Teaching Golf Green Construction Using Lecture, Videotape, and Scale Models in a Turfgrass Management Course

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ABSTRACT

Knowledge of golf green construction methods is necessary for students who will work in the golf course maintenance industry. Field demonstrations are seldom practical due primarily to economic constraints. To provide this information, golf green construction was taught using lecture, videotape, and scale models. In a survey conducted over a 5-year period, 66% of the students found the lecture to be very useful while 72% percent indicated the video was very useful. The student survey indicated that 74% thought that construction of the model increased their knowledge of golf greens types and 70% indicated it increased their knowledge of golf greens construction. Integration of video and active learning with lecture provided an opportunity for students to critically and visually evaluate their own work.

INTRODUCTION

Often, traditional classroom instruction results in students acquiring specific information but does not facilitate integration of the information into real-life situations (Schweitzer, 1986). The use of videotapes to supplement lecture material in various crop and soil science courses has proven to be an effective teaching technique to enhance learning and to keep the subject matter modern (Burger and Aleamoni, 1972; McCrimmon et al., 1992). Furthermore, this technique increased the amount of material that could have been presented and improved the overall quality of teaching. Videotape delivery was determined to be so effective that it has been used as the primary delivery system in some educational programs in the U.S. (Miller and Honeyman, 1994).

Students that become involved in active learning may be challenged to critically analyze information and then apply previously learned knowledge (Hall, 1989). Active learning projects that reinforce lecture have been incorporated successfully into the classroom learning experience (Buhr and Knauft, 1984; Kesler, 1998; Schweitzer, 1986). Projects that employ the use of realistic problems and situations that require higher-level thought concepts and improve student understanding are generally regarded by students as valuable learning experiences (Danneberger, 1994; Howe and Durr, 1982; Turgeon, 1999). The article describes an active learning project that has been used successfully in a Turfgrass Culture course over a 5-year period. The purpose of writing this article was to demonstrate how this learning method was administered to and received by students.

The United States Golf Association (USGA) recommendations (US Golf Association Green Section Staff, 1960, 1973, 1989) have been the most widely used method for golf green construction throughout the United States and in other parts of the world since the 1970s (Snow, 1993). Since there is a direct correlation relating physical condition of putting green soils to their performance (Hummel, 1993), a basic understanding of these specifications and the procedure for constructing a green is necessary for individuals working in the golf course maintenance industry. Field demonstrations of greens construction are seldom practical due to lack of greens construction activity at the time of year when most turfgrass classes are taught, a large time commitment, and the large amount of equipment and materials required. The objective was to develop a laboratory exercise to teach students about greens construction material testing and the steps involved in greens construction by supplementing lecture with videotape instruction as well as an active learning project. To assess the effectiveness of this laboratory exercise, student attitudes concerning their self-perceived knowledge improvement and overall acceptance of the supplemental teaching aids were determined.

MATERIALS AND METHODS

Evaluations were conducted during fall semesters of 1995-1999. The lab exercise started with a traditional lecture relating to golf greens. A handout that provided desired performance characteristics of green construction material was given to the students as well as information related to greens construction using USGA specifications, including the subgrade, drainage, gravel and intermediate layers, sand selection, amendment selection, root zone media, and seed bed preparation. The individual steps in putting greens construction were detailed along with the physical specifications of the construction materials. The handout was thoroughly discussed with the students in a classroom setting, giving the students opportunities to ask questions. Students were asked to bring this handout with them to the following laboratory period.

At the start of the laboratory period, a 25 minute video *USGA Putting Green Construction* (U.S. Golf Association, 1989) produced by the USGA (Far Hills, NJ) was shown to the students. This video took students through the construction of a putting green from initial grading to the first mowing, using the USGA method (U.S. Golf Association Green Section Staff, 1989). Topics covered included the subgrade, drainage, root zone media, and establishment of turf.

After viewing the video, students were placed in groups of three to best utilize the equipment and supplies available in the laboratory as well as give them an opportunity to interact as part of a small group. Before beginning construction of an actual green, all construction materials must be tested by an accredited lab and meet stringent specifications related to their physical properties. To give the students an opportunity to test greens construction materials and to begin the active learning project, each group collected approximately 1000 cm^3 of rootzone media (mostly sand) from large containers. Each group was required to evaluate their subsample for particles size distribution to see if it conformed to USGA specifications (U.S. Golf Association Green Section Staff, 1989). Standard USGA sieve testing procedures (U.S. Golf Association Green Section Staff, 1989) were demonstrated and then each group was given time to test their samples. The evaluation procedure and a worksheet for this exercise were attached to the putting green handout they received in lecture. Even though particle size determination is only one of many tests run by an accredited lab for USGA specification analysis, it gave the students an opportunity to evaluate the one characteristic that has the greatest influence on other performance characteristics (e.g., bulk density, saturated conductivity, porosity, and moisture retention). These other analyses are not easily evaluated within a two hour lab period due the constraints of equipment, space, and time. As each group completed their evaluation, they recorded their data on the classroom's chalkboard. The class then determined which media samples met United States Golf Association (USGA) specifications.

