolated in the online environment (Fulford and Zhang, 1993). While the dynamic nature of online courses can provide a flexible learning (and teaching) format in which students can progress at their own pace, they must be self-disciplined and highly motivated to be successful in online courses (Waschull, 2005). Instructional strategies that enhance frequent interactions and student engagement in online courses can help keep students connected to the material and to each other and motivated, even in virtual space (Phillips, 2005).

Active and interactive learning activities may be fundamental strategies to keeping students engaged in online courses (Edwards et al., 2007). Active

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learning is a learner-centered approach where students actively take part in their learning through discovery and inquiry and is often found to be more effective than passively receiving course content (Bruner, 1973). Active learning can enhance students' ability to control and regulate their own learning, which can facilitate the cognitive, motivational, and emotional learning processes (Bell and Kozlowski, 2008). There is a great deal of acknowledgement in the literature that active learning and learner-centered approaches can promote student understanding and success in online courses (Phillips, 2005). It is often a challenge for faculty to be aware of and select from the many specific instructional strategies, such as asynchronous discussions, chats, videos, interactive content materials, formal and informal quizzes, etc. that can provide meaningful interactions and enhance learning in an online environment for students with various learning styles.

This paper aims to identify a selection of successful strategies to engage students in active and interactive learning in an online environment based on the experiences from teaching an Introduction to Agroecology online course at North Carolina (NC) State University. The course format, design, and learning activities for this agroecology course were developed purposefully with the intention of maximizing student interactions and active learning online. The description of the activities and instructional strategies for this course are general and diverse enough to be easily utilized by a variety of online courses. This paper will describe the Introduction to Agroecology course development, outline specific strategies to promote active learning and student interactions used in this course, and share student evaluations and lessons learned complied after eight successions of teaching and "field-testing" this online course and general pedagogical methods to teaching online supported by other studies. The information in this paper can be valuable to the development of an online course in any discipline and hopefully will stimulate further communication about shared pedagogical strategies to successful online teaching and learning.

Course Description

The Introduction to Agroecology online course was first offered in fall 2005 and was developed to support a new undergraduate Agroecology Minor program at NC State University. A face-to-face section of this course had already been developed, so much of the course materials already existed but needed to be reorganized and formatted specifically for an online course. Throughout the agroecology course, students are required to critically analyze the sustainability of various agricultural systems and practices from a balance of the environmental, social and economic perspectives presented in the lecture materials, scientific readings, and case studies.

The development of this online course was initiated through an Innovation in Distributed Education Applications (IDEA) grant through the Distance Education and Learning Technology Applications (DELTA) at NC State University. This IDEA grant provided funds for the course development, educational training for the course instructor and focused support from a team of DELTA instructional designers. In the initial steps, the instructor participated in a Teaching and Learning with Technology Summer Institute to learn about the many resources, instructional technology tools and techniques available that can be used to support teaching and learning online at NC State. Participation in this summer training experience also provided the instructor a collegial environment to connect with other faculty teaching online courses across many disciplines at the university. Through the grant period and afterwards, the DELTA instructional designers worked with the course instructor to determine the appropriate technology tools and educational strategies for online instruction specific for the course objectives. Because agroecology is multidisciplinary and applies ecological concepts to agriculture for the design and management of sustainable agriculture and food systems (Francis et al., 2003), experiential and inquiry based learning play a fundamental role in agroecology education (Trexler et al., 2006). The course instructor worked closely with DELTA instructional designers to develop a course design format, instructional techniques, activities, and assessment tools aimed to engage students with each other and with the agroecology materials that promoted interaction and active learning in an online environment. Students logged into one central site for all course activities, WebCT Vista® 4.0, which was the primary online learning environment for in this course.

Because agroecology is a relatively new discipline and it was also important to develop a course that could serve as a model for other institutions looking to create web-based agroecology materials or courses. This course has been taught eight times by the same instructor with a total enrollment of over 90 students (average online class size is 12 students). The strategies and course components listed below are a compilation of key approaches to enhance active learning and student interactions in this online course and they have been refined from student feedback over the multiple offerings of this course. It is important to note that much of the course success and strategies for active learning would not be possible without the DELTA instructional design support and prompt technical support staff at NC State University.

