

**From Academia to the Farm:
Adapting Asynchronous Distance Learning to a Diverse Group of Students**

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Abstract

A distance learning graduate level course which used the Internet as a component of the instruction delivery method was offered to South Carolina middle and high school teachers, county extension agents, elementary and junior high teachers, and university students. The course focused on the following agricultural topics: Water Quality, Biodiversity, Conserving Soil Resources, Money Matters and Energy. The major objective was to help the students understand the roles of various agricultural sectors in food production and help them develop course materials and lesson plans to use in their classrooms. The course began with a face-to-face introduction which included a hands-on computer training workshop. During mid-semester, the students attended a field trip. The students utilized printed materials (distributed during the introduction), videotapes, the Web, a Listserv and real-time chat sessions to learn the material and complete assignments and exams. The discussion includes observations by faculty and students of course organization and implementation as well as strengths and weaknesses of this style of distance learning. Collaboration between schools and universities within small states and other countries will increase the usefulness in developing and delivering distance education courses. Based on the results, a model for small states is discussed.

Introduction

High school science teachers are always looking for courses with materials to enhance their curriculum. Materials related to agriculture are particularly desirable, since they have a defined scope and allow for practical discussions of science in the context of the “real world” (Albers, 1995). Other agricultural professionals, like

extension agents, who not only advise farmers but also teach youth about environmental concerns, benefit from instruction about the interactions between agriculture and the environment. Thus, a course in sustainable agriculture that exposes teachers and other professionals to the modern technology of food production while emphasizing the importance of the safe use of our natural resources would be very useful.

The principles of successful agriculture are sufficiently diverse to provide lesson opportunities in basic sciences such as biology, chemistry, physics, earth science and ecology. An appropriate course exposes teachers to the innovative technology of modern agriculture and to the importance of the sustainable use of the natural resources. Genetically engineered crops, more efficient field machinery and precision farming using satellite technology for farm management are now commonly implemented.

Topics and projects related to sustainable agriculture improve the student's perception of agriculture and create the possibility of garnering students who might be disposed toward a career in this field. Such projects provide students with the knowledge that agriculture and related careers encompass a wide spectrum of possibilities.

Because teachers are restricted in travel and non-classroom related time during the school year, distance learning becomes an attractive alternative for teachers who want to attend university courses. Distance learning also offers educational opportunities to teachers and others living in rural communities. There are different delivery techniques used for distance education. Universities have progressed over the past 120 years from correspondence courses and films to videos, satellite linking, cable television, computer aided instruction, and, most recently, conferencing via the Internet (Telg, 1996).

In 1990 and 1991 the Agronomy Department at Clemson University offered a distance learning graduate course on Plant Biotechnology targeted at high school teachers (Ferguson, Adams and Franklin, 1992). This was the first distance learning course offered by the department. The course used a text, thirty-six videotaped lessons, eight live closed circuit sessions and two Saturday lab sessions. The overall objective of the course was

to update and strengthen the knowledge of teachers in the use of modern genetic and biological techniques in agriculture. Evaluations indicated that the students liked this format for a distance course. Further, more literacy in the role of biotechnology to potentially solve many agricultural problems was achieved. This report describes another approach to distance learning that was subsequently developed and utilized.

A sustainable agriculture course titled "Agricultural Sustainability: Environmental Factors", which used almost exclusive delivery through the Internet, was developed at the University of Florida at Gainesville and offered through the University of Florida, the University of Kentucky at Lexington, Auburn University, South Carolina State University and Clemson University. The course development was supported with funds obtained by the University of Florida from the US Department of Agriculture Telecommunications Program for a regional project, "Reaching Secondary School Teachers through the Electronic Classroom". Compared to other methods of distance learning, such as video courses or live satellite instruction, the advantages of an Internet course are: first, it allows for greater personal interaction between the students and instructors through the Listserv and chat sessions; second, it allows much greater time flexibility than a televised real-time instruction where students must meet at a designated facility for scheduled instruction; and, finally, it expands resource opportunities through access to the World Wide Web and the potential to communicate with specialists throughout the world (Mayadas, 1997).

The Internet instruction offered at Clemson University used some of the materials provided by the University of Florida but the instruction was significantly modified to suit the needs of the students and teaching styles of the instructors. The course was approved for South Carolina Teacher recertification and graduate school credit.

