Journal of Business & Leadership: Research, Practice, and Teaching (2005-2012)

Volume 1
Number 1 *Journal of Business & Leadership*

Article 25

1-1-2005

Active Teaching In Business and Accounting: A Survey of Techniques and An Empirical Test

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ACTIVE TEACHING IN BUSINESS AND ACCOUNTING: A SURVEY OF TECHNIQUES AND AN EMPIRICAL TEST

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This study empirically examines the effect of an active teaching approach on student test scores. In a between subjects design, 40 students learned introductory budgeting concepts under an active approach, and 42 were presented the same material via lecture. Test scores reveal that students in the active condition performed better than the lecture group when test questions were essays involving synthesis of concepts. When tested for acquisition of factual knowledge using multiple choice questions, the two groups did not differ. The study extends the existing literature in two ways. First, it tests an active teaching approach which is a blend of techniques which have been previously tested individually. Secondly, by including test questions ranging from factual to conceptual, the study examines the level at which active learning begins to have an advantage over lecture.

Introduction

This paper reviews active teaching/learning methods which have been empirically tested for their effect on student test performance, and it further identifies an important sub-category of these methods which can be described as an informal style commonly used by educators in business disciplines. The paper provides an example and empirical test of this latter style of teaching. The paper should be of interest to educators across the business disciplines, particularly those in accounting.

Previous studies have empirically examined the effect of Socratic lecturing, in-class writing, and in-class simulations on student test scores. These studies are carried out in live classroom settings, and they compare the particular teaching method with traditional lecture as a baseline or control. A less well defined category of teaching which is common today is to combine these three elements (questioning, role-playing, and writing).

Few teachers today lecture for an entire term to groups of student-stenographers. Teachers pause to ask students questions, probing their interest and comprehension; business situations are introduced to apply and illustrate concepts; and students are asked to write out ideas and solutions. These things are done on a daily basis, often in combination; today's teaching is often an informal mixture of more well-defined techniques. The goal of this paper is to provide an example and empirical test of this common style of teaching.

Active Teaching Methods

A list of papers examining teaching methods for their impact on student learning includes papers in general education reviewed by McKeachie, Pintrich, smith and Sharma (1990). An area of focus within McKeachie et al. is a group of papers comparing lecture versus discussion as rival teaching approaches (seventeen papers reviewed, table 5, pg. 82). The broad sweep of this literature suggests that lecture is as good as, or better than, discussion for imparting factual knowledge while interactive discussion works better for higher level outcomes. Representative of this body of work is an early study by Solomon, Rosenberg and Bedzek (1964), who examine the effect of instructor attributes on student learning in an undergraduate political science class. Student performance on test questions measured learning of both factual knowledge and comprehension of concepts. Instructor attributes included measures of personal warmth, permissiveness, clarity of expression, and tendency to lecture. Significantly, instructor tendency to lecture was found to be positively related to student learning of factual knowledge, but not conceptual understanding.

The efficacy of active teaching and learning is largely based on the principle of elaboration, and empirical studies in accounting education frequently cite it for theoretical support [e.g. Hermanson (1994), Almer, Jones and Moeckel (1998), Braun and Simpson (2005)]. Elaboration occurs when a student is stimulated to generate his or her own ideas about new material, making connections between the new material and existing or familiar knowledge. McKeachie (1994: 284) summarizes the idea as follows:

> Active learning works because active learners are more likely to be attentive and to be thinking about the topic, relating new knowledge to previous learning, and elaborating the implications of what they have learned - emphasis added.

Journal of Business & Leadership: Research, Practice, and Teaching (2005-2012), Vol. 1 [2005], No. 1, Art. 25

Based on the principle of elaboration, teaching methods can be viewed as more or less "active" in their approach. Pure lecture is not active because students are receptors of information without the opportunity to think about the material, while interactive lecture, which encourages student discussion, provides time for students to think about material, to ask questions and suggest possible solutions. These educational ideas have migrated into teaching in business administration and accounting and take a broad range of forms, several of which are discussed below.

One style of interactive lecture is Socratic questioning, i.e., a series of questions posed to the class as a way of both presenting material and involving students. Presenting a question to the class can be a good way of increasing attention, participation, and interest in subject matter. An interesting question followed by a pause sets in motion the active thought processes of students: students have time to think about possible answers and propose solutions. Interest in the subject matter is typically increased, in part because students have the prospect of offering their ideas to the class. While not all students like to be recognized in class, most do, even if they would not acknowledge so. For those students who do not like the spotlight, there is still a thought process going on as they ponder quietly. In other words, it may not be necessary for all students to verbalize their ideas for elaboration to take place; a purely rhetorical question, if followed by a pause, may be effective as long as it stimulates student thought.

