User Tendencies and Response of Students to Supplemental Crop Identification Aids in a Freshman Lab[1]

Lurline Marsh[2]

Department of Agriculture and Natural Science
Lincoln University
Jefferson City, MO 65102

Abstract

Web based Blackboard® and CD images of selected crops were developed for the plant identification module of an introductory freshman level crop science lab to supplement existing live plant and seed materials, and to increase access to students. Over three years, students in three classes (n=48) were surveyed on their usage and perceptions of these four aids when allowed to select any of them. Most (62%) used all the available combinations of aids. Students used the seeds twice as much as any of the other aids. Although students reported good satisfaction with all four aids, they found the seeds and live plant materials most useful. The number of study aids used was somewhat positively correlated with student test scores and overall frequency of their use (r= 0.38, p=0.01, r=0.35 p=0.05). This study indicates that students' tendency to use all available study aids of live materials and computer aids was beneficial in learning crop identification.

Introduction

Today's agriculture undergraduates maintain busy schedules as they balance their time between classes, jobs, family and other activities. For some, this problem is further exacerbated when they commute to campus where they spend limited time while out of class. Consequently, both time and access to materials are constraints in their studies. To alleviate this problem, it is necessary to provide alternative study aids which allow them some flexibility in accessing complementary study materials outside of scheduled class times and regular university hours. Study aids can supplement the materials used in the practical sessions and improve student learning. Previous work indicates that study and learning aids can help students master course material (Cobine, 1997; Helgeson, 1988; Kulik and Kulik, 1987). For instance, computer use was beneficial in complementing materials or as tutorials (Cobine, 1997; Helgeson, 1988). Computer programs can allow learners to access supplementary information easily and quickly and also allow the learner to control the pace (Rae, 1994).

Other materials such as field guides, plant specimen and various key guides were also effective when used in classroom sessions and field trips (Driscoll, 2002; Douce et al., 1996; Fermanian et al., 1989; Meyer and Gaynor, 2000; and Seiler et al., 2002). While some of these methods have established benefits for student learning in the classroom and outside, there is no information on their combined use and effectiveness when students are allowed to freely choose from the available combinations of traditional aids plus computer study aids compatible with their time and convenience, instead of being assigned specific aids. Student's verbal feedback from previous freshman crop science classes indicated that time and access to the study materials for a module on plant and seed identification were concerns. These students like the current ones had varying levels of education and scientific backgrounds. Student access to the materials was through the combined use of the traditional study aids, which were the plants in the greenhouse and seeds which they used at the lab and or collected for off campus study. Moreover, it was unclear what study habits they were using to learn the materials.

Therefore this study was conducted to 1) to determine student's usage and evaluation of four study aids of their choice that could be used on or off campus to help them learn crop identification and 2) to determine any relationships between the study aids used and their learning as measured by performance on a test.

Materials and Methods

This study was conducted during the spring semesters of 2001, 2002, and 2003 when the 16-week semester course, "Introduction to crop science," a freshman level course was offered. The numbers taking part in the study each year were 24, 10 and 14, which represented 94% of the enrolled students. The

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[2]Current address: Department of Agriculture, University of Maryland Eastern Shore, Princess Anne, MD 21853; Email: lemarsh@umes.edu; Phone: 410-651-6168.

class met weekly for one two- hour lab and two one-hour lectures. To learn the identification of selected Missouri grown vegetables and agronomic crops, and selected world crops (Table 1) for one of the lab modules, students used four study aids. They were: individual seed samples used outside of class time at their convenience, live plants in the greenhouse available during regular university hours, individual CDs with images of the seed and plant samples, and the web based software, Blackboard® access to images similar to those on the CD. The instructor captured the images with a digital camera, edited them with Adobe Photoshop® where necessary and assembled them in a PowerPoint presentation. Access to Blackboard images was only available in the last two years of the study. The images of each crop were assembled on separate slides, with both common and scientific names.

Images of each crop included a seed against a scaled measurement and at least two of the following stages of development: seedling, vegetative stage, and reproductive stage. The CD was created to complement use of the seed samples and plant materials and to facilitate greater access to the materials in preparation for the test. At the time of the test, only a portion of the plants had reached the reproductive stage. Each student received a CD at the time of planting the crops and was requested to begin using it and recording the times spent using it for a later survey which he/she would receive. For the live plant materials, students planted seeds of 48 crops during the second week of the semester, studied their emergence and seedling development and continued to monitor their growth up to the time of the exam, eight weeks later. Concurrent with the study of the developing plants and the available seeds, students used the two computer aids. However, CD and Blackboard® images for most crops also included a reproductive stage. The test was given on seed samples and live plant material. After the scores were returned, students completed a 15 -question survey on the value and their usage of the study aids using a rating scale where 1 was inadequate, 2= adequate, 3= good, 4= very good and 5= outstanding (Tables 2 and 3).

