

## **Restructuring a Plant Propagation Course for Distance Education**

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### **Abstract**

**The development of strategies to reach students who are place-bound due to their job, families, or community responsibilities is an important opportunity for land-grant colleges. University of Florida (UF) currently has 13 satellite programs where various undergraduate degrees in agriculture are offered. The onset of interactive video has created an opportunity to merge the on site and off site classes into one united class and to improve the effectiveness of educational programming. Although distance education has been around for many decades in different forms, UF is structuring a new concept of bringing the state-wide expertise of faculty and the diversity of students together via interactive videoconferencing and web-based technology.**

### **INTRODUCTION**

The development of satellite programs by the College of Agriculture and Life Sciences (CALs) throughout the state of Florida provides opportunity for place-bound students to earn a baccalaureate degree from the CALs in several different disciplines and provides opportunity for enrollment expansion outside the boundaries of the main campus in Gainesville. Numerous land grant universities have established distance learning systems (Murphy, 1996). The challenges of developing off campus research and education centers have been well discussed (Verkade et al., 1988; Tignor and Wilson, 1999; Klock-Moore et al., 2000; Wirth and Thornsbury, 2001) and it is generally agreed that educational programming for place-bound students provides a needed educational opportunity for students, while strengthening undergraduate enrollment in agriculture.

### **Distance Education**

Distance education courses use a variety of delivery methods specific to a particular course. The principal advantage of distance education is that it enables learners to take academic courses and pursue college degrees without having to attend classes at the University of Florida campus in Gainesville. Delivery methods for distance education courses include interactive videoconferencing, narrative PowerPoint, video streaming, world wide web, and web course tools (<http://training.ifas.ufl.edu/deft>). Hybrid courses allow the instructor to interchange several delivery methods as needed to most effectively utilize classroom time, minimize scheduling conflicts, and maximize flexibility.

## **Integrating Tradition and Technology in the Classroom**

The UF plant propagation course (PLS 3221C) is currently taught live on site at four locations throughout Florida and scheduled for state-wide distance delivery from one location to six additional campuses in Fall 2002 (Fig. 1). Lectures will originate from Milton and Fort Pierce campuses and will be broadcast to designated campuses throughout the state of Florida. Corresponding labs will be administered on site by a faculty member at each campus. To facilitate the integration of tradition and technology in the classroom, a teaching team comprised of all instructors responsible for teaching plant propagation was created. The goal of this team was to define a framework for the development of a coordinated plant propagation course that would clearly define course content, faculty responsibilities, and a time-line for implementation while considering the expertise, faculty responsibilities and facilities available at the various satellite programs.

## **Enrollment and Expense**

Sixty students were enrolled in Plant Propagation last year at four locations throughout the state, including Gainesville and IRREC, WFREC, and FLREC campuses. In Fall 2002, the course will be taught live from a central location (Milton and Fort Pierce) and broadcast via interactive videoconferencing to six UF campuses.

All sites have PictureTel videoconferencing systems (Polycom, Pleasanton, CA) that cost approximately US\$26,000 for the basic equipment. Along with the Gainesville site, three other sites with major teaching programs have additional equipment to allow them to originate classes or other videoconferences. This equipment ranges from about US\$20,000 to US\$80,000 (depending upon the various needs and uses of the sites) and includes items such as an Elmo document camera (Multi-Media Solutions, Knoxville, TN), a computer (Dell Marketing, Austin, TX), a LCD projector (Proxima, Wilsonville, OR), microphones (Shure, Inc., Evanston, IL), cameras (Canon, Lake Success, NY), and an Autopatch audio and electronic mixer (XN Technologies, Inc., Cheney, WA).

The cost incurred to UF for interactive videoconferencing is approximately US\$60.00 per hour per site. This cost helps to cover the videoconferencing charges and the line charges, or cost of the quarter T-1 lines to each site, which range from about US\$400 to US\$1200 depending upon the distance of each site from major telephone trunk lines.

