Enhancing a Botany Learning Environment

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Abstract

A video camera, a microscope, and an LCD projector were used in a large lecture hall to project live plant specimens onto a large screen. The purpose of this project was to provide students learning experiences within a contextual learning environment.

Responses to student surveys indicated that a majority of the students felt that the quality of the projected images was good and that the projected live images showed more details than most of the printed illustrations used in class. Students also felt that the projected live images helped them better understand and retain the information presented in class; students responded similarly when asked to compare typical printed illustrations with projected live images. Compared with projection of print illustrations, students preferred seeing projections of live plant materials, and students felt the projected live images helped them better understand their laboratory experiences. Students felt that using a variety of ways to visualize information is better than using only one way.

Students indicated low agreement with one survey statement that "projected live images help students improve their note-taking ability." The projected live images seemed to have little effect on students' ability to take notes.

Introduction

There are many concepts in botany such as the movement of molecules into and throughout a plant, energy flow in photosynthesis, or detailed anatomy of a plant's inner parts that are not easily presented in large classroom settings. Nor are they grasped cognitively because of difficulties in showing either living plant specimens or close-up views of demonstrations that illustrate these and other concepts. With the current economic necessity for increasingly larger classrooms of students, it will become even more difficult to adequately demonstrate and illustrate the dynamics of living plant specimens.

Faculty typically use professionally prepared illustrations, pictures, and full color slides to illustrate plant materials during classroom and laboratory teaching. These visuals show important anatomical relationships and often facilitate student learning by depicting abstract models of complex botanical concepts. However, they are also one and sometimes two levels removed from many students' cognitive reality and thus may lack important and familiar criterial cues necessary for comprehension, understanding, and learning (Bostick, 1983).

Creative use of instructional technology can enhance the learning environment and facilitate the development of advanced learning skills necessary for students to develop both intellectually and in job or task performance. After all, a primary motivation for using technologies in education is the belief they will support superior forms of learning (Clark and Sugrue, 1991).

On college campuses, as well as in the public schools, there seems to be renewed interest in what is often referred to as "active learning." Most of the historical literature on this subject indicates that advanced skills of comprehension, reasoning, composition, and experimentation are acquired not through the transmission of facts (i.e., through lecturing or reading texts) but through the learner's active interaction with content (Resnick, 1987; Berryman, 1991). A major tenet of this vision is the emphasis on the development of learning environments that increasingly use technology.

Berryman (1991) reminds us of the false assumption held by some teachers that students should be looked upon as passive receivers of learning, empty vessels into which knowledge is poured. Those who believe in this assumption may sometimes be the staunchest promoters of the lecture mode of teaching. However, an absolute reliance on lecture-teaching may prevent students from developing necessary cognitive management skills.

Students who find themselves placed in a passive, lecture-teaching learning environment are prevented from exercising higher order thinking skills (Resnick, 1987). These skills elude precise definition; however, Resnick describes some key features that help us recognize higher order

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thinking when it occurs. Some of these features include the following:

> Higher order thinking is nonalgorithmic. That is, the path of action is not fully specified in advance.
>
> Higher order thinking involves nuanced judgment and interpretation.
>
> Higher order thinking often involves self-regulation of the thinking process; in other words, we do not recognize higher order thinking in an individual when someone else "calls the plays" at every step.
>
> Higher order thinking involves imposing meaning, finding structure in apparent disorder.
>
> Higher order thinking is effortful. Considerable mental work is involved in the kinds of elaborations and judgment required.

The role of a contextual learning environment

Collins et al., (1989) suggest that the learning environment should reproduce the technological, social, time, and motivational characteristics of real world situations where what is being learned will be used within a personal context. This is closely associated with Ausubel's (1968) cognitivist theories of learning which focus on the importance of inputs to the learning situation. It seems logical that by placing subject matter content within real word contexts, students will more readily learn to apply or transfer knowledge to other situations. For example, classroom discussions of botanical concepts using the same live plant materials students work with in their lab assignments builds upon real world contextual relationships.

