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Using CD-Based Materials to Teach Turfgrass Management

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Using CD-Based Materials to Teach Turfgrass Management

Abstract

Traditional Extension programs are delivered in face-to-face workshop settings. Recently, educators have used new technologies for program delivery with increasing frequency. One technique (CD-ROM) has not been explored thoroughly. Using a turfgrass management curriculum for Master Gardeners, researchers sought to determine if learning differed between students taught using CD-based materials versus those taught in traditional workshops. Using a pre-test/post-test design, 94 participants' turfgrass management knowledge was measured. CD-based materials were more effective than traditional settings for teaching turfgrass management topics to Master Gardener trainees. CD-based materials could increase the number of clientele reached and enhance their learning experiences.

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Introduction

The Smith-Lever Act of 1914 created the Cooperative Extension Service to educate the public about agriculture, home economics, rural energy, and related subjects. Practical application and transfer of research knowledge is the key to Cooperative Extension work. The transfer of knowledge can be accomplished through public demonstrations, workshops, youth activities, and publications (Smith-Lever Act, 1914). Since the early 1900s, new technologies such as computer applications, e-mail communications, and World Wide Web methodologies have allowed greater access to knowledge transfer.

Nine compact disc (CD)-based modules in turfgrass management titled Turf for Texans were developed by the Departments of Soil and Crop Sciences and Agricultural Education at Texas A&M University. The Turf for Texans CD is a tool for teaching turfgrass management to Texas Master Gardeners. While some programs are using World Wide Web methodologies (Rost & VanDerZanden, 2002), the Turf for Texans program chose the CD-format to forego connectivity problems in rural areas (Federal Communications Commission, 2004). The goal of the Turf for Texans CD was to allow Extension personnel to convey a consistent curriculum to a large number of people with less travel, therefore at a lower cost (M. Hussey, personal communication, November 22, 2002). The ability to reach more clientele at a lower cost is important, but participants must also receive quality-learning experiences (D. Chalmers, personal communication, May 29, 2003).

Master Gardener training sessions are generally conducted in face-to-face workshops. The Trans-Texas Videoconference Network (TTVN) and digital slide presentations were used when necessary to train Master Gardeners (2002 Texas Master Gardener Report, 2003). Although these technologies are being used currently, other options remain available. One available technology, the compact disc, is not being used to its fullest potential. CD-based training formats provide flexibility for both instructor and participants.

Conceptual Framework

Cooperative Extension has used various learning formats to deliver educational programs. The formats included closed circuit television, cable television, satellite television, and World Wide Web methodologies. Research in Indiana (Branson & Davis, 1985), Minnesota (Sunnarborg, Bradley, & Haynes, 1988), New York (Staats, 1995), Missouri (Warmund & Schrock, 1999), Pennsylvania (Swistock, Sharpe, & Dickison, 2001), and Oregon (Rost & VanDerZanden, 2002) have examined Extension clientele education for learning comprehension in non-traditional settings.

Programs on swine breeding topics (Branson & Davis, 1985), weight control and exercise (Sunnarborg, Bradley, & Haynes, 1988), water quality (Swistock, Sharpe, & Dickison, 2001), and basic soils (Rost & VanDerZanden, 2002) were successfully taught using distance education methods. In each case, the distance education methods were as successful in teaching the subject matter as was the traditional face-to-face method of programming.

Researchers in New York (Staats, 1995) and Missouri (Warmund & Schrock, 1999) evaluated participant satisfaction with distance education methods versus traditional face-to-face methods. Participants identified many positive elements related to distance education methods. Obstacles such as transmission problems and potential audience loss were also mentioned by participants. Warmund and Schrock (1999) found that a majority of participants felt it would be easier to learn material in a face-to-face setting, while one-third of the distance education participants felt that using interactive television would make learning easier.