Hoyle (1996), in a study involving sixty-nine students in two sections of intermediate financial accounting, examined the impact on course grades of using Socratic questioning versus straight lecture. No difference in average grade between the two groups was observed, however Hoyle did not separately examine the impact of the teaching method on the acquisition of basic facts versus higher order skills. If he had differentiated the material in this way, perhaps the Socratic method would have been found superior in imparting higher order skills.

Another way to encourage active student thought about subject matter is through the use of in-class writing. In-class writing can take the form of solving practice-problems, or summarizing ideas in the form of prose. Practice problems with specific quantitative solutions may be more common in areas such as accounting, while prose may be more immediately associated with courses such as strategic management, where solutions involve integration and synthesis of business functions. One form of in-class writing is the familiar "one-minute paper." Students are asked, at the conclusion of class, to summarize in their own words the major ideas presented during the period. The act of thinking and writing causes students to generate their own thoughts about the topic, making a connection between what they have just learned and their prior, existing knowledge.

Almer, Jones and Moeckel (1998) examined the impact of one-minute papers on a series of ten-point quizzes administered throughout the semester in a study involving 867 undergraduate students enrolled in introductory accounting. They found that students who are writing papers scored an average 1.47 points higher than students who did not write, a result significant at a .02 level of confidence. While Almer et al. did not vary the subject matter tested from factual to conceptual; they did use two quiz types, multiple choice and essay. Further analysis of their results showed that the improvement in average quiz score was confined to essay quizzes: students taking multiple choice quizzes scored just as well without benefit of in-class writing. This result is consistent with the notion that active learning helps with higher order skills in that successfully writing about something implies greater command of it than simply selecting the correct response from a list.

A third type of active learning is simulation. Simulation can take the form of games or role-playing in class, and extends to interactive computer simulations. One common type of simulation is the use of a mock trial in business law courses with students taking roles as defendants, attorneys, judge and jury. Simulation is part of a larger category known as experiential learning which encompasses everything from active learning in the classroom to business internships and service learning outside the classroom. Students with learning styles which thrive on concrete experience particularly benefit from experiential learning. These students are called "kinesthetic" learners by Fleming and Bonwell (2000). Simulation activities allow students to think and respond and therefore qualify as an 'active' teaching method.

Bobrowski and Molinari (2000) test the effects of a computerized marketing simulation on student learning in a study involving 141 undergraduate students enrolled in principles of marketing. Sixty-eight students used the simulation to learn factual knowledge in principles of marketing while 73 students who did not use the simulation served as a control. Toward the end of the semester, a 29-item multiple choice test was given to students in both groups. The mean score for the two groups did not differ significantly, both scoring approximately 24 out of 29 or 83%. Bobrowski and

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DOI: 10.58809/ECKA5323

Molinari intentionally design their test instrument to monitor the level of factual knowledge acquired by students. They conclude that use of the simulation at least did not reduce the level of factual learning in their students.

Active Teaching in Everyday Use

Educators in business disciplines use a variety of active methods on a daily basis to involve and engage their students. An interactive lecture style combined with short problems or cases worked in class are typical examples. Textbooks and instructor manuals provide active learning tips, and in accounting, activity books have been published for financial and managerial accounting - for example, for principles of financial accounting, Doran (1997), and, for principles of managerial accounting, Hannon (2000). These teaching techniques are informal, short in duration, and combine archetypes discussed above. A representative example of this teaching approach in the context of introductory managerial accounting is provided in Gunderson (2002), a budget negotiation simulation available on the Houghton Mifflin textbook company web-site. Many instructors use mock negotiations between middle and upper-level managers to illustrate how budget targets are set in practice. In Gunderson, the simulation is designed to introduce and apply basic budgeting concepts within a single 50-minute class, and to allow students to appreciate a key finding in budgeting research by Fisher, Frederickson and Peffer (2000). This finding involves the dissatisfaction a subordinate manger feels when, after a failed negotiation, superiors impose a budget target.

In carrying out the simulation, the instructor takes the role of upper level management and each student is asked to think of him/herself as a subordinate manager involved in negotiating a budget target. The instructor guides a discussion, introducing basic budgeting concepts and asking leading questions designed to illustrate and apply concepts. At a particular point in the simulation, time is taken for students to individually suggest budget targets, and record their thoughts about how they arrived at their solution; this paper is collected by the instructor (the specific handout completed by the students is included in appendix 1).