Strategies to Promote Active Learning and Student Interactions in the Introduction to Agroecology Online Course

1. Creation of online student and instruc-

tor collaborative learning community. It was important early in the course to create a learning community that would encourage students to communicate and experience genuine interactions with each other and the instructor in an online environment.

Specific course components include:

• Use of WebCT Vista® for course online environment. Only students enrolled could access the course and all materials, activities, and communication through this one central program.

• Instructor introduction through a short video clip and discussion board message welcoming students the first day of class.

• Student introductions to each other through use of a discussion board where they were asked to describe their background, major, and interests. Students were also asked to upload a recent photo of themselves to the discussion board the first week of class.

• Creation of virtual student lounge where students could interact outside formal assignments. Several students (no more than 20% from each course) used these to share news headlines, on campus seminars or local events related to the course subject.

• Use of peer review for a topic paper assignment. Students were allowed to write their topic paper on any subject related to the course and approved by the instructor. The instructor then grouped students in pairs based on papers with similar topics. Students were required to review each other's paper through a peer review process where they a grading rubric developed by the instructor. They could virtually meet through a discussion board, chat or email to discuss their papers. This peer review grading was an important course component that not only helped students understand how to critically evaluate writing from a peer but also to develop a student's sense of community in a small group within a large online course. All papers were also reviewed and graded by the course instructor and the students also critiqued their peer review partner. Peer review critiques comprised only 20% of the total grade of the topic paper and the instructor had the ability to override the peer review grade if necessary.

2. Development of clear course objectives, educational goals and unambiguousness course assignments and deadlines. Some online students can have a harder time keeping up with course materials and assignments and can disengage and drop out of online courses more frequently than face-to-face students (Bernard et al., 2004; Carr, 2000). For this reason, it was important to make learning objectives, course assignment descriptions, and due dates as clear as possible and easily accessible to reduce student frustration in the online course.

Specific course components include:

• Course syllabus downloaded from main page that clearly describes course goals, assignments, grading and expectations. A lecture schedule with dates for completing assignments and lectures modules (twice a week) was also included to encourage students to designate a set amount of time each week similar to their face-to-face courses.

• Development of educational goals for each lecture module that defines what a student should know after reviewing materials. Students are encouraged to use these educational goals to prepare for exams.

• Use of a calendar tool to remind students of assignment due dates. Students can also use the calendar tool to add individual reminders and notes.

• Creation of "Steps to Succeed in the Course" document that outlines specifically what a student needs to do to succeed in the class. Although much of the information seemed intuitive to the instructor, students liked this "how to manual" suggested by a previous online student.

• Announcement function (as a pop up window when students log into the course) and email used to reiterate important assignment due dates.

• Development of clear grading rubric for topic paper (a high point value assignment), which was broken into smaller assignments spread throughout the semester including an outline, draft, peer review and revision process. Through this grading rubric, students understood how the instructor would grade the paper before they wrote it which resulted in more well written papers. This grading rubric was also used by students to peer review each other's papers. The students then used the two reviews of their paper to revise their paper in a final draft, which was also graded using the same grading rubric. The whole process of writing an outline, draft, peer review and revision process on a topic of their own enabled students to focus on a specific aspect of the course they found interesting. Understanding and valuing the process of review and revision, created an additional opportunity for individual interactions with the instructor and fellow students.

3. Transition away from typical PowerPoint lectures to creating integrated learning modules. Each previous PowerPoint based lecture was reorganized into integrated lecture modules that outlined overall learning outcomes and then broke up the information into 5-10 concise subthemes (Figure 1). The learning modules were html documents that contained both graphics and/or tables intermixed with text that the instructor normally would orally describe in a face-to-face lecture. The text was concise and organized in bullet points with main points or definitions highlighted so students would understand the emphasis on particular details. The emphasis on focal points through bold or highlighted text boxes in the online course were important to substitute for emphasis sometimes made through voice inflections or other methods in a typical classroom lecture. All lecture modules could

