Evaluation of a Software Prototype Designed to Teach Landscape Cost Estimation[1]

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Abstract

A project was undertaken to develop an interactive software program that could be used to instruct students in the process of landscape cost estimation. The objective of this study was to evaluate an early prototype of this software and compare its effectiveness, as a teaching tool, to the more traditional type of instruction consisting of lecture and overheads. Pre/post testing indicated that both instructional methods increased student understanding about the subject, and the software proved equally effective to the lecture in this regard. Students generally regarded the software as a more entertaining delivery platform, and thought that the software would be a useful teaching tool when completed.

Introduction

The business of landscape horticulture has become increasingly competitive. It is estimated that only fifteen percent of newly established landscape horticulture companies survive until their tenth anniversary (Ross, 1993). The reasons for this high failure rate are uncertain but one contributing factor is that students preparing to enter the industry usually receive little, if any, academic training in the area of cost estimation.

Cost estimation is defined as the "art of adding markups to costs in order to determine a price for a job" (Hutson, 1994). It is a complex process consisting of many different steps that must be performed in a logical sequence.

The process, while very difficult for students to conceptualize, also proves challenging to horticulture instructors who attempt to teach the subject. Most landscape horticulture programs do not offer full semester courses in cost estimation and time allocated to the subject often consists of a single lecture

Table 1. Pre- and posttest given to students involved in evaluation of cost estimation software.

I understand the following terms:							
1. Debt retirement	Don't Understand	1	2	3	4	5	Understand
2. Material overhead	Don't Understand	1	2	3	4	5	Understand
3. Direct labor cost	Don't Understand	1	2	3	4	5	Understand
4. Composite base wage	Don't Understand	1	2	3	4	5	Understand
Rate the following methods by which a landscape contractor may estimate the cost of a landscape installation job:							
5. Multiply the materials cost times ten	Inaccurate	1	2	3	4	5	Accurate
6. Multiply the materials cost times three	Inaccurate	1	2	3	4	5	Accurate
7. Assign an 'across the board' price based on the size of the job	Inaccurate	1	2	3	4	5	Accurate
8. Assign a calculated percentage to each unit of material to be applied	Inaccurate	1	2	3	4	5	Accurate
9. Estimate income of owner and determine price	Inaccurate	1	2	3	4	5	Accurate
To determine the amount of a bid for an installation job a landscape contractor needs to know:							
10. Direct costs	Disagree	1	2	3	4	5	Agree
11. Overhead costs	Disagree	1	2	3	4	5	Agree
12. Anticipated performance	Disagree	1	2	3	4	5	Agree
13. Bid amount of competitor	Disagree	1	2	3	4	5	Agree
Labor burden includes:							
14. The level of difficulty of work for a project installation	Disagree	1	2	3	4	5	Agree
15. Payroll taxes	Disagree	1	2	3	4	5	Agree
Direct costs refer to:							
16. All expenses involved in running a business	Disagree	1	2	3	4	5	Agree
17. Cost attributable to overhead	Disagree	1	2	3	4	5	Agree
18. Costs billed to a specific job	Disagree	1	2	3	4	5	Agree
Composite base wage includes:							
19. The total amount of labor wages paid per hour to personnel performing the work	Disagree	1	2	3	4	5	Agree
20. The average wage paid per hour to personnel performing the work	Disagree	1	2	3	4	5	Agree

[1] Research funded through the USDA Higher Education Challenge Grants Program

Table 2. Means, standard deviations, amd P values on pre- and posttest for students involved in evaluation of cost estimation software.

Question	Test	Control Mean[Y]	Treatment Mean[X]	P Values[Z]: Pretest Control vs Treatment	Posttest Control vs Treatment	Control Pretest vs Posttest	Treatment Pretest vs Posttest
1	Pre	1.82 (1.02)	1.92 (0.91)	.71	.02*	.00**	.00**
	Post	3.79 (0.92)	3.12 (1.13)				
2	Pre	3.61 (1.31)	3.06 (1.11)	.19	.00**	.00**	.04*
	Post	4.46 (0.69)	3.64 (0.80)				
3	Pre	3.86 (1.15)	3.38 (0.79)	.23	.12	.04*	.01*
	Post	4.39 (0.79)	4.20 (1.00)				
4	Pre	2.57 (1.03)	2.20 (0.82)	.16	.66	.00**	.00**
	Post	3.75 (1.14)	3.88 (0.97)				
5	Pre	1.71 (0.90)	1.96 (0.98)	.34	.35	.23	.17
	Post	2.07 (1.27)	2.40 (1.26)				
6	Pre	3.25 (1.38)	2.88 (1.20)	.31	.66	.05	.65
	Post	2.57 (1.17)	2.72 (1.31)				
7	Pre	2.43 (1.40)	2.88 (1.13)	.21	.21	.49	.56
	Post	2.77 (1.31)	3.08 (1.29)				
8	Pre	3.36 (1.22)	3.80 (1.08)	.17	.52	.00	.28
	Post	4.30 (0.99)	4.12 (0.97)				
9	Pre	1.61 (1.10)	1.92 (1.26)	.34	.32	1.0	.16
	Post	1.81 (0.88)	2.26 (1.33)				
10	Pre	4.71 (0.53)	4.14 (1.02)	.21	.82	.13	.04*
	Post	4.52 (0.31)	4.68 (0.82)				
11	Pre	4.68 (0.67)	4.56 (0.87)	.58	.74	.33	.86
	Post	4.43 (1.17)	4.52 (0.71)				
12	Pre	4.07 (1.12)	3.92 (1.04)	.61	.94	.32	.08
	Post	4.00 (1.19)	4.12 (1.06)				
13	Pre	3.07 (1.65)	3.28 (1.34)	.62	.64	.46	.45
	Post	2.75 (1.60)	2.96 (1.62)				
14	Pre	4.11 (1.29)	3.96 (1.21)	.67	.88	.10	.14
	Post	3.46 (1.55)	3.40 (1.57)				
15	Pre	3.15 (1.38)	3.40 (1.29)	.50	.35	.65	.45
	Post	3.32 (1.47)	3.68 (1.28)				
16	Pre	2.93 (1.51)	3.32 (1.57)	.36	.71	.48	.25
	Post	2.64 (1.52)	2.80 (1.55)				
17	Pre	3.15 (1.41)	3.24 (1.36)	.81	.42	.61	.56
	Post	3.36 (1.62)	3.00 (1.58)				
18	Pre	4.04 (1.16)	3.96 (1.14)	.82	.21	.07	.45
	Post	4.54 (0.84)	4.20 (1.08)				
19	Pre	3.29 (1.51)	3.88 (1.24)	.12	.53	.62	.21
	Post	3.07 (1.72)	3.36 (1.63)				
20	Pre	3.75 (1.51)	3.36 (1.19)	.34	.40	.86	.00**
	Post	3.68 (1.54)	4.62 (0.82)				