Results and Discussion

Students' responses on the usefulness of supplemental aids were generally good. They rated the live plant and seed material highest, 4.06 and 3.84, respectively followed by Blackboard® and CD, (3.24 and 3.27, respectively) (Table 2). Lowest student ratings for the computer-assisted aids were perhaps partially due to problems with accessibility. Although students gave an average rating to computer access for CD and Blackboard® (Table 2), a few criticized the CD and Blackboard® for lack of utility with the computer they were using at home. Though the CDs were compatible with the computers at the university computer labs, some students did not use them there because they did not have time to be on campus. However, these images were also accessible on other computers that did not have PowerPoint software because power point executive file was saved for use in the windows operating system computers. Off campus, a few students did not have computers. Furthermore, the downloading of the 150 to 200 images in Backboard® was impossible on some home computers which only had dial- up access to the internet. Those with digital subscriber link (DSL) or cable access were able to view the images readily. Students rated the images of the different stages of the each crop good. Students generally gave the highest rating for clarity and completeness of images to the seeds, and the lowest to the images of reproductive stages. This was expected, as there were missing images for about 10 % of the reproductive

Table 1. List of crops used as images for CD and Blackboard for plant identification

Common	Scientific	Common	Scientific
Alfalfa	Medicago sativa L.	Oats	Avena sativa L.
Asparagus	Asparagus officinalis L.	Okra	Abelmoschus
Barley	Hordeum vulgare L.		esculentus L..Moench
Beets	Beta vulgaris L.	Onions	Allium cepa L.
Birdsfoot trefoil	Lotus corniculatus L.	Orchardgrass	Dactylis glomerata L.
Broccoli	Brassica oleraceae L.	Peas	Pisum sativum L.
	Italica group	Peppers	Capsicum annuum L.
Brussel sprouts	Brassica oleracea L.	Pigeonpea	Cajanus cajan L.
	Gemmifera group	Pumpkins	Cucurbita spp. L.
Cabbage	Brassica oleraceae L.	Radish	Raphanus sativus L.
	Capitata group	Rice	Oryza sativa L.
Canola	Brassica napus L.	Rye	Secale cereale L
Carrots	Daucus carota L.	Snap bean	Phaseolus vulgaris L.
Cauliflower	Brassica oleraceae L	Sorghum	Sorghum bicolor L.Moench
	Botrytis group	Soybean	Glycine max L. Merril
Clover	Trifolium spp L.	Spinach	Spinacia oleraceae L.
Cotton	Gossypium hirsutum L.	Squashes	Cucurbita spp. L.
Cowpea	Vigna unguiculata L.	Sudan grass	Sorghum Sudanese [Piper] (Stepf)
Cucumber	Cucumis sativus L.	Sunflower	Helianthus annuus L.
Eggplant	Solanum melongena L.	Sweet corn	Zea mays L.
Fescue	Festuca arundinacea L.	Timothy	Phleum pratense L.
Field corn	Zea mays L.	Tomatoes	Lycopersicon
Lespedeza	Lespedeza spp. L		esculentum Mill
Lettuce	Lactuca sativa L.	Turnip	Brassica rapa L.
Lima bean	Phaseolus lunatus L.	Watermelon	Citrullis lanatus Thunb
Muskmelon	Cucumis melo L.	Wheat	Triticum aestivum L.

Table 2. Summary of student response to survey to assess perceptions of seed and plant identification aids for a freshman level crop science class over three years at Lincoln University.

Questions	Scores[Z] Seed	Plants	CD	Blackboard
1-4. Rate overall usefulness of each aid	3.84[a] (48)	4.06[a] (48)	3.27[b] (48)	3.24[b] (24)
5. Rate the clarity of the seed images	-	-	3.40[a] (48)	3.29[a] (24)
6. Rate the clarity of vegetative plant stage images	-	-	3.27[a] (48)	3.29[a] (24)
7. Rate the clarity of reproductive plant stage images	-	-	3.13[a] (48)	3.33[a] (24)
8. Rate the completeness of the seed images	-	-	3.73[a] (48)	3.92[a] (24)
9. Rate the completeness of vegetative plant stage	-	-	3.40[a] (48)	3.50[a] (24)
10. Rate the completeness of reproductive plant stage	-	-	3.17[a] (48)	3.29[a] (24)

[Z] Rating scale where 1 = inadequate, 2=adequate, 3=good, 4=very good, and 5 = outstanding
Numbers in parenthesis represent "n"
Means with different letters in the same row are significantly different P< 0.05 based on LSD

stages due to unavailability of suitable plants when the photographs were taken. The lack of these images did not present a problem in the preparation for the test because at this 8-week stage few of the test plants reached the reproductive stage. For those which did, there were reproductive image stages on the slides.

Of these three study aids, students spent most time (7.8 hours) using the seeds (Table 3). Their time on Blackboard® could not be determined because that information was unavailable, only their number of times (frequency) using Blackboard® was available. The seeds provided them ready convenience because of the small size and portability of the collection attached to small note cards. Some students reported that the seed was an easy study tool. On the other hand, students used the plants, CD, and Blackboard® less frequently, perhaps because of decreased access. Plants were only available for study during the 5-day work week for 8 hours. In addition, Blackboard® tracking by the instructor revealed that students did not access the site at all the available times, but only between 11pm and 7am. Given the concern of students over lack of time it was surprising that they did not make full use of this tool throughout the 24-hour period.