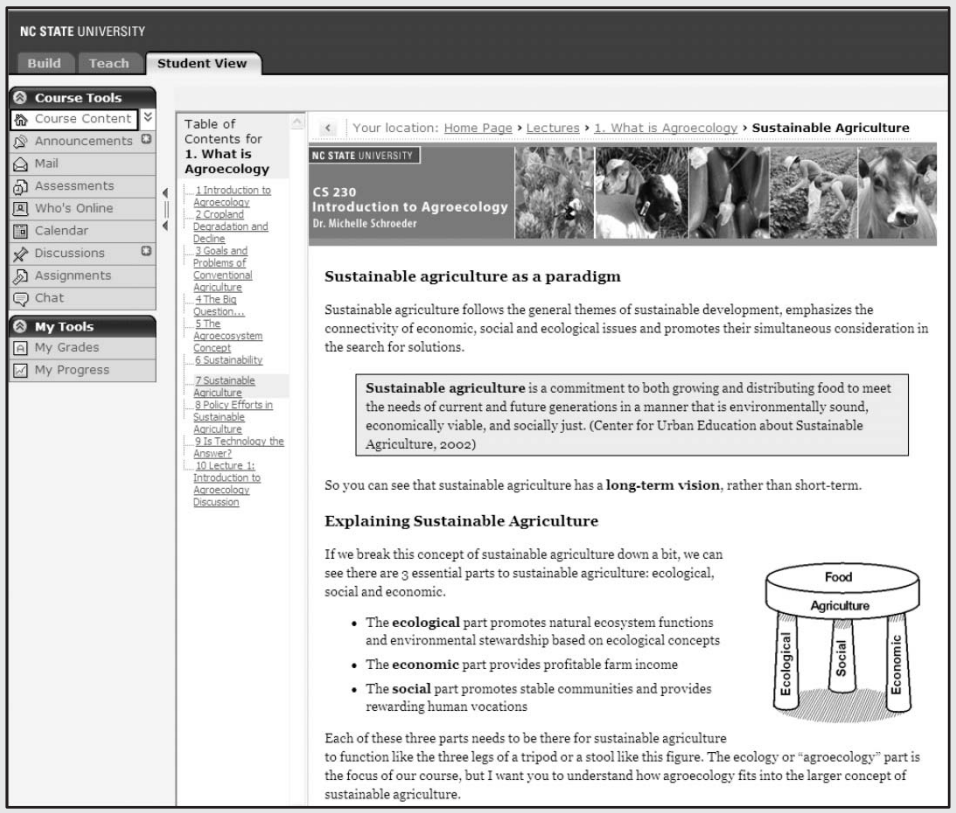

Figure 1. Screen shot from Introduction to Agroecology online lecture module from a student view of the course. The lecture module is organized in nine sub-themes and ends with a question for students to answer linking to a discussion board that is viewed in the Table of Contents (top left middle heading). Course tools (top far left) enable students to easily navigate to email, discussions, assignments, grade book ("My grades"), and other important course tools. The "Build" and "Teach" views are only accessed by the instructor where course materials, assignments, and grade book can be modified.

be printed for students to take separate notes on or to use for studying.

4. Use video clips and graphics to engage visual learners. Whenever there was an appropriate opportunity, the instructor would try to use videos or graphics to emphasize a point over text. Moreover, because agroecology as a discipline is very inquiry-based and multidisciplinary, the instructor often brought students to local farms or brought in sustainable agriculture experts from various disciplines into the face-to-face section of the course. These same learning activities were developed in the online course through the use of focused video clips. It was important to use the short video clips selectively to emphasize specific points or case study examples rather than using videos for all the lecture material. Moreover, the integrated learning modules described above allowed students to easily print the material, which would have been challenging to accomplish if all the lecture material was on video format. Additionally video files may be more difficult to update with new information but they very valuable to illustrate specific concepts in a visual format.

Specific course components include:

• Creation of a virtual farm tour of a local farm. The instructor worked with a local producer highlighted for his sustainable production practices and DELTA instructional video designers to develop short two to three minute video clips organized in topical themes on a virtual tour of the farm (e.g., "sustainable soil management," "managing crop diversity," etc).

• Development of a video clip that introduces the instructor to the students and provides overview of course.

• Development of four guest lecture videos, accompanied by PowerPoint presentations which introduced students to various sustainable agriculture researchers and experts from NC State and partner institution, NC Agriculture and Technical University.

• Increased use of figures, graphs and photos integrated in lecture modules to emphasize learning objectives.