[Z] *,** significant at P=0.05 or P=0.01, respectively
[Y] Means and standard deviation (in parenthesis) based on a total of twenty-seven students.
[X] Means and standard deviation (in parenthesis) based on a total of twenty-six students.

and perhaps one lab session.

Because of the difficulties mentioned above, computer-based instruction may prove the best method to teach students the subject of cost estimation. Computer-based instruction has been found to have beneficial effects on achievement in a wide variety of instructional settings (Draper, 1996; Roblyer, 1985; Kulik and Kulik, 1987). Benefits include individualized instruction which may be paced to the needs of the student, cost-effectiveness (particularly when compared to outdoor lab exercises), and increased efficiency with respect to the amount of time it takes students to learn a particular subject. In addition, students may be better able to develop critical thinking and problem-solving skills when using computer based instruction (Rhodus and Hoskins, 1995).

A project was initiated at Southern Illinois University Carbondale (SIUC) in 2000 to develop an interactive software program that could be used to instruct students in the process of landscape cost estimation. The objective of this study was to evaluate a prototype of this software and compare its effectiveness, as a teaching tool, to the more traditional type of instruction consisting of lecture and overheads.

Materials and Methods

Fifty-three students enrolled in a landscape design class within the Dept. of Plant, Soil and General Agriculture at SIUC were randomly assigned to either a control group (27 students) or treatment group (26 students). All students took a pretest (Table 1) designed to assess the students' existing knowledge of cost estimation. Students participating in the study had received no formal academic training in cost estimation prior to administration of the pretest.

One week after administration of the pretest, students in the control group attended a lecture presentation on cost estimation in a typical classroom setting using the same room in which the class was normally held. The lecture format included use of overhead projections. Students in the treatment group, who were not exposed to the lecture, were taken to a multimedia center on campus and asked to view the software prototype that had been developed. Both the control and the treatment groups received the same information with respect to cost estimation although the delivery formats were different.

Immediately following the lecture and software presentations, a posttest (Table 1) was given to both groups of students. The same set of twenty questions was used for both the pretest and posttest. All questions were presented in a Likert scale format with possible responses ranging from one (disagree) to five (agree). Control and treatment groups were compared with respect to their mean scores on both pre- and pretest using t-test at the 5% significance level. Then the difference between the pretest and posttest scores was determined for each student.

T-tests were performed to determine whether the

difference between pretest and posttest scores were significant for each question within each group of students (Table 2).

Following administration of the posttest, a qualitative survey (not presented) was given to all participants in both the control and treatment groups. The survey was designed to assess student perceptions about the presentation formats, and did not ask questions specifically about cost estimation. Students were also encouraged to make written comments concerning any aspect of the testing procedure.

Results and Discussion

Results of the pretest indicate no significant difference between the control and treatment groups on any of the twenty questions (Table 2). Therefore, it was assumed that both groups were equivalent with respect to their knowledge concerning cost estimation prior to receiving any instruction on the subject.

Posttest results indicate no significant difference between the control and treatment groups on eighteen of the twenty questions (Table 2). However, the control group did perform better on questions one and two which dealt with common terminology used in cost estimation. Improved performance on these questions (compared to the treatment group) likely relates to the fact that students raised questions about these items while listening to the lecture, leading to impromptu discussion and better understanding among the participating students.

Posttest scores for both the control and treatment groups were significantly greater than pretest scores on the first four questions (Table 2). Getting the students to understand the basic terminology (debt retirement, material overhead, direct labor cost, and composite base wage) presented in these questions was a major goal of this project and results indicate success in reaching this objective. Posttest scores of the treatment group also increased significantly on questions ten and twenty which dealt with the concepts of "direct costs" and "composite base wage". These concepts were thoroughly covered on the software prototype and their clear presentation likely accounted for improved scores.

Summary

The software prototype proved equally effective to the lecture in teaching students about the subject of cost estimation. Survey comments were generally positive about both presentation formats although several students described the lecture presentation of the cost-estimation material as dull. The software was regarded as a stimulating and entertaining format although there were several comments regarding technical flaws and navigational problems that were present in the prototype. A number of useful suggestions were received from the student population, and these suggestions are currently being incorporated into the final release of the software.

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