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**DEVELOPMENT AND TESTING OF INNOVATIVE  
LEARNING TECHNIQUES IN WOODY PLANT IDENTIFICATION  
AND TREE BIOLOGY**

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Computer-enhanced delivery of instructional materials is finding increased use in the classroom. This is even true for instruction which has traditionally been taught in an outdoor laboratory setting. A good example of this is woody plant identification, which typically involves a series of outdoor laboratories supplemented in part by herbarium specimens and photographic material. For the past several years we have been developing and testing computer- and world wide web (WEB)-based classroom material for enhancing instruction of woody plant identification and forest biology. Our goals were to (1) provide unlimited self-paced learning that emphasizes the use of high-quality photographic images and student interaction; (2) provide students with an opportunity for self-evaluation and immediate feedback; and (3) increase the availability of teaching aids and frequently asked questions through the use of WEB-based material.

In the area of woody plant identification we have developed a multimedia computer tutorial that supplements our traditional outdoor instruction. The program is being distributed commercially by Kendall-Hunt Publishing. The software provides over 2,000 high-quality color images of twigs, leaves, bark, fruit, flowers, and form for species common throughout the eastern United States. A morphology section familiarizes students with terms used in plant identification. Multiple images of critical plant parts are available so students can develop a feel for normal field variation. Immediate side-by-side comparisons of similar-looking species is possible for all plant parts. Full text descriptions, range maps, critical distinguishing features, and interesting tidbits are provided for each species. Perhaps most useful is a quiz section, which allows students to evaluate themselves.

The success of this software was determined by a perception survey administered to students. Results of the survey indicated that the software was well liked by the students (Table 1) (Seiler et al. 1997).

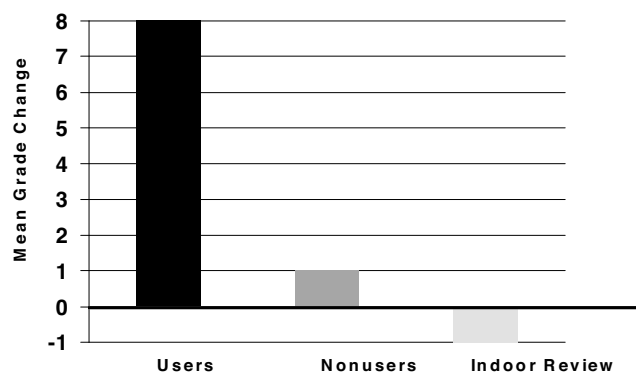
**Table 1. Average response to student perception study. Twenty and fifty-five students responded to the survey in 1995 and 1996, respectively.**

Question	Average Response*	
	1995	1996
Tree ID was easy to use	1.22	1.35
The overall program was useful	1.56	1.48
Tree ID should be used as a supplementary aid in Dendrology Lab	1.56	1.53
Tree ID could be used to replace some outdoor instruction	3.11	3.14
The self-paced quizzing module assisted me with later tree identification in the field	—**	1.99
The pictures and graphics were of high quality	1.67	1.87
The tutorial text and tree descriptions were useful	1.67	1.79

\*1 = strongly agree; 2 = agree; 3 = disagree; 4 = strongly disagree.

\*\* Question was not asked in 1995 survey.

Controlled testing of the software in 1995 indicated that after two weeks of use it helped to improve actual field identification (Figure 1). Further evaluation in 1996 found that the final course grade was 5 percent higher ( $p=0.07$ ) in users compared to non-users of the program. Among users, neither total use time, average time per visit, nor number of visits was correlated with grade received in the class. However, this does not suggest that computer use did not help students. Potentially, a student who might have received a D in the course received a D+, or a student who might have received a B received a B+ by using the software.



**Figure 1. Percent change in quiz grades for the two weeks prior to computer tutorial use compared to the two weeks following use (students are routinely quizzed every week). Users had access to the program for a two-week period. Indoor review students received a "conventional" session with an instructor.**

We have also developed a Dendrology class home page (<http://www.fw.vt.edu/dendro/dendrology/dendro.htm>) where students can view their grades, check the weather, and link to other interesting sites. One of the most useful features of our homepage are tree fact sheets. These fact sheets contain a text description of the tree and color pictures of key plant parts. They are arranged by lab as well as alphabetically. Students are encouraged to print these sheets out ahead of time so that in the field they can look at key plant features instead of taking notes. Maps to off-campus labs are also available so students can preview new species and potential quizzes for that day in the field.

At Virginia Tech we teach a two-semester-hour course in Forest Biology. The class covers basic structure, development,

and physiology of woody plants, as well as forest biomes. Historically, it has been difficult to find a textbook suitable for this class given the wide range of material presented and the short contact time (2 credits). Through grants from Virginia Tech's Center for Excellence in Undergraduate Teaching and Center for Innovation in Learning, we have developed an on-line interactive textbook which students access through a class homepage <http://www.fw.vt.edu/dendro/forestbiology/forbio.htm>. On-line help via e-mail links is available to assist students with gaining access to the textbook.

The textbook is arranged by topic area (e.g., carbon uptake). Each topic area begins with a set of major learning objectives and the text closely follows lecture material. High-quality visuals and interactive activities are placed throughout. Hypertext words are linked directly to a glossary. A bank of test questions is being developed that will generate on-line practice tests for students. We are in the process of evaluating the electronic textbook. The results of a student perception survey will be presented as well as insights gained from interacting with students. Use of the textbook is not mandatory.

#### LITERATURE CITED

Seiler, J. R., J. A. Peterson, C. D. Taylor, and P. P. Feret. 1997. A computer-based multimedia instruction program for woody plant identification. *J. Nat. Res. Life Sci. Ed.* (in press).