5. Development of diverse opportunities for students and instructor to interact and communicate online. It was important to incorporate both graded and non-graded scheduled discussions throughout the semester to keep students engaged in material and with each other.

Specific course components include:

• Creation of six student-led discussions spread throughout the semester designed to develop students' critical thinking and oral communication skills on current topics in sustainable agriculture. These discussions were based on readings selected by the instructor that consisted of a farm case study and a scientific or theory paper that complemented a lecture module topic. All discussions occurred on a discussion board for a scheduled date over approximately a one week period. Student discussion leaders worked in small groups (2 to 4) and were expected to post questions the first day of the discussion and respond to other student posts. Students were encouraged to share individual experiences, opinions and respect the diversity of perspectives around the various topics. Students were graded both on leading a discussion and participating in discussions led by other students. Although there were always a few students that continually posted to the discussion

boards, many online students need an incentive to participate in discussions (Andresen, 2009), even if it consisted of only a few points.

• Integration of discussion questions into lecture modules that assessed periodic student comprehension of material.

• Creation of discussion board for student collaborative groups working on peer review or discussion assignments.

6. Diverse learning assessments and regular performance feedback. Various types of learning assessments were created to meet the needs of different learning styles in the online course. Immediate and individual feedback on the assignments also provided students with concrete information about their performance and encouraged continued student engagement.

Specific course components include:

• Development of five, short quizzes spread throughout the semester that focused on key topics from lecture modules. Quizzes were timed (15 minutes) and graded automatically, except when short answer questions were used. The instructor could incorporate individual feedback for each question and students could print graded quizzes with corrected answers and feedback.

• Use of a grade book that was continually updated and available for student access throughout the semester.

• Development of a topic paper assignment that assessed students' writing and analytical skills on an individually chosen topic agreed on by instructor. Students used research articles to support their topic and this assignment was broken into four graded components consisting of an outline, paper draft, student peer review, and final revision. After the paper drafts were turned in, the instructor paired students together in groups of two with similar topics and each student peer reviewed their partner's paper. The instructor reviewed and graded all papers and the students were given a grading rubric before they began writing and used this rubric to review peer papers.

• Use of cumulative final exam that integrated the use of multiple choice, fill in the blank and matching questions (similar to the quizzes) and a longer essay question. This was also timed (two hours) and the instructor could also provide individual feedback on each question.

7. Provide prompt feedback and personal contact with individual students within and outside of the online environment. It was very important to maintain continual communication with students and to answer students' questions over email promptly in the online course, more so than in a face-to-face course. It also became important to inform students at the beginning of the online course to expect a 24 to 48 hour response time from the instructor because some students expected instantaneous responses to their emails. Physically meeting with students (when possible) also became an increasingly important strategy after the course had been taught a few times to help keep students engaged in the class early on and help students feel that instructor is a real person that they can come see or call when they have questions.

Specific course components include:

• Required face-to-face meeting (or individual phone call if students could not meet) with students and instructor in the first week of the course.

• Use of email (within WebCT Vista® 4.0) to communicate with individual students about their progress or answer any questions. Instructor checked email daily and responded to student emails promptly. Emails were also sent to students early on in the course if instructor observed they were falling behind.

• Encouragement of students to come see instructor in person or call if they had any questions about the material or assignments throughout the semester.

Student Feedback and Evaluations

Student feedback and evaluations of the Introduction to Agroecology online course were compiled from NC State University official course evaluations from spring 2007 thru spring 2009 and from post-course surveys from fall 2005 thru spring 2009. Because the web-based evaluations for online courses were not initiated until spring 2007 at NC State, the instructor developed post-course surveys early on as a way to obtain student feedback and continually improve the course. Development of a post-course survey also allowed the instructor to develop questions about specific assignments and learning aspects of the course that a general university evaluation does not include. Moreover, individual ratings on overall student satisfaction alone are not enough to effectively evaluate student engagement and interaction, which is another motivation for assessing student responses to specific course assignment and instructional strategies through multiple question types (Likert vs. open ended questions) and course evaluations. Questions and mean student responses based on a Likert scale (same scale used for each evaluation) from the NC State course evaluations and instructor post-course surveys are displayed in Table 1. Questions from the post-course survey that were repetitive with the official course evaluation were omitted. The instructor also included a few open-ended questions on the post-course survey to capture additional student opinions and perspectives and a selection of the most predominant responses are displayed in Table 2. The predominant answers displayed were representing a selection of responses based upon criteria if 30% of all students responded with similar answers to the post-course survey from fall 2005 thru spring 2009 (excluding fall 2006). Average student response rate to the NC State course evaluations and the instructor

post-course surveys were 69% (N= 46) and 75% (N=65), respectively. Key findings from the evaluation and survey results are discussed below.