In the academic world, content and contexts are constantly changing. Teachers and students who are operating in this state of flux would seemingly benefit from a much more holistic approach to solving learning and teaching problems (Kemp, 1994). Teaching that takes into consideration the contextual element acknowledges the reality of the environment within which future performance will take place. Furthermore, the creative design of effective visual messages can play an important role in establishing appropriate contextual relationships.

Project Description

Each year, North Carolina State University, through the Provost's office, provides mini-grants to support development of new teaching strategies. Mini-grant funding was provided to enhance the learning environment in Botany 200 (Plant Life), a large, introductory botany class. This course introduces students to the structure, processes, and reproduction in higher plants. Subject matter content includes the diversity of the plant kingdom and principles of inheritance, ecology, and evolution. One section of about 150 students enroll in this course every semester. The classroom can accommodate 200 students.

For the mini-grant project, a video camera, a microscope, and an LCD projector were used in a large lecture hall to project live plant specimens onto a large screen. The purpose of this project was to provide students learning experiences within a contextual learning environment. We wondered if students would be interested, and thus more attentive, in viewing live plant materials (the same plant materials students use in their lab assignments). We wondered, also, if projecting live specimens would make lectures more relevant to the students' cognitive field and thus improve the climate for learning. And finally, we wanted to know if the technology would support and foster an active learning process that has the potential to draw students into an activity in ways that are not easily accomplished in large classroom settings.

Fig. 1 illustrates how a typical auditorium setup was modified to project microscopic images onto a large projection screen. Typical video systems found in large lecture halls feed video signals from a control room located at the rear of the room to either one or more monitors at the front of the room. Auditoriums may also use LCD projectors located in control rooms to project images onto large screens.

An initial problem was encountered with the video source; it had to originate from the front of the room rather than from the control room. A microscope fitted with a video camera was going to be used to project microscopic specimens of live plant materials. It was also important for the instructor, the lab assistant, and students to be able to manipulate the plant materials while they were being viewed.

Some backward, or reverse, engineering was used to solve the projection problem. The video signal from the microscope camera was fed into the video output jack located on the front wall of the auditorium. In this case the video signal had to go from the front of the auditorium, back to the control room, and then to the LCD projector.

This projection setup was used twice before a survey was administered and twice before an identical survey was administered. A survey instrument was developed to determine student attitudes toward the use of live, microscopic projected images in classroom discussions (see Table 1). Students could also add their own personal comments to the end of the survey.