The aforementioned studies demonstrate a variety of research on learning in formal and nonformal educational settings using various instructional delivery formats. These studies indicate that distance education methods, including closed circuit television, cable television, satellite technology, interactive television, and the Internet, can be successful in delivering Extension programs. The results also indicate that educators should be cognizant of obstacles and possible learner resistance related to distance education methods. However, no studies have been found where research was conducted that evaluated the success of a CD-based Extension program.

Purpose and Objectives

The purpose of the study reported here was to determine if Texas Master Gardener program participants' learning levels differed when taught nutrient, water, and pest management topics using CD-based materials versus traditional workshop materials. The following objectives guided this study.

1. Compare learning between Master Gardeners taught in face-to-face workshop settings versus those taught using CD-based materials.
2. Evaluate students' satisfaction with the instructional materials.

Procedures

A pre-test/post-test experimental design was used to test the effect of extraneous factors (Borg & Gall, 1989) in the study. The experimental group was Master Gardener participants receiving turfgrass management training via a CD-based curriculum. The control group consisted of Master Gardener participants receiving turfgrass management training in a face-to-face workshop setting.

The population for this study was 107 Master Gardener county programs, provided by the Texas Master Gardener Program office. A proportional stratified sample (Borg & Gall, 1989) was drawn to ensure appropriate representation for Master Gardener programs in all 12 Texas Cooperative Extension Districts. Using demographic averages in race, income, and education level, test programs were chosen that best represented each of the 12 Extension districts. Based on the distribution of programs throughout the state, one test program out of every 10 programs would represent each district. Therefore, 16 test programs statewide were considered for the sample.

Overall, six counties, representing four of the 12 Texas Cooperative Extension Districts, participated in the study. The resulting response rate was 37.5%. Counties not participating in the study indicated that their programs were complete, they did not have an active Master Gardener program, or their programs were held during the fall.

Three of the nine Turf for Texans modules, including Nutrient Management, Irrigation Matters in Texas, and Pests and Integrated Pest Management (IPM), were tested. Three separate researcher developed instruments were used for this study. The pre-test instrument contained three parts. The first section included turfgrass management knowledge and perception questions developed by the researcher, a turfgrass graduate student, and the Texas Cooperative Extension state

turfgrass specialist. The second section of the instrument consisted of community participation questions (not a part of this report), while the third section collected demographics, including age, gender, education, ethnicity, and computer experience.

The workshop post-test instrument and the CD post-test instrument consisted of two parts. The first part contained the same turfgrass knowledge and perceptions questions as presented in the pre-test instrument. The second part contained questions used to evaluate the program. Participants were asked to rank nine statements using a four-point Likert-type scale. The scale ranged from strongly disagree (1) to strongly agree (4). These statements included: (a) the information was easy to understand; (b) the information will help me in giving advice to other homeowners; and (c) the information presented was relevant to my geographic location.

CD-based participants were asked to evaluate both the workshop and the CD-based training settings. A second scale allowed CD-based participants to evaluate the usefulness of the components (video, audio, handouts, etc.) used in the CD-based materials. The scale was a four-point scale that ranged from not useful (1) to very useful (4). Three other questions regarded the usefulness of the information, behavior change, preference for training, and satisfaction with the program. Reliability for the knowledge portion was calculated using the Kuder-Richardson 20 method, resulting in a KR-20 alpha coefficient of .68. Content validity was determined by a panel of experts in the Departments of Soil and Crop Science and Agricultural Education at Texas A&M University.

Two options for training existed. Master Gardener participants completed the workshop entirely in a face-to-face setting or completed two-thirds of the workshop in a face-to-face setting and one-third using the CD-based materials. The Texas Cooperative Extension state Extension turfgrass specialist conducted all workshops to maintain consistency throughout the face-to-face training sessions.

The pre-test was administered to all 94 participants. All participants attended the first two-thirds of the basic turfgrass training. Participants who self-selected to complete the three CD-based lessons were dismissed before the instructor began the nutrient management discussion. The remaining students continued the training in the face-to-face setting. Upon completion of the workshop, the post-test was administered to the remaining participants. Fifty-three students completed the workshop post-test.