Overall, students found the online Introduction to Agroecology course to be a positive learning experience indicated by their high ratings from the NC State course evaluations ranging from 4.29 to 4.55 and from the instructor post-course surveys ranging from 3.97 to 4.64 (highest score is 5 for each survey) (Table 1). From the NC State course evaluations, some of the highest scores were in agreement with the statements concerning the instructor responded to the unique needs of distance learners, the instructor effectively used instructional technology, the instructor was receptive to student questions, the course improved subject knowledge and the course readings were valuable learning aids (Table 1). These student responses indicate that how an instructor communicates with students and what they do to create a collaborative learning environment is as important as the course materials or technology used online. Students expressed that they liked the course readings used in the student-led discussions, which were a mix of real farm case studies, scientific journal articles, and book chapters, because they reinforced the information from the lecture modules. The lowest score (but still 4.29, which indicates agreement) was found for the statement that the instructor gave prompt and useful feedback. Responses to this feedback question differed considerably (greatest variance). In initial semesters of teaching the course before the suggested response time was initiated, responses to this question were slightly lower. From the instructor post-course surveys, the highest score (4.64) was in agreement from a statement focused on the lecture module format and organization.

From instructor discussions with students and open-ended post-survey questions, students indicated that they liked having the educational goals at the beginning of each lecture module and the highlighted boxes of important bullet points because it helped them focus on the important aspects of each lecture module and effectively study for quizzes and the final exam. Many also indicated that they liked that the lecture module was divided into smaller, concise sub-sections because it didn't feel overwhelming to read or understand. The lowest score (3.97) received from a statement in the post-course survey was centered on the student-led discussion assignment. Responses to this question also differed greatly among students and some students may have not agreed with this statement because of lack of understanding about how to lead a discussion, frustration with working or communicating with other group discussion leaders or missing the purpose of communicating with peers. Some lack of agreement with this question did not agree with many of the positive responses about the discussions received in the open-ended questions of the post-course survey.

The most informative student feedback came from responses to the open-ended questions of the post-survey (Table 2). When students were asked what learning activities influenced their learning most in the course, many responded to an aspect of the learning modules. Some indicated they liked the shorter sub-sections, the educational goals listed in the beginning of each, the integrated discussion board questions, the different visual components from guest lectures, videos, figures, or how information was displayed in tables. A variety of students articulated that they liked the student-led discussions because the readings provided real-life examples of sustainable farming practices and gave students opportunities to interact and relate to each other (see Table 2). The instructor tried to limit posts to these discussions and provide an environment where students felt discussions were student-owned and not intimidated to articulate their opinions. Because student backgrounds and experiences with agriculture were very diverse, the instructor always reminded students about respecting different opinions before these discussions occurred. This diversity of perspectives never posed a problem in any of the discussions and quickly become a strength of the course when these diverse student experiences were valued in this way. There were only a few responses (less than 30% and therefore not displayed) to this question found the peer review process to influence their learning. Although the peer review process and grading rubric was clearly explained, some students lacked confidence in their ability to critique their peers or found the instructor's review more valuable than their peers. Although not highly valued among students, the instructor continues to utilize this educational method for their topic paper assignment because of the skills gained through the process of peer review and revision of writing, even if it didn't enhance student interactions to a great deal online.

When students were asked to give advice to future students in the course, many responses were simple and clear messages to stay on top of the syllabus, lecture modules, and assignment due dates (Table 2). Many students said to make time for this online course and treat it like “real” class, similar to face-to-face courses. Even though there were students who had taken online courses prior to this course, many perceived online courses weren't as real or as rigorous as face-to-face courses. With that initial attitude, some students were surprised by the expectations in this online agroecology course and had a harder time keeping up with the course assignments. The instructor made additional efforts to send reminders about assignment deadlines and expectations, email individual students and enter grades in the online grade book promptly with individual feedback. Sometimes a zero grade for a smaller assignment early in the course was enough to motivate and remind students to keep up with the course.