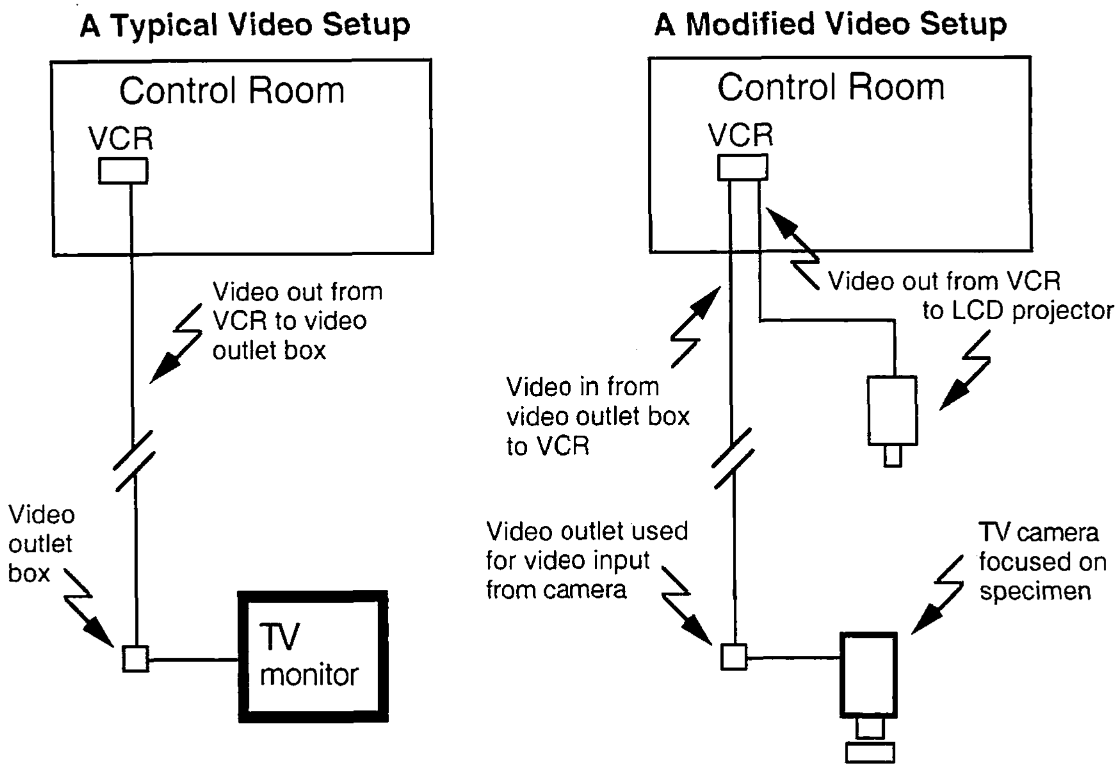

Fig. 1. Schematic illustration comparing a typical video setup with one modified for LCD projection of microscopic specimens.

Results

The student survey was administered twice: once midway through the first half of the semester and again halfway through the second half of the semester. Survey results are shown in Table 1.

The survey responses indicate that a majority of the students felt that the quality of the projected images was good and that the projected live images showed more details than most of the printed illustrations used in class. Students also felt that the projected live images helped them better understand and retain the information presented in class; students responded similarly when asked to compare typical printed illustrations with projected live images. Compared with projection of print illustrations, students preferred seeing projections of live plant materials, and students felt the projected live images helped them better understand their laboratory experiences. Students felt that using a variety of ways to visualize information is better than using only one way.

Students indicated low agreement with one survey statement. We wanted to know if projected live images might help students improve their note taking ability. The projected live images seemed to have little effect on students' ability to take notes.

Summary

Using projected live images in combination with printed illustrations supports a holistic approach to solving learning and teaching problems in the botany classroom and may have important pedagogical uses in other learning environments. Projecting the same live materials that students use in laboratory exercises during classroom discussions provides an important contextual element that acknowledges the reality of the learning environment within which students and teachers perform. The creative design of effective visual messages can play an important role in establishing appropriate contextual relationships.

The process of human communication is complex; and yet, it is an activity in which we all engage with apparent

Table 1. Survey results of student attitudes toward the use of projected images of live microscopic plant materials.

	Level of Agreement: 1=Low, 5=High	
	Survey One N=140	Survey Two N=105
1. The quality of the microscopic projected images was good.	3.74	3.94
2. The projected images showed more details than most of the usual illustrated print images.	3.63	3.80
3. Compared to typical illustrated print images, the projected live images helped me better understand the information presented in class.	3.62	3.79
4. Compared to typical illustrated print images, the projected live images helped me better retain the information presented in class.	3.46	3.62
5. Compared to typical illustrated print images, the projected live images helped increase my understanding of the relationships between the different parts of plants.	4.10	3.64
6. The projected images helped me better understand the information presented in class.	3.42	3.80
7. The projected images helped me better retain the information presented in class.	3.38	3.57
8. The projected images helped increase my understanding of the relationships between the different parts of plants.	3.45	3.71
9. The projected live images helped me improve my ability to take notes.	2.87	2.74
10. Compared to the projection of typical illustrated print images, I prefer seeing living specimens of plant materials projected from a microscope.	3.56	3.84
11. Using a variety of ways to visualize information is better than using only one way.	4.18	4.37
12. The projected live images helped me better understand my laboratory experience.	3.73	3.91

ease and with varying levels of success. The ease and the success of our instructional communication will be determined, in no small measure, by our ability to design effective visual messages.