Participants using the CD-based materials were given 10 days to complete the course. Upon completion, participants completed a post-test by connecting (via the Internet) to a secure server. E-mails were sent to the participants reminding them to complete the course and online tests. Forty-three students agreed to complete the CD-based portion, but only 37 completed the online CD post-test.

Data were collected during late spring and early summer 2004. This timing was chosen to coincide with module development. It was also indicated that 75% of Master Gardener trainings were held during spring of each year (D. Welsh, personal communication, February 24, 2003). Data were analyzed using descriptive and inferential statistics.

Findings

The first objective was to compare learning between Master Gardeners taught in face-to-face workshops versus those taught using CD-based materials. Mean scores were calculated for each of the four test types. Independent samples t-tests were used to compare the mean scores. The tests revealed no significant differences in learning between the two pre-test types, indicating that the students had somewhat equal knowledge of turfgrass management topics prior to beginning the course. Additional t-tests between post-test types revealed a significant difference in learning between workshop scores and CD-based scores (Table 1). Post-test scores analyzed by individual modules (Nutrients, Water, and Pests) revealed no significant differences based on instructional delivery format (Table 2).

Table 1.
Post-test Comparison of Knowledge Comprehension--All Modules

Module	Test Type	<i>n</i>	<i>M^a</i>	<i>SD</i>	<i>t</i>
All ^b	Workshop Post-Test	53	15.87	3.84	-2.00*
	CD-Based Post-test	37	17.38	3.01	
<p><i>Note.</i> ^aTotal scores could equal 21, and ranged from two to 21. ^bTwenty-one knowledge questions related to nutrients, water, and pests.</p>					

* $p < .05$.

Table 2.
Post-Test Comparison of Knowledge Comprehension by Module

Module	Test Type	<i>n</i>	<i>M^a</i>	<i>SD</i>	<i>t</i>
Nutrients ^b	Workshop Post-test	53	5.57	1.38	-1.83
	CD-Based Post-test	37	6.05	1.03	
Water ^b	Workshop Post-test	53	5.42	1.40	-0.99
	CD-Based Post-test	37	5.70	1.31	
Pests ^b	Workshop Post-test	48	5.40	1.16	-0.79
	CD-Based Post-test	37	5.62	1.46	

Note. ^aTotal scores could equal seven, and ranged from zero to seven. ^bEach module consisted of seven knowledge questions related to the subject area.

While both groups made gains, participants using the CD-based materials had higher gains from the pre-tests ($M = 13.70$, $SD = 3.41$) to the post-tests ($M = 17.38$, $SD = 3.01$) These results indicate that the CD-based materials were more effective, overall, in teaching turfgrass management topics to Master Gardeners, than were traditional workshop materials.

The second objective was to evaluate participants' satisfaction with instructional materials and format. All participants were asked to evaluate the workshop instructional format (Table 3). Participants indicated their satisfaction by agreeing or disagreeing with eight statements, measured on a four-point Likert scale (1 = strongly disagree to 4 = strongly agree). An independent samples *t*-test revealed no significant differences between participants' satisfaction levels with instructional format used to complete the course. All participants were satisfied with the workshop format. Participants were most satisfied with the presenter's knowledge of the subject matter; they were least satisfied with "ease of understanding" the information (Table 3).

Table 3.
Student Satisfaction with the Workshop Instructional Format (N = 87)

Statements	Workshop (<i>n</i> = 50)		CD (<i>n</i> = 37)		Total (<i>N</i> = 87)	
	<i>M^a</i>	<i>SD</i>	<i>M^a</i>	<i>SD</i>	<i>M^a</i>	<i>SD</i>
The presenter was knowledgeable about the subject.	3.69	.47	3.65	.48	3.67	.47
The examples used were relevant and meaningful.	3.53	.50	3.38	.55	3.47	.52
The information presented was relevant to my geographic location.	3.50	.51	3.43	.55	3.47	.52

The information will help in decisions about my own situation.	3.35	.48	3.41	.50	3.38	.49
The information was presented in a logical, easy to follow manner.	3.34	.63	3.24	.60	3.30	.61
The pace of the program was appropriate.	3.18	.69	3.22	.63	3.20	.66
The information will help me in giving advice to other homeowners.	3.14	.46	3.16	.65	3.15	.54
The information was easy to understand.	2.92	.54	3.14	.48	3.01	.52
<i>Note.</i> ^a Four-point scale (1 = Strongly Disagree, 4 = Strongly Agree).						