The simulation combines elements of role-playing, interactive lecture, and in-class writing, and reflects teaching methods business teachers routinely use on a daily basis. The question is: is the simulation as good as straight lecture? Based on the foregoing discussion, the expectation is that lecture will be as good as, or better than, the simulation in instilling factual knowledge, while the active technique will dominate lecture for higher level outcomes.

An Empirical Test

An experiment was carried out using the Gunderson (2002) simulation in two consecutive semesters, fall 2002 and spring 2003. The experiment, done in a classroom setting to retain external validity, was designed with as much experimental control as possible. To eliminate a possible confounding effect of textbook learning, students were not given a reading assignment and were not told what the topic would be on the day of the experiment. Thus, to ensure the students had only one source of learning introductory budgeting material (the in-class teaching method, either lecture or simulation), the experiment was carried out once each semester with a between-subjects design.

In each semester, two parallel sections of introductory managerial accounting were randomly assigned to treatment and control conditions. In both sections a business case involving a restaurant was introduced early in the course to illustrate and apply course topics (Buehlmann and Sommer, 1994). The restaurant then provided a common setting in which the budgeting topics were taught, using either the simulation, or lecture. All sections were taught by the author who has significant teaching experience (ten years), including five teaching introductory managerial accounting.

Permission was obtained from the university to conduct the study. Table 1 shows the distribution of students in treatment and control sections. In order to be included in the study students had to attend two consecutive classes, the class period involving the teaching method (simulation or lecture), and the subsequent class when a test instrument was administered. Students who were repeating the class or for whom no ACT data was available were excluded. The sample consisted of 82 subjects distributed as shown.

Table 1: Distribution of Subjects

	Fall 2002 Treatment	Fall 2002 Control	Spring 2003 Treatment	Spring 2003 Control
Students attending both classes	23	22	21	24
Students repeating the class		1		
Students with no ACT data		2	4	1
Final sample	23	19	17	23

Descriptive statistics for the sample are provided in table 2 below. Test score data reported is out of a possible ten points (the test instrument is discussed in detail below). Doran, Bouillon and Smith (1991) used multiple regression to study factors associated with student exam performance in introductory managerial accounting and found the following four significant: Grade earned in introductory financial accounting, cumulative grade point average, ACT score, and the student's performance on the first exam taken in the course. Grudnitski (1997), in a similar study, confirmed that grade earned in introductory financial accounting is related to student success in managerial, and also found student intent to major in accounting significant. These factors are used as control variables in the current study and are presented in table 2 below for the sample of 82 students. Of the means in table 2, the test score for the fall 2002 control group (8.0), and spring 2003 control group (6.52) differ significantly ($t = 2.31$ $p = .03$, two-tailed test). All other means reported in table 2 do not differ significantly at standard levels of confidence (0.05 or better, 2-tailed test).

Table 2: Descriptive Statistics: Means (Standard Deviation) by Group

	Fall 2002 Treatment	Fall 2002 Control	Spring 2003 Treatment	Spring 2003 Control
Mean SCORE	7.30(2.06)	8.0(1.86)	7.29(1.45)	6.52(2.21)
Mean ACT	20.96(3.62)	21.74(4.76)	21.53(4.67)	21.09(3.64)
Mean GPA	2.85(0.463)	2.89(0.513)	2.97(0.499)	2.89(0.578)
Mean GRADE	2.30(1.063)	2.79(1.032)	2.88(0.781)	2.61(0.839)
Mean EXAM1	0.715(0.15)	0.758(0.18)	0.795(0.16)	0.738(0.14)
MAJOR	4	1	3	1

SCORE = score on 10-point test instrument
ACT = composite ACT score
GPA = cumulative GPA
GRADE = grade earned in introductory financial accounting (A=4, B=3, etc.)
EXAM1 = percentage score on first exam in introductory managerial accounting
MAJOR = number of students in each condition intending to major in accounting

The test instrument was administered at the beginning of the class period immediately following the day of teaching. In the fall, treatment and control classes met on the same day, while in the spring they met on different days; random assignment of sections to treatment and control resulted in the spring treatment section taking the test first, so any communication between students would bias the results away from a finding for the treatment. In any case, such communication is not considered likely due to the commuter nature of the student population at the university; fewer than 20% of students live on campus, and most depart quickly after class for jobs or other commitments.