Student responses to the post survey questions also emphasized to ask the instructor questions and meet with the instructor when needed. When students were asked for any additional comments or suggestions in the post survey there were a diversity of responses that ranged from making the time for taking the quizzes longer (the instructor did increase the time for these after that suggestion) to commenting how easy it was to fall behind in an online class. A number of students also responded how much they enjoyed communicating with other students in the class and that discussions made the course more "social and interesting." This emphasized the value of creating opportunities for communication and interactions among students and the instructor in the online class. The instructor valued these post-survey questions greatly since many of these responses and ideas for improvement would not have been evident from the NC State course evaluations.

Table 1. Course Evaluations Complied from NCSU Evaluations from Spring 2007x thru Spring 2009 and from Post-Course Survey Questions Developed by Instructor from Fall 2005 thru Spring 2009 (excludes fall 2006). Open-ended Questions from Post-Course Survey are Displayed in Table 2 and Repetitive Questions with the NCSU Course Evaluation were excluded. The Response Scale was the Same for Both Evaluations.

Evaluation Questions	N	M[y]	SD
Official NCSU course evaluation questions:			
1. Overall, the instructor created an effective distance learning environment.	32	4.42	.68
2. The instructor responded to the unique needs of distance learners.	32	4.54	.65
3. The instructor provided sufficient opportunities for interaction among students.	32	4.48	.68
4. The instructor effectively used instructional technology.	32	4.54	.68
5. The instructor gave prompt and useful feedback.	32	4.29	.90
6. The instructor was receptive to students questions and concerns.	32	4.55	.61
7. The instructor stated course objectives/outcomes.	32	4.40	.75
8. This course improved my knowledge of the subject.	32	4.53	.52
9. The course readings were valuable aids to learning.	32	4.54	.63
10. The course assignments were valuable aids to learning.	32	4.51	.55
Post-course survey questions:			
1. I felt the format of the lecture modules was organized and made clear points.	65	4.64	.42
2. I felt the quizzes were fair and tested what we learned in the course.	65	4.11	.80
3. I felt the student-led discussions were useful and I would keep them as an assignment.	65	3.97	.68
4. Writing the topic paper was a positive experience and I learned a lot about an aspect of agroecology.	65	4.14	.68
5. Sufficient instructions were given to complete all assignments.	65	4.38	.69

[x] NCSU course evaluations of online courses were not made available until spring 2007.
[y] Scale: 1= Strongly disagree, 2= Disagree, 3= Neither agree nor disagree, 4= Agree, 5= Strongly agree

Lessons Learned

After eight consecutive semesters of teaching this Introduction to Agroecology course online and analyzing student responses from various evaluation and survey questions, there are number of lessons learned that can be valuable to the development of online courses in any discipline. The lessons learned described below are meant to provide ideas for successful strategies and a running start to individuals new to developing online courses. They are also meant to stimulate those currently teaching online and create a dialogue about effective instructional strategies used in web-based learning. Although these lessons learned were developed from experiences teaching this online agroecology course, several of these parallel the Seven Principles for Good Practice in Undergraduate Education (Chickering and Gamson, 1987) and therefore germane to traditional face-to-face courses as well.

1. Learn about the resources available at your institution and from others currently teaching online. This is a fundamental step for those interested in developing online courses with no prior experience. Not understanding the technology or resources needed for teaching online is a primary obstacle instructors identify for developing new online courses (Maguire, 2005). Many institutions have distance education staff, departments and resources (including funding) that can help instructors design new online courses. It's also important for faculty currently teaching online courses to communicate across disciplines and share similar challenges and educational strategies in a collaborative learning community. Such networks may exist or can easily be formed and supported within many intuitions or across institutions.