Participants who used the CD-based materials were asked to evaluate both the workshop and CD-based materials. Participants reported high levels of satisfaction for both types of materials. The CD-based materials were given higher ratings in five of seven categories pertaining to both instructional formats. The categories included ease of understanding, making decisions related to their own situation, giving advice to others, program pace, and presentation of the material. The results indicated that participants were pleased with the CD-based materials (Table 4).

Table 4.
CD-Based Participants' Evaluation of Instructional Formats (n = 37)

Statement	CD-Based		Workshop	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
The information was easy to understand.	3.30	.52	3.14	.48
The information will help in decisions about my own situation.	3.43	.50	3.41	.50
The information will help me in giving advice to other homeowners.	3.32	.58	3.16	.65
The presenter was knowledgeable about the subject. ^a	—	—	3.65	.48
The examples used were relevant and meaningful.	3.35	.48	3.38	.55
The pace of the program was appropriate.	3.38	.55	3.22	.63
The information presented was relevant to my geographic location.	3.22	.53	3.43	.56
The information was presented in a logical, easy to follow manner.	3.39	.55	3.24	.60
The course materials were easy to navigate. ^b	3.27	.80	—	—
<i>Note.</i> Scores were calculated using a four-point scale (1 = Strongly Disagree,				

4 = Strongly Agree). ^aStatement was relevant only to the workshop presentation. ^bStatement was relevant only to the CD-based materials.

Individual components of the CD-based materials were evaluated for their usefulness. Participants rated the usefulness of the different CD components (Table 5). Overall, participants were pleased with the components used in the CD materials. Text on screen, static graphics, and links to outside information sources received the most useful ratings. Components receiving the lowest ratings were audio and video clips.

Table 5.
Evaluation of Components Used in CD-Based Materials (n = 36)

Component	<i>M</i>	<i>SD</i>
Text on screen	3.34	.59
Static graphics	3.28	.62
Links to outside information sources	3.26	.66
Handouts (i.e. Adobe Acrobat files)	3.11	.62
Video clips	2.69	.72
Audio clips	2.26	.86
<i>Note.</i> Items were measured on a four-point scale (1 = Not Useful, 4 = Very Useful).		

Individuals also were asked their preference for future Master Gardener training programs. An overwhelming majority (78%) of the workshop participants indicated they preferred face-to-face instructional formats. Approximately one-half of the CD-based participants indicated they would prefer to have face-to-face trainings, while a large group (38%) indicated that a combination of training methods would be preferred (Table 6).

Table 6.
Respondents' Instructional Format Preference (N = 87)

Training Method	CD (n = 37)		Workshop (n = 50)	
	<i>f</i>	Percent	<i>f</i>	Percent
Face to face	19	51.4	41	77.4
CD-based	2	5.4	3	5.7
Internet based	2	5.4	2	3.8
Other ^a	14	37.8	4	7.5
<i>Note.</i> ^a The majority of responses indicated a combination of methods was preferred.				

A final question regarding overall course satisfaction was asked to all participants. Participants rated their satisfaction using a four-point scale (1 = Very Unsatisfied, 4 = Very Satisfied). The CD participants were satisfied ($M = 3.38$, $SD = .72$) with their overall experience, while the workshop participants were more satisfied ($M = 3.52$, $SD = .81$) with their experience than were the CD participants. Overall, both groups were satisfied with their instruction.