Communication between students taking the course in the fall and the following spring is a greater likelihood, but is mitigated by the fact that the test instrument was a small percentage of the total points involved in the course. While the test instrument has ten questions, for grading purposes only five points were allocated to it with each question worth a half point, a fact that students became aware of when the test was handed back. Thus, the prominence of the test in the course is reduced, and, correspondingly, the likelihood of it becoming a discussion topic among students. Fall versus spring performance is controlled for by an indicator variable (discussed below in multivariate analysis).

The ten-question test instrument was designed in accordance with the teaching objectives for introductory budgeting; these objectives are to introduce and apply basic budgeting concepts, and to gain an appreciation of motivational aspects of budgeting from Fisher et al. (2000). Using Bloom's Taxonomy (1956), and its application to test questions as discussed in Sax and Newton (1997), test questions at each of five levels of learning were designed including knowledge, comprehension, application, analysis, and synthesis. Two multiple choice questions were used to test each of knowledge, comprehension, application, and analysis levels; two essay questions were used to test at the synthesis level. An example knowledge question and synthesis question, with solutions, are provided in appendix 2. Each question, whether multiple choice or essay, was given equal weight. Essay questions were graded on a credit/no credit basis. In order to receive credit, the student had to touch upon at least three of the four factors shown in the grading template.

Table 3 below shows performance by question type. Overall, students scored an average of 7.24 out of 10 (standard deviation of 1.98). Comparing adjacent question types, the mean knowledge score (1.56) is significantly lower than comprehension (1.73), ($t = 1.96$, $p = .05$, 2-tailed test); the mean analysis score (1.27) is significantly lower than application (1.73), ($t = 4.38$, $p = 0.00$, 2-tailed test); and the mean synthesis score (0.95)

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DOI: 10.58809/ECKA5323

is significantly lower than analysis ($t = 2.56$, $p = 0.01$, 2-tailed test). These results confirm that higher level questions are generally harder, with the exception of knowledge questions which were somewhat harder than comprehension and application. This may reflect the fact that the scores are based on a 50- minute teaching session which attempted to address all five levels. While basic terms were defined, much of the session was devoted to development and application of these ideas in a business setting (i.e., the restaurant with upper-level and subordinate managers). What students retained best were skills at the comprehension and application levels.

Table 3: Mean Scores by Question Type

	K	C	AP	AN	S	Total
Mean score (all sections, n=82)	1.56	1.73	1.73	1.27	0.95	7.24
Mean score, pct. (all sections)	78.1%	86.5%	86.5%	63.4%	47.5%	72.2%
Mean score (control, n=42)	1.62	1.67	1.71	1.41	0.79	7.19
Mean score (treatment, n=40)	1.50	1.80	1.75	1.13	1.13	7.30
t-ratio for mean difference, tmt. vs. ctl.					1.99	
p-value (2-tailed test)					0.05	

Note: there are two questions of each type, for a total of ten.
K = Knowledge Questions
C = Comprehension Questions
AP = Application Questions
AN = Analysis Questions
S = Synthesis Questions

Mean scores for treatment and control conditions are also presented in table 3. T-tests for differences in sample means reveal no significant differences, at standard levels of confidence (0.05, 2-tailed test), with the exception of synthesis questions where the treatment mean (1.13) was significantly higher than the control mean (0.79), ($t=1.99$, $p=0.05$). This result is consistent with prior work suggesting that active methods work best for higher level outcomes. Multivariate tests are conducted to determine whether this result holds while controlling for significant factors associated with test performance.

Multivariate Analysis

The following regression equation (1) is used to examine the effect of the treatment on the variable of interest, student scores (SCORE):

$$(1)\ SCORE_i = B_0 + B_1\ TMT_i + B_2\ SEM_i + B_3\ ACT_i + B_4\ GRADE_i + B_5\ GPA_i + B_6\ EXAM1_i + B_7 MAJOR_i + \varepsilon_i$$

WHERE:

TMT = A dummy variable indicating student membership in: A control section (TMT = 0); or a treatment section (TMT = 1).

SEM = A dummy variable indicating student membership in: A fall 2002 section (SEM = 0); or a spring 2003 section (SEM = 1).

MAJOR = A dummy variable indicating: student intends to major in accounting (MAJOR=1); student does not intend to major in accounting (MAJOR = 0).

SCORE, ACT, GPA, GRADE and EXAM1 are as defined earlier.

Equation (1) is specified in accordance with factors found to be significant in previous research and factors of interest in the current study. Three hypotheses of interest are stated and discussed below.