Students consistently showed a preference for using the combinations of all available aids (Table 4). As a result, the highest percent of users (62%) opted for the combined use of all the available resources of seeds, plants, and CD in the first year. Student preference for using all available resources was similar in the succeeding two years when an additional tool, Blackboard® was added. Thereafter, the highest percent of students (73%) again opted for using all the available study aids which were then Blackboard®, CD, seed and plant combination. Students never used the two computer assisted tools alone or in a joint combination. Instead they combined them with the plants and seeds. However, users of the two traditional aids, either singly or in combina-

Table 3. Summary of Student response to survey to assess study habits of seed and plant identification for a freshman level crop science class over three years at Lincoln University.

Questions	Seed	Plants	CD	Blackboard[Z]
1. How many times did you use each aid	10.7[a] (48)	4.5[b] (48)	3.2[b] (48)	4.3[b] (24)
2. What is the total hours you use each study aid	7.8[a] (48)	3.8[b] (48)	3.0[b] (48)	-
3. How easy was it to find computer to access the CD or Blackboard [Y]	-	-	3.4[a] (41)	3.9[a] (22)

[Z] Blackoard response was from instructor tracking
[Y] Rating scale where 1 = difficult, 2= ok, 3=easy, 4=moderately easy and 5 = very easy
Numbers in parenthesis represent "n"
Means with different letters in the same row are significantly different P< 0.05 based on LSD

Table 4-. Student use of seed and plant identification aids in a freshman level crop science class during three years at Lincoln University

Aids Used	% Student Using 2001	% Student Using 2002 and 2003
None	3.8	-
Seeds only	7.7	-
Plants only	3.8	-
Seeds and Plants	7.7	3.8
Seeds and CD	7.7	-
Seeds, Plant and CD	61.5	7.7
Seed, Plant and Blackboard	Not available	7.7
Seed, Plant, Blackboard and CD	Not available	73.1
No Response	7.7	7.7
	N=26	N=26

tion were low, fewer than 10%. As students increased the number of their study aids, both their time and frequency of use increased. Pearson correlation between frequency of use and combinations of aids was 0.35, ($p=0.05$, $n=48$).

No significant correlations were found between the times spent using the seeds, Blackboard®, or CD and the students' performance. A similar trend for computer usage was found by Rohrback and Stewart, 1986 who reported that the amount of time spent with microcomputer assisted instruction did not affect student test scores when given the freedom to select the amount of time spent. The number of study aids had a low positive correlation with test score ($r= 0.38$, $p=0.01$, $n=48$), indicating that increasing the number of available study aids was beneficial. In fact, this was confirmed by the students' comments from the survey.

The comments provided by students can be separated into three categories: computer access, lack of time, and the value of the aids. Few did not have computers, others admitted that they did not have time to find computer on which to view the images, or did not have time to use a campus computer. Some reported not having time to come by lab to study plants. A few students reported printing the images and using them instead of the computer assisted aids. However their pictures were not clear, making the differentiation between some plant pictures difficult. Other students reported that having real plants was most helpful. Another studied the material in small groups of 10 each week and others suggested that they learned the material better when they studied a portion of the crops each week.

One clear indication in this study is that access to study aids was a drawback for some students who reported that they did not have enough time to use the campus facilities or resources on campus. One lesson learned in this study is that the CD compatibility with users should be improved by adding user friendly keys to allow images to be viewed in a non linear fashion so that learning can proceed at an individualized pace driven by curiosity and student pace of learning. Such was the finding of Shoener and Turgeon (2001) who reported that students preferred a learner controlled version web accessible course with alternative pathways, which allowed them to control their pace of learning. Perhaps, arranging the crops according to groups such as grasses and dicots may be less overwhelming for the students who had difficulty memorizing the names. Although students were only learning the materials at a low level, namely knowledge and comprehension of Bloom hierarchical structure (Bloom, 1956), the under preparation of many in this heterogeneous freshman group may have made it more difficult for their learning. In fact some complained that they found memorizing the scientific names and common names of 48 crops difficult for a freshman level class. Data was analyzed using SAS (SAS Institute, Cary, NC). Treatment means were separated by LSD ($P< 0.05$).

Summary

In conclusion this study shows that most students preferred to use all the available combinations of the four study aids in preparing for crop identification in this lab. Students spent most of their time using the small and more portable seed samples and less time with the less- accessible tools, the computer images and plants. Frequency of their use of all the aids had a low correlation with the number of aids they used ($r= 0.35$, $p=0.05$, $n=48$). Number of study aids used also showed a low correlation with test scores ($r=0.38$, $p=0.01$, $n= 48$). These results indicate that students' use of the complete combinations of supplemental aids can help them learn to identify crops.

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