To complete the active learning project, each three-member group had to construct scale models of USGA golf greens. Model height and individual profile component heights are approximately one-half scale, whereas the actual root zone media, choker layer (if included) and gravel components meet USGA specifications (Fig. 1). Model width is 5 cm and can be viewed from either side if assembled correctly (Fig. 2). The model case is constructed of two sheets of 1-cm thick Plexiglas cut 22-cm wide and 33-cm tall. The sheets are attached with bolts and screws to a 2.5-cm thick plastic spacer cut 2 cm wide. The spacer is cut in a continuous U-shape to prevent the components from sifting through cracks. This also allows a single piece of spacer to cover the top opening, which facilitates filling the model with rootzone media from the top and then sealing it shut (Fig. 2).

After completing the models, the class discussed the difficulties maintaining uniformity with each layer added to the model. The discussions provided an opportunity for student analysis of their work, as well as exposed students to projects completed by other students. Student evaluations of the lecture, video, and active learning project were completed by providing a short questionnaire at the end of the laboratory period. Student responses to all questions except one was limited to: not useful, useful, very useful (Table 1). Student evaluation data were summarized in contingency tables where the classification variables were year and student evaluation scale. Chi-square analysis was then used to test for independence, that is, to test whether the frequency of student responses was the same from year to year. In addition to responding to questions with an evaluation scale (i.e., not useful, useful, very useful), each student was asked to write in suggested changes that could be made to improve the active learning project.

RESULTS AND DISCUSSION

Overall, the students responded positively to the lecture presentation, video presentation, and model construction. One hundred percent of the students enrolled in the course completed the survey in 1995, 1996, 1997, and 1999; whereas, in 1998 only 85% of the students enrolled completed the survey. Over the five-year period 92 students responded to the evaluation questions. The chi-square test of independence for year x student evaluation scale were not significantly (p ranged from 0.09—0.75) for each question, indicating that the classes did not differ in their evaluation of the project. Table 1 presents the results from questions related to the different kinds of presentations. No student indicated that the lecture, video, or model construction was "not useful" for their understanding the concept of golf greens or their construction. Sixty-six percent of the students found the lecture to be "very useful". The students probably found lecture material useful because a detailed handout was provided that could serve as a reference. Also, since this was a new subject for most of

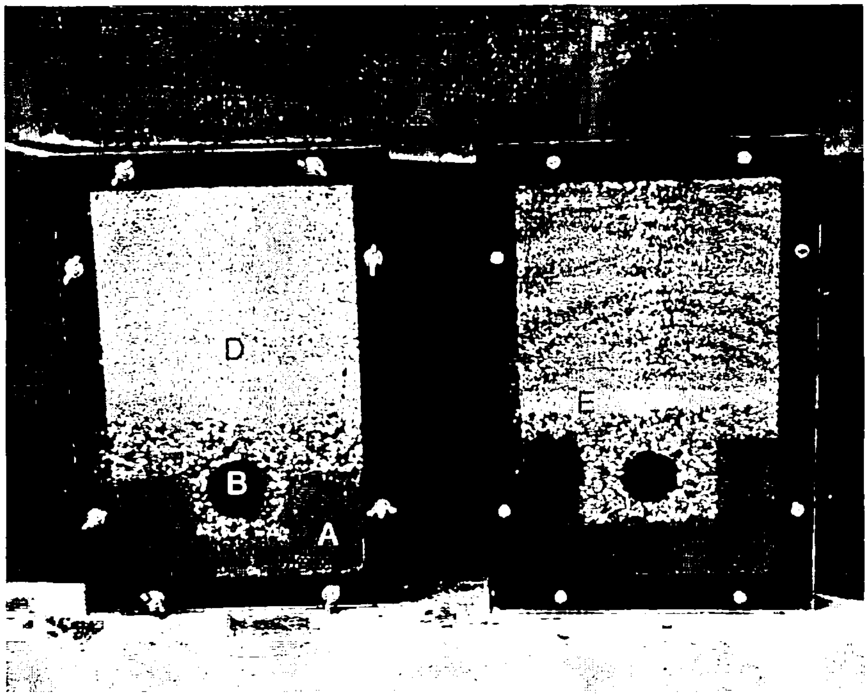

Fig. 1. Completed model showing base clay layer (A), drainage pipe (B), gravel layer (C), and root zone mix (D), and a second model design with choker sand layer (E).