$H1_o$: SCORE, including all questions, will be unaffected by the teaching method used; $H1_a$: SCORE, including all questions, will be affected by the teaching method used: $H1_o$: $B_1 = 0$ vs. $H1_a$: $B_1 \neq 0$.

Hypothesis one investigates whether total test scores differ between treatment and control. If active teaching is better for higher outcomes but less efficient at conveying factual knowledge, as suggested by previous studies, it may have no overall effect on a test combining both; it is unknown which effect may dominate, and, therefore, no directional expectation is established for this hypothesis.

$H2_o$: SCORE, including lower level outcomes (K, C, AP), will be unaffected by the teaching method used; $H2_a$: SCORE, including lower level outcomes (K, C, AP), will be lower using the active teaching method: $H2_o$: $B_1 \geq 0$ vs. $H2_a$: $B_1 < 0$.

Hypothesis two follows from previous work suggesting that lecture may be the better method for imparting factual knowledge. Because the demarcation between "lower" and "higher" levels is unknown, equation (1) is estimated multiple times, defining SCORE as including, singly and in combination,

knowledge (K), comprehension (C) and application (AP) questions.

$H3_0$: SCORE, including higher level outcomes (AP, AN, S) will be unaffected by the teaching method used; $H3_a$: SCORE, including higher level outcomes (AP, AN, S) will be higher using the active teaching method: $H3_0$: $B_1 \leq 0$ vs. $H3_a$: $B_1 > 0$.

Hypothesis three follows from previous work, this time with active teaching expected to be better than lecture for imparting higher level skills. Because the demarcation between "lower" and "higher" levels is unknown, equation (1) is estimated multiple times defining SCORE as including, singly and in combination, application (AP), analysis (AN), and synthesis (S) questions.

Results of ordinary least squares estimation of Equation (1) with SCORE containing all ten questions are presented below in table 4. Results in table 4 indicate that three variables, SEM, ACT and EXAM1, are significant in explaining student scores. The adjusted R^2 of 40% compares with that of 59% for Doran et al. (1997) who studied performance on tests taken during an entire semester. Two variables found significant in previous research, GRADE and GPA, are not significant in the regression above. This is likely due to the fact that this study uses actual data for ACT, GRADE and GPA, and these variables exhibit a high degree of multicollinearity. Doran et al. (1997) relied on student self-reported scores for ACT, GRADE, and GPA. Student self-reported data may be biased and reflect constructs other than ability and past performance, which may account for their distinctiveness in Doran et al. who conclude that in their study "the regression results do not suffer materially from multicollinearity problems (pg. 81)." Although GRADE and GPA may be redundant in this study, they are left in the model as control variables.

The variable MAJOR was also not significant, which is contrary to Grudnitski (1987), but consistent with Doran, Bouillon and Smith (1991) who also found this factor insignificant. The negative coefficient on the variable SEM reveals that students in the spring semester under-performed students in the fall. There is no apparent reason for this result, other than perhaps the spring doldrums that often affect students in the middle of the spring semester.

Table 4: OLS Estimation of Equation (1): Score = All Questions

(1) $SCORE_i = B_0 + B_1\,TMT_i + B_2\,SEM_i + B_3\,ACT_i + B_4\,GRADE_i + B_5\,GPA_i + B_6\,EXAM1_i + B_7\,MAJOR_i + \varepsilon_i$

Variable	Coefficient	Estimated Coefficient	Standard Error	T-ratio (74 df)	P-value (2-tailed)
INTERCEPT	B_0	0.7704	1.2690	0.607	0.546
TMT	B_1	-0.0163	0.3302	-0.049	0.961
SEM	B_2	-0.8396	0.3252	-2.582*	0.012
ACT	B_3	0.2112	0.0499	4.236*	0.000
GRADE	B_4	0.0379	0.2428	0.156	0.876
GPA	B_5	0.1253	0.4952	0.253	0.801
EXAM1	B_6	0.0251	0.0126	1.994*	0.050
MAJOR	B_7	0.4606	0.4881	0.944	0.348

*Significant at 0.05 or better (2-tailed test)
Number of observations=82
Mean of dependent variable = 7.24
$R^2 = 0.45$; Adj $R^2 = 0.40$
Overall F=8.62 (p=0.000)

Table 4 reveals that the coefficient on the treatment variable is not reliably different from zero; thus $H1_0$ is not rejected and it is concluded that teaching method has no effect on students' total scores on the ten-point test instrument. This finding is consistent with prior research, for example that of Hoyle (1996).