2. Field of dreams myth. Although some may feel if "you build it, they will enroll and succeed," for most instructors currently teaching online courses, they understand the value and success of the course will depend upon how it can evolve with various student learning styles and keep up with changing course information and technology. Online courses should be developed to accommodate various types of changes

Table 2. Student Responses from Open- ended Questions on Post-Course Survey Compiled from Fall 2005 thru Spring 2009 (excludes fall 2006). Selected Responses Represent Predominant Responses from 30% or Greater from all Students for Each Question

1. What learning activities most influenced your learning? Please describe
• *I liked the variety of using recorded lectures as well as lecture modules (the goals stated for each lecture module was very helpful). I think it was helpful to have quizzes along the way to measure how much I had learned. However, I was always very nervous about the quizzes since they were timed.*
• *The lecture questions and student-led discussions provided the most influence on my learning because it required me to interact with my classmates and to use critical thinking skills.*
• *I liked the student-led discussions because they gave us real-life examples of farming practices. It also gave every student a chance to voice their opinions and hear those of others in the course. It helped each student relate to one another.*
• *The shorter sections of the lecture modules made it a task that was not daunting. The charts and pictures that accompanied the lecture modules helped. As a visual learner, these helped me learn and remember more of the notes.*
• *I liked having the educational goals listed at the beginning of each lecture module. I also liked the guest lecture videos, just to hear the material audible helped. I also liked whenever information was displayed in a table or chart form. This really helped me visually and mentally organize the information.*
• *All the videos- I'm a visual learner.*
2. What words of advice would you offer to a future student in this online class?
• *Use the course syllabus and immediately mark the assignments and due dates in your personal calendar. Choose 3 hours per week as if you had class and do your work then, just like you were attending a traditional class.*
• *Check WebVista daily, do not get behind and really put the effort into the class discussion as it can benefit everyone.*
• *Keep the syllabus posted near your computer and put sticky notes somewhere as reminder for assignments. Otherwise, out of sight is out of mind.*
• *Do the work on time. Keep up with the lectures/discussions/assignments and paper. It's simple but it makes the class and material much more enjoyable and stress free. Also, get involved and ask questions. It's a lot easier to ask questions one would otherwise probably not ask in front of a class full of peers.*
• *If you have a question, ask. The teacher is always willing to help, you just must ask for it.*
3. Any additional comments or suggestion on any aspect of the course?
• *At first I did not see any value to communicating with other students, but eventually I found that I was reading everything that they were posting! This "social" part of the course actually made it more fun and interesting.*
• *The topics are presented in an easily-understood manner with picture, graphs, maps, videos and relevant assigned readings. Some students may feel overwhelmed by the amount of work involved but I enjoyed the feeling of being challenged.*
• *I felt I slowly fell behind as the semester went on. I know it is my responsibility to keep up with the course material, I just found it difficult to balance as online course with a full schedule of actual classes.*
• *I would have liked more time on the quizzes. I felt anxious when taking them and therefore did not do very well on those.*
• *The length and diversity of lecture materials is efficiency and effectively used in a way that students are not bombarded with readings that they never read and never use. I would also like to add that agroecology should be a required course for all students in CALS especially with the changes and needs that are arising in agriculture.*

easily and instructors must continually strive to understand the specific course audience and their needs and challenges (Mupinga et al., 2006). Additionally, new online courses may not have immediate enrollment and may be slower to build student interest and awareness than traditional face-to-face courses. Because of this instructors may need to advertise online courses in new ways within their institutions and outside the institutions to networks of similar disciplines.

3. Online courses are not static and must be updated regularly to be relevant and interesting. Students can see right through course materials and information that have not changed in years. For this reason, it is essential to consider a course format, delivery of materials (e.g., how to update information in audio or video files), and learning environment that facilitates change and updating specific information with ease early in the development of an online course. Updating the course with relevant materials, discussing current news related to course topics, engaging different external experts (farmers, extension agents or related faculty in the case of this agroecology course) will connect the course to real-life topics and keep students engaged and interested in the course.

4. Learning is a social process– Instructor facilitated and student owned. Activities and assignments for online courses should be developed to promote active student participation in their learning (Phillips, 2005). Working with others, sharing one's ideas, and responding to others' often increases student involvement in learning. This can be achieved no matter what discipline; through providing diverse opportunities for communication and engaging students in discussing real-world problems and sharing their own experiences through formal or informal assignments. This can also be accomplished even if the online class size is large through creating smaller student learning communities of two to five students focused on specific questions or topics. In addition to utilizing discussion board, chat or videos described in this course, there are new technologies, such as virtual worlds and use of avatars that can provide students a shared virtual environment where they can see, hear and modify artifacts together which

can also work to engage students in a collaborative learning community (Franceschi et al., 2009). Engaging students in discussions and interactions can stimulate teaching and learning in online environments, but it must be developed carefully to achieve course goals and learning objectives no matter what technology is used (Zhu, 2006). Development of an online learning community is fundamental goal where good learning is collaborative and social, not competitive and isolated (Chickering and Gamson, 1987).