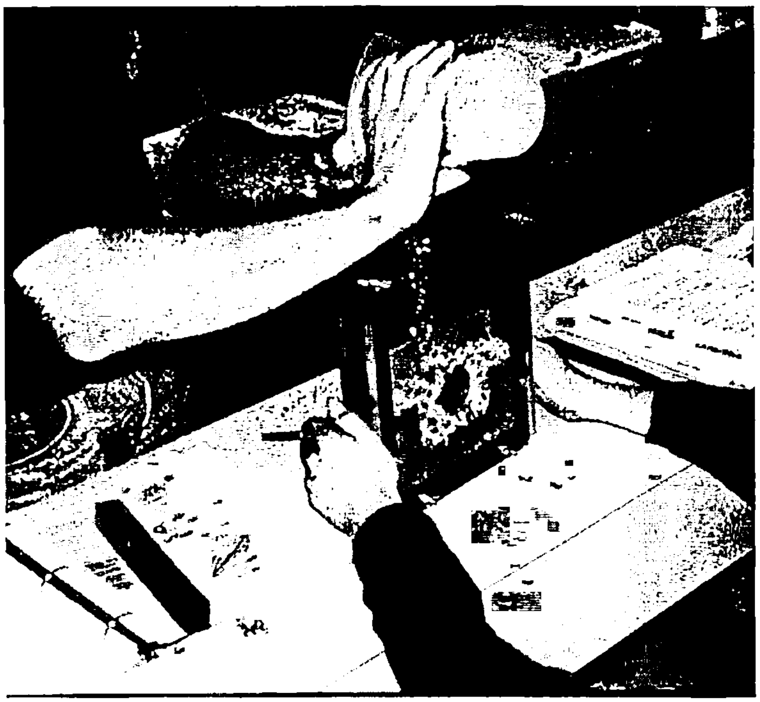

Fig. 2. Pouring gravel layer into model. Note clear Plexiglas to allow viewing from either side.

these students, their interest level was high. The topic of USGA greens had been alluded to in earlier lectures, but had not been explained until the students understood the basics of soil science and turfgrass culture. The lecture on USGA greens incorporated their knowledge of earlier lectures and had practical implications to golf course management. The video further emphasized points brought out in lecture, while providing visual stimulus and appropriate examples. Students remarked that the video was very useful (72%) in learning how greens are constructed.

Student evaluations indicated that constructing the model was useful (74%) to increase understanding of different types of greens. Buhr and Knauft (1984) reported 86% of a group of plant science students agreed that activity projects were an important learning tool. In this class, seventy percent believed the models increased their knowledge of how golf greens are constructed. During discussion, most of the students thought that building the greens would be much easier than it turned out to be.

A final open-ended question asked students who completed the green construction project, "What improvements could be made concerning the design or construction of the models?" Two responses were written more than 15 times in five years. These were, "nothing" and "everyone make their own so that we can keep them". Several students suggested that water should be added to the top of the model to verify if the soil layers actually resulted in a perched water table. These suggestions were in response to a conceptualization presented in the USGA video (U.S. Golf Association, 1989).

Presenting information using lecture and video provided an excellent base of information that enabled a student to hear and then observe the concept. McCrimmon et al. (1992) reported that turf undergraduate students indicated that videos (topics included: pesticide handling, equipment calibration, lawn aeration, turf insects, turf weeds, and maintenance of mowers) were a positive supplement to a

Table 1. Student response to golf green construction lecture, video and active learning project in Turfgrass Culture (one class studied for 5 years).

	Response[z]		
Questions	Not Useful	Useful	Very Useful
1. The information presented in lecture about the "different kinds of golf greens" was:	0	34	66
2. How useful was the video on golf green construction in learning how golf greens are constructed?	0	28	72
3. How useful were the models in learning how "different golf greens" are constructed?	0	30	70
4. Did construction of the models increase your understanding of different types of golf greens?	2	24	74

[z]Total number of responses for the 5 years was 92. Numbers are reported in percentages.

turfgrass management course, but were not a substitution for traditional teaching methods. McCrimmon et al. (1992) reported that students found hands-on learning opportunities to be more effective than videotapes. Kesler (1998) reported that group activity projects will improve the quality of instruction and knowledge retention for most students. Completing the learning experience through the active learning project presented in this paper increased student involvement in their learning process and provided an opportunity for students to put into practice concepts that were presented. The integration of information into a physical product allowed the students an opportunity to test their knowledge and to critically analyze their own work.

SUMMARY

Understanding golf green construction methods is critical for people who will work in the golf course maintenance industry. A lecture on basic golf green design and construction can provide a framework upon which visual material and hands-on learning opportunities can be based. The greens construction models can be assembled in a lab period and cost is minimal. The active learning activity described above gives students an opportunity to discuss concepts in a group setting, hear other students' opinions, and then work as a team toward a common goal.

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