## **MATERIALS AND METHODS**

### **Lecture Delivery**

**1. Interactive Videoconferencing.** The course was designed so that 75% of the lecture material is delivered via PowerPoint presentations projected to each site with a PictureTel Videoconferencing System. This compressed video network system operates by sending audio and video signals through digital telephone lines. As a result of the compression, the picture quality was somewhat reduced and could only be delivered to locations that were equipped. Live courses taught by voice-activated interactive videoconferencing allow the instructor and students to communicate with each other either point-to-point (two sites) or multi-point (three or more sites). This enables an instructor to teach in one location and broadcast the live lecture to all other locations designated as videoconferencing sites. The UF Institute of Food and Agricultural Science (IFAS) Videoconferencing Network (IVN) consists of eleven sites distributed around the state. One is located at the main UF campus in Gainesville, two are at community colleges where UF has teaching programs, and eight are at IFAS Research and Education Centers. The system operates over quarter T-1 telephone lines at 384 kilobits per second. Instruction by PowerPoint slides can be supplemented by use of an Elmo that allows the instructor to write or project images.

**2. WebCourse Tools.** Web Course Tools (WebCT) is a provider of integrated e-learning systems for higher education, which allows web-based course management for distance education. This system facilitates the creation of sophisticated web-based educational

environments ([www.webct.ufl.edu](http://www.webct.ufl.edu)). Features of WebCT include a course conferencing system, electronic mail, assignments, student self tests, grading tools, a calendar of events, a searchable image archive, and a searchable and linkable glossary. The UF Office of Academic Training maintains a site license for WebCT with presently 532 course accounts being used by 334 faculty designers. WebCT users access WebCT using a web browser from a networked computer, so no special software is necessary.

**3. Development of a CD for Online Instruction.** The remaining 25% of the lecture content was web-based to provide students background information or in depth detail that would otherwise reduce the allotted amount of classroom time necessary to present new lecture material. To avoid potential technical problems with slow internet connection speeds or WebCT access, the web-based portion of the course was accessible by WebCT and as a CD that would be administered to each student. The CD was based on a series of web pages created with a Macromedia Dreamweaver 4 HTML authoring software (Macromedia, Inc., San Francisco, CA). The web pages work like a directory or index for the videos with brief descriptions about the nursery or speaker featured in the videos. A Flash animation was created using Macromedia Flash 5 (Macromedia, Inc., San Francisco, CA) to give an introduction to the CD and highlight the collaborative effort between the University of Florida, Texas A&M, University of Vermont, and University of Arizona faculty. The CD itself was then designed with a cover using Adobe Photoshop (Adobe Systems Incorporated, San Jose, CA) and the content was burned onto the individual CDs using Microboards Saturn 2 (Microboards Technology, Chanhassen, MN).

**4. Developing an Animated Life Cycle of Angiosperms.** Over the years, it was noticed that students had difficulty conceptualizing the detailed life cycle of angiosperms, including anther and ovule development, pollination, and fertilization. This premise initiated the idea to animate the life cycle of angiosperms. Technical information and graphic ideas describing the life cycle process were relayed to the Center for Instructional Technology and Training (CITT) at UF, who oversaw the project in coordination with the Web Implementation Center. Because of the desire to animate and audio-narrate the life cycle to allow more effective examination of the various stages and processes, Macromedia Flash (Macromedia, Inc., San Francisco, CA) was used as the primary development and delivery program and Sound Forge (SonicFoundry, Madison, WI) was used to record and produce the digital audio. By using a common browser plug-in, Flash allowed for wide-spread ease of use.

The basic life cycle was redrawn from a combination of various graphics. Using this as a template, additional elements were added as needed for enhancement and clarification.

These included a series of “popup” animations that provided greater detail at certain stages of the life cycle, and an animated bee that initiates process of fertilization. At the beginning of the animation, the bee was coordinated with music to interject some initial humor and generate interest. Voice narration was linked to each step of the life cycle to personalize the animation and explain key components of the life cycle process.