Course Objectives

The objectives of the course were:

1. To offer a graduate level course to junior and senior high school teachers that would help them analyse and discuss the linkages between the food production system and the environment;
2. To help the participants design, teach and evaluate curriculum materials obtained primarily through the World Wide Web which they could incorporate into their current teaching materials;
3. To help the participants develop computer skills to access information and use the Internet as a tool for teaching and exchanging ideas;
4. To network and exchange ideas with participants from other disciplines across state boundaries;
5. To provide a course that could be used for teacher recertification in science, biology, chemistry, or health.

Course Content

The written material consisted of a detailed syllabus, a series of five modules in separate spiral bound packets and a "Readings and Exercises" packet of supplemental articles from professional journals. The modules were developed by the faculty at the University of Florida in Gainesville and at Auburn University in Auburn, Alabama. Each module served as an independent unit to cover one of five topics. The five modules were water quality, biodiversity, conserving soil resources, economics and energy. Videotapes, which gave a brief introduction and overview for each module, were developed at the University of Florida.

Course Delivery and Structure

The three-credit graduate level course was offered at Clemson University during the fifteen-week fall semester, 1996. It was listed in the course catalogue for the Crop and Soil Environmental Science, Education, Agricultural Education, and Biology Departments, since the course content was relevant for several disciplines. The course advertisement and registration were coordinated by Telecampus, which is responsible for the development, implementation, and evaluation of televised delivery to off-campus sites. The primary method of advertisement was a mailing to all middle and high schools in South Carolina near the end of the 1996 school year and again near the end of the summer. The Clemson University Telecampus office organized and processed the course registration and student inquiries regarding computer hardware and communication requirements necessary to participate in the course.

The course offered at Clemson University utilized the expertise of three core professors for instruction, with support from a computer technology assistant and a teaching assistant. One guest professor from the Crop and Soil Environmental Science Department led the chat discussion for the biodiversity module and another guest professor from the Aquaculture, Fisheries and Wildlife Department led the aquatic insect investigations during the mid-semester field trip held at the Clemson University campus.

Even though the majority of the instruction occurred over the Internet, at the beginning of the 1996 fall semester, registered students came to Clemson University for a five-hour Saturday orientation and workshop. The students received the syllabus, instructional materials for each of the five modules, a packet of additional reading materials, and videotapes produced and duplicated by the University of Florida. The

syllabus contained detailed information about the instructors,Telecampus,prerequisites,curriculum schedule, course description, learning objectives, course material,and the course evaluation.Initially, the participants were given an overview of the course and the objectives. The training session also served as a means for clarifying questions about the course and a chance for the participants to get to know each other as well as the instructors and teaching assistants, since there would be limited face-to-face contact through the rest of the semester.

The university computer centre provided personnel to help with the initial computer training. With the assistance of the computer centre staff, the students were given hands-on training in a computer lab so they could learn how to use the Listserv to access the discussion list, access Web pages and download Netscape Chat onto their hard drives for the chat sessions. Auburn (1996) surveyed users of an electronic Sustainable Agriculture Network. She found that among the early adopters of Internet technology, use of the more complex Internet tools and functions such as Web searches was less common than the use of e-mail. We likewise found that many of the students were already familiar with the use of e-mail but had previously never or rarely used the more advanced tools such as Web browsers or chat capabilities.

The Listserv is an asynchronous means of electronic communication similar to an e-mail distribution list. In our case,all the instructors and students were subscribed to the list. An e-mail message sent to the Listserv username would go out to all the subscribers.A reply to the Listserv is delivered to all the subscribed members. It serves as a “slow motion” conversation with everyone or as an electronic “bulletin board”.The university postmaster at the computer centre created the Listserv. Netscape Chat is one of the

many software programs available for establishing the capability of a live synchronous chat session and can be installed on the hard drive directly from the Web. With a chat session, all the participants use a selected name to enter an electronic “chat room” housed on a server.The live chat is similar to the Listserv but has the added advantages that the sent messages are instantly received,previous messages are saved and scrolled above the new messages on the computer screen, and there is a “chat room” moderator (the instructor or teaching assistant) who has control over who is allowed to enter the chat room. A person can converse with the others as fast as he or she can type.