5. Set educational goals, guidelines, and schedule and stick to them. Clearly stating the educational objectives for the overall course, each lecture module and individual activities not only makes the expectations understandable and achievable for students but also allows instructors to effectively assess them. Clear and obvious assignment due dates and descriptions are essential to alleviate student frustrations in online courses, where information may seem less apparent or accessible than traditional classroom courses (Hara and Kling, 2001).

6. Technology is helpful but not enough alone to demonstrate successful student learning online. Technological tools and programs that are used in online courses need to reflect specific educational goals within the course. Educational technology, programs and communication tools are increasing at a rapid rate, much faster than most instructors can keep up with. It is enticing to implement the latest technology in online courses; however, each tool should only be used for a specific purpose or enhancement of a course educational objective. It is much easier and worthwhile to assess what educational technology, communication tool or learning environment is the best to help achieve specific learning objectives and enhance student active engagement with the material. When assessing online course effectiveness, Rovai and Barnum (2003) found only active interaction was a significant indicator of an online student's perception of their own learning. Moreover, many student frustrations in online courses are derived from pedagogical issues rather than technical ones (Kanuka, 2001). Our most important goal, therefore as online educators is to develop sound pedagogical strategies to enhance active learning first and then the appropriate technologies to accomplish this will follow. With that in mind, it is also important to understand the various student learning styles, backgrounds, any accessibility or other specific challenges to select the most appropriate technology or communication tool for the specific course audience (Mupinga et al., 2006).

7. Prompt and consistent feedback and assessment is fundamental. Timely instructor responses to student questions and frequent communication, especially early in the course, are essential for students to assess performance. Prompt and informative feedback as well as additional care in creating course materials, assignments and instructions that are clear, well organized and easily accessible can also help decrease student's sense of isolation and frustration in an online course (Bray et al., 2007; Hara and Kling, 2001).

8. Encourage as much personal communication and face-to-face interaction as possible. Face-to-face meetings (when possible) and personal communication through phone calls or individual emails has become an increasingly important means of helping students feel engaged in this introductory agroecology course. Early and frequent personal communication with students, beyond just email, helps promote an environment where students feel that the instructor is concerned about their individual needs and can be easily contacted with questions about any aspect of the online course (Minich, 1996). Moreover, a meeting at the beginning of the course with all the students and instructor allows opportunities for students to meet and interact with each other in person, which encourages more student communication throughout the online course.

9. Online courses require evaluation and need to be valued for promotion and tenure. Although all would agree with this statement, we have been slower to design and implement effective evaluations for online courses. The way we evaluate online courses and the questions we ask should differ from traditional face-to-face courses. Moreover, as collaborative and interactive teaching strategies have been shown to increase the effectiveness of student learning online, they also need to be specifically evaluated, which means rethinking traditional evaluation methods (Swan et al., 2006). As online instructors, we need to continually assess what and how we are teaching to improve the learning experience for students. Achieving excellence in online education at the individual or institutional level requires adequate support, training for faculty and recognition of value for promotion and tenure responsibilities, similar to face-to-face courses (Bray et al., 2007).

Summary

The student evaluations and feedback accumulated over eight semesters from the Introduction to Agroecology online course demonstrate the value for opportunities for active and interactive learning, frequent and constructive instructor feedback, clear expectations and personal communication and guidance in an online learning environment. Although all of these are also essential to successful face-to-face courses, activities and instructional strategies to enhance active and interactive learning must be prominent in the design and implementation of online courses to be successful (Fulford and Zhang, 1993; Rovai and Barnum, 2003). Online students need to feel that they are part of an interactive and collaborative learning community, even in virtual space. The instructional strategies to enhance

interactive and active learning, evaluation process, and lessons learned described here are general and diverse enough to be easily utilized by a variety of online courses in various stages of development. This paper is also meant to stimulate further communication on successful pedagogical strategies to online teaching and learning.

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