**5. Website Development.** The World Wide Web is a component of many classes today. However the extent to which it is utilized varies from simple e-mail communication between faculty and students to providing information and instructional content online in the form of interactive text, graphics, and web based hyper-media. A general website (<http://irrecenvhort.ifas.ufl.edu/Propagation/Index/index.htm>) was developed for the entire plant propagation course using Microsoft FrontPage 2000 version 4.0 (Microsoft Corporation, Redmond, WA). The website consists of HTML page files organized into folders that link to each other. Microsoft FrontPage allows the user to design and layout a web page on screen then generates the necessary HTML to create a Web page that a browser can display. For the Propagation website, a main index page was created containing a general description of the course and shared navigational borders. Shared borders is a feature of Microsoft FrontPage that allows the user to create top, left, right, and bottom borders only one time and then add part or all of the borders created to each addition page of the website by selecting them via a menu on the FrontPage toolbar. For

the Propagation website, top, left and bottom borders were utilized. This created a uniform and consistent look for each page of the Propagation website, while allowing the content of each page to change. The top shared border contained the course name, a University of Florida graphic and images from previous classes. Navigational links to the other pages of the website, including a link back to the main index page and links to the course syllabus, lab information, student presentations, and other relevant websites is contained in the left shared border. Through the left shared border, students are able to easily navigate to any page of the website without having to return to the main index page. Finally, each Research and Education Center's website as well as the University of Florida's Institute of Food and Agricultural Sciences website was linked to buttons created for each center on the bottom shared border. This allows students from main campus and each satellite campus to view their location's website, which contains relevant information specific to their location. Once the website was created, it was uploaded to the University of Florida's server via WS\_FTP LE version 4.6 (Ipswitch, Inc., Lexington, MA), a file transfer protocol software. Updates to the website can be made throughout the semester by using Microsoft FrontPage to make changes to each page and then uploading that page to the appropriate folder.

### **Lab Delivery-Statewide Coordination**

Laboratory sessions for Plant Propagation offer a variety of subjects from which faculty can choose accordingly for each of the topics covered by the lectures. The approach used was to compile a series of laboratory exercises from faculty throughout the state who have previously taught the labs. The lab exercises were organized, converted to Adobe® Portable Document Format (PDF), and placed on a web-based course site developed for plant propagation using WebCT as the interface. Because of the compact nature of PDF documents, they can be shared, viewed, navigated, and printed exactly as intended by anyone using free downloadable software (Adobe Acrobat® Reader®). As lab exercises are posted on WebCT, instructors statewide have exclusive access to the different exercises from which he or she could choose for teaching. The main advantage to the instructor was that he or she would have ready access to a group of exercises using different methods and/or species that can be easily adapted to a particular location. Table 1 illustrates the range of topics that can be chosen for a particular subject. For example, for seed propagation, there is a list of existing labs that faculty could either choose to use entirely or build upon. One instructor located in South Florida may choose to teach a lab session on seed propagation of tropical plants, whereas an instructor located in North Florida may choose to use more temperate plants. Regardless of the plant materials used, the fundamental concepts covered by each campus will be the same. These were divided into six modules that directly refer to concepts covered in lecture. This approach adds the flexibility for faculty to choose and/or adapt existing labs to their particular situation and establishes a statewide coordination among different instructors.

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**Tables**

Table 1. Various laboratory exercises developed by University of Florida faculty located throughout FL and compiled for WebCT access. Each lab exercise coincides with weekly lectures.