Human Performance Technology is a field of practice that has evolved largely as a result of the experience, reflection, and conceptualization of the professional practitioner striving to improve human performance in the work place. It includes the process of selection, analysis, development, implementation, and evaluation of programs to most cost-effectively influence human behavior and accomplishment. Is college teaching, any teaching, different from this? No matter the medium of instruction, or how the media of learning may change, the essential ingredients remain constant: The committed teacher and the committed student.

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Implementing Selected Teaching Strategies to Accommodate Different Learning Styles among Students Enrolled in an Introductory Food Science and Human Nutrition course[1]

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Abstract

We conducted an exploratory, qualitative study of the impact of selected teaching strategies implemented in Introduction Food Science and Human Nutrition, a course with an enrollment of 208 undergraduate students. To complement a traditional classroom lecture, we integrated into the course a comprehensive, media-enhanced Web site; daily writing assignments; a peer-reviewed, a popular press publication critique; and product and process demonstrations. We used the Gregorc Style Delineator™ to determine the dominant learning style of each student. The distribution of Gregorc learning styles in our course was 42% Concrete Sequential, 14% Abstract Sequential, 26% Abstract Random, and 18% Concrete Random.

Following each of the four mid-term exams, the students completed a feedback form to help us assess the effectiveness of each teaching strategy on their learning styles. We analyzed the data using one-way ANOVA and the results indicate that selected teaching strategies can enhance learning among a group of students representing all four Gregorc learning styles. Our results suggest that instructors who recognize students exhibit different learning styles may be better prepared to modify their pedagogical repertoire (instructional activities, methods, and content) to fulfill the learning needs and preferences of their class.

[1] Adapted from the poster, "Accomodating different learning styles using a variety of teaching strategies in an introductory Food Science and Human Nutrition course" presented by author Javenkoski at the Annual Meeting of the Institute of Food Technologists, Chicago, IL 26 July 1999.

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Introduction

Learning occurs when an individual perceives, processes, and retains information using his or her sensory and perceptual skills. The method or style in which information is processed differs among students. A learning style is an individual's preferred method of perceiving, interpreting, processing, organizing, storing, and retaining new and complex information (Dunn and Dunn, 1987; Davis, 1993). A student's learning style may affect how he or she learns in specific instructional situations and environments (Hartel, 1995).

Educational researchers have proposed several learning style models and designed instruments to assess those styles. Six models are commonly cited in the literature: 1) Witkin's Field-Dependence/Independence model (Witkin et al., 1971); 2) Gregorc's Learning Style Delineator (Gregorc, 1982, 1985); 3) Kolb's Learning Style model (Kolb, 1984, 1985); 4) Felder-Silverman Learning Style model (Felder and Silverman, 1988); 5) Herrmann Brain Dominance model (Herrmann, 1990); and 6) Myers-Briggs Type Indicator (Lawrence, 1994). We selected the Gregorc Learning Style Delineator™ (GSD; Gregorc Associates, Inc., Columbia, CT) based on Anthony F. Gregorc's extensive research on a number of adolescent and adult learners in a variety of learning environments. The participants in our exploratory study collectively represent a large (n = 208), diverse group of college students from 42 different academic disciplines and educational experiences (Figure 1).

Gregorc (1979) asserted that learning styles evolve from two types of *learning* orientations (concrete and abstract) and two types of *ordering* orientations (sequential and random). By observing students, Gregorc determined that these orientations formed four distinct learning methods or styles: Concrete Sequential (CS), Abstract