Web sites were used extensively as a resource for subject related information. Since the course was designed primarily for high school teachers,many assignments required that they scan the Web or investigate library resource materials for classroom projects that coincided with the module being discussed. The students used information from their Web site investigations and other sources to create lesson plans which were submitted via e-mail for grading. The instructor(s) selected the best lesson plans and posted them on the course’s Web home page so that the other students could review and download them for use in their classrooms. Thus, the students had ready-made lesson plans available for use in topic areas such as biology, chemistry, physics, or ecology. The students often found additional interesting Web pages through their own investigations and shared their findings with the other students via the Listserv.The class Listserv was the primary means of communication between students and faculty.

Throughout the course, faculty members led the instruction for the various modules relevant to their expertise. Assignments were posted on the Web or sent out on the Listserv. Each of the five modules encompassed readings from the spiral

bound modules, readings from professional publications, role play and questions on the Listserv, investigative research assignments, the exploration of Web sites, and the culmination of the module with an online chat.

In mid-semester, the students returned to the Clemson University campus for a one-day field trip. The objectives were to reinforce what they had learned on the Internet with hands-on field experience and also to reestablish face-to-face contact with each other. The first stop for the field trip was the Clemson University Botanical Gardens to observe organic methods of crop production. Two graduate students from the Entomology Department had set up insect traps the day before to assess the ratio of beneficial insects to damaging insects. The traps included sticky traps, sweep nets, and pit-fall traps. The next stop was a conventional vegetable farm where pesticides were used regularly. The insect traps likewise had been set out in those fields to make the beneficial vs. damaging insect population comparisons. A professor from the Aquaculture, Fisheries and Wildlife Department led an examination of the nearby stream fauna to assess the impact of erosion from agricultural lands. The final stop was a mountain stream where the guest instructor demonstrated the greater diversity and population of fauna in an undisturbed stream. This last stop was the most popular with the participants because they were able to see a much greater diversity of fauna than observed at the previous stops. Subsequently, they were able to fully appreciate the impact of the environment on biodiversity.

Module exams were sent out on the Listserv. The participants responded by sending their test answers to both the instructors and the teaching assistant by e-mail. Questions were generally in an essay form which required individual responses. A final exam was created by the three

core team members of faculty and distributed via the Listserv. A survey was also distributed at the end of the course to determine the student's assessment of the effectiveness of the course delivery and its content.

Grade Assessment

Assessment of student performance encompassed various aspects of the course. Students were graded for their performance at the introductory workshop and field trip, individual and group projects, module exams, and the final exam. For some assignments, students were assigned an e-mail partner. As in normal class situations, some groups worked together well and in other cases, one of the partners would not make an equal contribution. In those cases, the team members would be regrouped with different students. The student's final grade was based on performance in the following areas: introductory workshop and field exercise (20 percent), module tests (30 percent), class participation and assignments (20 percent), final project (20 percent), and the final exam (10 percent).

Student Population and Course Evaluation

The students came from a wide variety of backgrounds. Of the twelve students, three were graduate students at Clemson University. The off-campus students were four county extension agents (one from South Carolina and three from Georgia) and five South Carolina public school science teachers (one elementary, one middle school, and three high schools). The diversity of this group allowed for interesting interaction, especially on the Listserv and during the chat sessions. The county agents were especially helpful in bringing real life experiences to the discussions.

A questionnaire was distributed to all the students at the end of the semester. Table 1 shows the questions and a summary of the responses received. The reaction to course content was favourable. The mediocre response to the comment "The computer workshop adequately prepared students for using the computer" was likely due to the initial problems several students had accessing the Web page, using the Listserv, and participating in the live chat sessions. The computer workshop enabled the students to do all these skills hands-on but when some attempted these functions later, they encountered various problems with their computer hardware and software, Internet provider, or access to the chat room. Our computer technology teaching assistant provided aggressive follow-up support so that after the first two weeks, everyone could carry out all the required Internet functions.

The majority of the students thought that the Internet was an effective teaching tool. In several written responses, however, there were complaints that there was too much "busy work" and the county extension agents were especially opposed to creating several required lesson plans. In future course offerings, an alternative would be to allow the county extension agents to develop materials in a style more conducive to a field day presentation. The county extension agents also wanted a stronger emphasis on agriculture and thought that the course covered some topics that strayed away from agriculture.

When asked for a written response regarding their perception of the effectiveness of Web searches to research various topics, the majority listed the following advantages: they could study when they were mentally ready (not at a fixed class time), they could freely explore a wide range of topics, and they could access more information than available in local libraries. This is especially true for those living in rural areas.