	Topics	Subtopics
Module 1	The Propagation Environment	a. Similarities and differences in propagation media
		b. Water holding capacity, relative dry weight, porosity
Module 2	Seeds	c. Selecting the growing medium
		d. Facilities, containers, substrates, and fertilizers
		a. Seed viability test
		b. Seed dissection
		c. Seed germination
		d. Germination of difficult seeds
		e. Seed scarification
		f. Seed stratification
Module 3	Vegetative Propagation, Cuttings	g. Seed production and storage
		h. Seeds available for labs: diploid and triploid watermelon, palms, geranium, bean, corn, honey locust, redbud, petunia, begonia, among others
		a. Types of cuttings
		b. Influence of leaf area on rooting of cuttings
		c. Use of rooting hormones
		d. Talc vs. liquid rooting hormones
Module 4	Budding and Grafting	e. Propagation by modified and/or specialized leaves, stems and roots
		f. Species available: African violets, plumbago, coleus, begonia, chrysanthemum, lantana, bamboo, aquatic plants, several species of bulbs, and any species of student's choice
		a. Types of budding
Module 5	Layering, Natural Modifications	b. Types of grafting
		c. Several species available, including rose and citrus
		a. Types of layering
Module 6	Tissue Culture - Micropropagation	b. Air layering black bamboo
		c. Several species available, including <i>Malvaviscus arboreum</i> , <i>Campsis radicans</i> , <i>Wedelia trilobata</i> and <i>Ficus benjamina</i>
		a. Types of micropropagation
		b. Somatic embryogenesis
		c. Effects of plant growth regulators in the medium
		d. Comparison of liquid and solid media
		e. Effects of air exchange rates of the culture vessel on plant growth
		f. Shoot organogenesis in <i>Torenia fournieri</i>
g. Micropropagation of <i>Sansevieria trifasciata</i>		
h. Micropropagation of <i>Ajuga reptans</i> and <i>Brassica oleracea</i>		

**Figures**

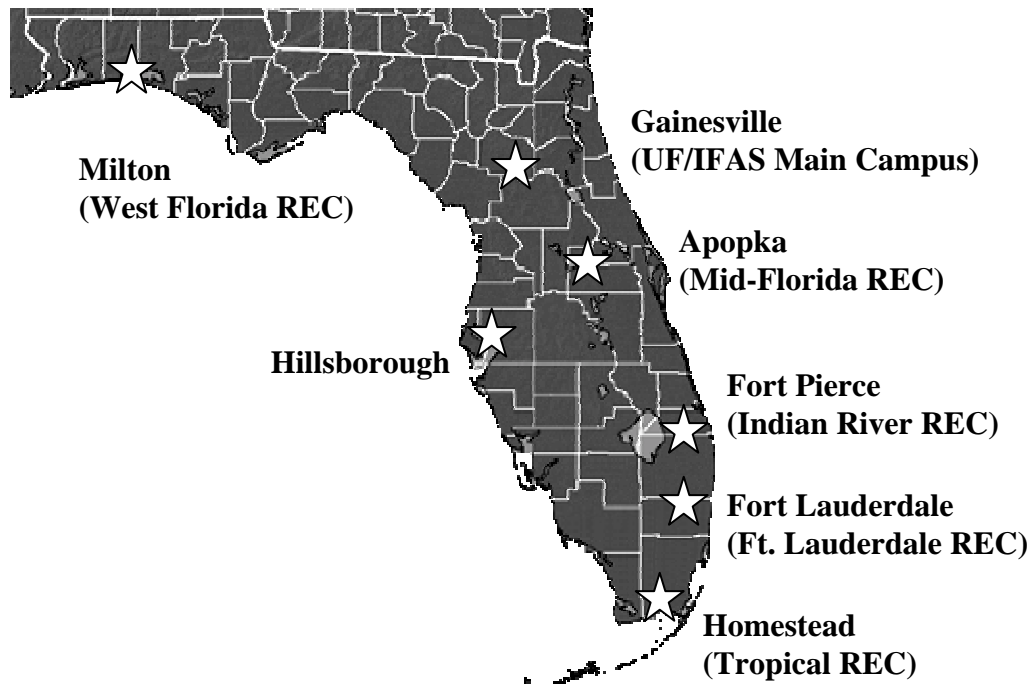


Fig. 1. Location of University of Florida campuses scheduled to receive Plant Propagation (PLS 3221) via interactive videoconferencing, Fall 2002.