Conclusions

CD-based materials were more effective in promoting understanding of nutrient, water, and pest management turfgrass topics to Master Gardener trainees than were the face-to-face workshop settings. The results indicated that CD-based materials could be used to teach Extension clientele difficult subject matter. These results contradict previous research (Branson & Davis, 1985; Sunnarborg, Bradley, & Haynes, 1988; Swistock, Sharpe, & Dickison, 2001; Rost & VanDerZanden, 2002) that found no differences in learning based on instructional format. Possible explanations exist in that CD-based participants in the current study had greater computer literacy skills, less computer technology anxiety, or were much more attuned to the instructional materials. Additional study is needed to isolate these factors in the learning environment.

Several conclusions can be drawn about participants' satisfaction with the instructional materials. First, participants were satisfied with both training methods used in study, which concurs with Staats (1995), who found student satisfaction with distance-based instructional materials was high. Second, the components used in the CD-based materials revealed audio and video clips as not particularly useful. The most useful items were text and static graphics. For this particular course, audio and video clips were not seen as key to students' success. Finally, individuals in the face-to-face setting indicated a preference for future face-to-face training programs. Participants using the CD-based materials showed a preference for face-to-face workshops, yet also indicated they would like to see a combination of instructional formats used in the future. This finding is concurrent with Warmund and Schrock's (1999) previous Master Gardener research.

Recommendations

Implications of this study could affect significantly Extension programming. While some programs use Internet-based training (Rost & VanDerZanden, 2002), Extension professionals should consider CD-based training materials as a viable option for an instructional delivery method. CD-based materials offer students with computers, but without Internet access, contact to programs that might not otherwise be available. Using CD-based training materials could open Extension programs up to new audiences that might not be able to attend traditional Extension programs. CD-based materials would allow clients the ability to complete training programs when and where they have time to complete the materials. This could greatly enlarge the reach of today's Extension programs.

It is recommended that research be conducted to test the effect of instructional formats on long-term retention. Additionally, a future study should be conducted to compare learning between Master Gardeners who are taught in face-to-face workshops versus those taught using CD-based materials using the complete Turf for Texans curriculum.

Extension professionals should consider using CD-based materials for program delivery. Extension educators should be cognizant, however, that clientele were satisfied with CD-based materials, but also would like to see a continued human presence. It is recommended that CD-based materials be used as core training materials, with follow-up question-and-answer sessions, if warranted by participants.

Participants in this study were asked to evaluate both the workshop and the CD-based instructional formats. It is possible that participants compared the materials rather than evaluated each format on its own merits; caution is warranted in generalizing this possibility beyond the sample group. A future study should be conducted to evaluate the Turf for Texans CD-based curriculum as a single instructional format.

Technology Tips

For those wondering about the difficulties in creating CD-based curricula, these instructions may alleviate certain technology fears. First, create all instructional materials in a Web-based format on your computer's local hard drive. This creates a finished product that can be viewed in a consistent manner (i.e., in a Web browser) and removes one step in future developmental processes (converting CD-based materials to Internet-ready materials). Use one of several Web editing software programs (FrontPage, DreamWeaver, etc.) to create the instructional modules, complete with hyperlinks to Adobe documents, streaming videos, and graphical materials. Take caution in establishing a correct hierarchy in all folder and file structures necessary for viewing the modules.

Second, include AUTORUN.INF and AUTORUN.EXE files on the CD with your instructional modules. The autorun.inf file tells the computer to read or open an executable file (autorun.exe) when the CD is loaded into the CD drive. The autorun.exe file tells the computer to open/start another file

(index.html, or whatever name you used for your primary module home page).

Last, burn the entire instructional module folder and file structure, **and** the autorun.inf and autorun.exe files to a CD. The two autorun files **cannot be inside a folder** on the CD, or they will not be read when the CD drive closes. Finally, it is always a good idea to include "operating instructions" and/or your contact information on the CD label or CD case cover to prevent potential operator errors. Instructions may include the following.

1. Insert CD into CD drive
2. Auto-run will start automatically
3. If CD does not start/open in a browser:
 - a. Open "My Computer" to view your CD drive
 - b. Click the CD drive
 - c. Double-click the "instructional_module_folder"
 - d. Double-click the index.html file

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