When asked for the advantages of Internet learning, the students unanimously answered that it was the absence of commute time. When asked, "What critical elements do Internet courses lack when compared to traditional classroom courses?", the dominant response was the lack of face-to-face interaction. The students thought that there was a benefit to observing body language, hearing voice inflection, and taking advantage of informal socializing after class time. One student said that he missed the instant responses to questions that he would get in a traditional classroom, whereas if one uses the Listserv, responses to questions might be delayed several hours or even as long as a day.

Discussion

The aspects of this Internet course that the students liked the most were the online interactions with the instructors and other students, as well as learning how to use online searches and communications. The students thought that the course material was useful for their jobs. They enjoyed the field exercise, which they thought was effective in enhancing their knowledge.

The students described two major drawbacks of the course. They were the excessive number of assignments and occasional problems accessing the server for the afternoon chat sessions. When the server was down, the students would have to resort to the Listserv to communicate and work out a strategy for another server option for the chat. Of lesser, yet significant, importance, the students missed the personal interaction found in a traditional classroom. Many students thought that seeing body language was an important part of transferring information. Some disclosed that they missed the informal chatting that often occurs after a traditional classroom session.

Table 1 • Summary of student evaluations

Questions	Number of Responses				
	SA	A	N	D	SD
Course content:					
The course gave me new viewpoints	7	3			
The course stimulated my interests	6	3		1	
The course made me want to learn more about the subjects covered	3	5	1	1	
The course improved my ability to interpret and evaluate information		5	3	2	
The computer workshop adequately prepared students for using the computer		3	3	4	
The field exercises improved my knowledge of the subject matter	5	4	1		
I can use the subject matter in my job related activities	4	6			
The course helped me learn how to use the Internet	6	3	1		
The field exercises and computer workshop enhanced my feeling of belonging to a class	4	4	1	1	
Effectiveness of the Internet:					
The chat sessions were helpful for the course	2	3	2	2	1
I liked the sense of flexibility afforded by this course	3	6			1
Online interactions with instructors were valuable in understanding the subject matter	3	4	2	1	
I plan to continue online searches and interactions with others about subjects covered in the course	4	5	1		
I would NOT take another on-line course			3	3	2

Response key: SA=strongly agree; A=agree; N=no opinion; D=disagree; SD=strongly disagree.

An attempt was made to contact as many of the students as possible about six months after completing the course to ask if they have used or plan to use any of the course materials in their jobs. Three of the students responded: one middle school teacher, one county extension agent and

one graduate student. The middle school teacher said he used the Conserving Soil Resources materials at a “Geofest” event for geography teachers and in his earth science classroom. He also used the Water Quality module information in his earth science classroom. The county

extension agent reported using the information in working with organic farmers and he also used the information on stream biodiversity to help provide a local county commission with direction regarding monitoring stream pollution. The graduate student said that the course forced her to become knowledgeable on Internet use and she has since used her Internet skills with several other courses to research topics for presentations and papers. Additionally, she has used this knowledge to search for possible funding sources for some of her projects and converse with people at other universities to learn details about their research.

From an instructor's perspective, there were often a large number of e-mail messages to read and respond to each day. Twenty e-mails a day was not an unusual number. In a face-to-face classroom situation an exchange of ideas can happen very rapidly with oral communication but when each response has to be typed, it can be very time consuming. We feel that perhaps an enrollment limit of fifteen students should be enforced to maintain a manageable number of e-mail messages if only one person is responsible for responding.

Application for Small States

The two simplest tools used for the course have subsequently been used for four multi-week inservice trainings delivered to county extension agents from six US southeastern states. The instruction was limited to use of the Web to display all the reading material and the use of a Listserv for questions and answers between the county agents and the professors. Chatrooms were avoided to prevent problems with server availability and to keep the instruction truly asynchronous. Posting all materials on the Web eliminated handouts. Anyone who has the most

basic knowledge of the Internet knows how to access Web pages and send/receive e-mail. Since the course was offered, many software programs such as Web CT have been developed to facilitate online instruction but the authors believe that effective instruction can be delivered with only the two previously mentioned tools. For the students who have participated in Internet courses and training, the lack of travel requirements and the asynchronous method of communication have always made it very popular. As computers and the Internet become more accessible throughout the world, this approach for information transfer can be a valuable method of instruction over large distances.

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