To investigate whether lecture is better than the simulation on lower level outcomes, equation (1) was estimated with SCORE limited to knowledge, comprehension, and application questions. In none of these estimations was the coefficient on the treatment variable reliably less than zero; thus $H2_0$ is not rejected and it is concluded that lecture is not better than the simulation in conveying basic concepts in budgeting. This finding is consistent with prior research, for example that of Bobrowski and Molinari (2000).

To investigate whether the active method assists in learning at higher levels, equation (1) is estimated with SCORE defined as performance on application, analysis and synthesis questions. The null hypothesis, $H3_0$, was rejected only when SCORE was limited to synthesis questions. Results of the estimation using synthesis questions for SCORE are presented in table 5 in the next page. The significantly positive coefficient on TMT (p = 0.025, 1-tailed test) supports the notion that an active teaching method is superior to straight lecture in instilling higher level outcomes. This result is consistent with prior education literature, and one specific aspect of

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DOI: 10.58809/ECKA5323

Almer, Jones and Moeckel (1998): both studies show positive findings for an active learning method on written test questions, but not on multiple choice questions.

Table 5: OLS Estimation of Equation (1): Score = Synthesis Questions

(1) $SCORE_i = B_0 + B_1 TMT_i + B_2 SEM_i + B_3 ACT_i + B_4 GRADE_i + B_5 GPA_i + B_6 EXAM1_i + B_7 MAJOR_i + \varepsilon_i$

		Estimated	Standard	T-ratio	P-value	Partial
Variable	Coefficient	Coefficient	Error	(74 df)	(2-tailed)	Correlation
INTERCEPT	B_0	-1.1439	0.4083	-2.802*	0.006	-0.310
TMT	B_1	0.2965	0.1486	1.995*	0.050	0.235
SEM	B_2	-0.0696	0.1456	-0.478	0.634	-0.055
ACT	B_3	0.0726	0.0212	3.425*	0.001	0.370
GRADE	B_4	-0.0446	0.0865	-0.516	0.608	-0.060
GPA	B_5	-0.0944	0.1721	-0.549	0.585	-0.064
EXAM1	B_6	0.0106	0.0051	2.079*	0.041	0.235
MAJOR	B_7	0.3195	0.1849	1.728	0.088	0.197

*Significant at 0.05 or better (2-tailed test)
Number of observations=82
Mean of dependent variable = 0.95
$R^2 = 0.34$, Adj. $R^2 = 0.28$
Overall F=5.48 (p=0.000)

Limitations

As with any quasi-experiment, the possibility exists that some omitted factor, and not the treatment, is responsible for the observed effects. This study has attempted to minimize this possibility through careful control of classroom conditions and the use of control variables found significant in previous research. To investigate a possible omitted factor, regression residuals were examined. Residuals were plotted against values of the independent variables; visual inspection revealed no discernable patterns in the residuals. Major groupings of data inherent in the study (e.g. fall 2002 versus spring 2003) were examined for equality of mean and variance of residuals. These results show some tendency for the residual variance to differ between groups. To correct for possible effects of heteroskedasticity, standard errors reported in tables 4 and 5 are calculated using White's (1980) heteroskedastic-consistent covariance matrix. Histograms showed residuals to be approximately normally distributed.

A second limitation is that of practical significance. Despite statistical significance, findings may still have limited practical importance if the related effect size is not sufficiently large. This study and others may be of practical interest to business educators or administrators who make resource allocation decisions. However, devoting resources to a program of active teaching and learning must be justified by a significant payoff in terms of improved student outcomes. Stout and Ruble (1995) have specifically called upon those conducting accounting education research to report effect size information, noting that this has not commonly been done in the past. For multiple regression models, they recommend the reporting of partial correlation coefficients (pg. 288).

Table 5 reports partial correlations for independent variables. The partial correlation coefficient for the treatment variable is 0.226, and the partial coefficient of determination is 0.051. The partial coefficient of determination of 5.1% reflects the treatment's contribution to the overall model r-squared. Effect size information is meant to convey the extent to which relationships exist within corresponding population data. Stout and Ruble (1995) cite literature suggesting that, in terms of effect size, "1% is small, 9% is medium, and 25% is large (pg. 292)"; however, they recommend that, rather than using specific criteria like this, authors of research simply report effect size information so that judgments and relevant comparisons among studies can be made by readers. Readers must judge for themselves whether a 5.1% improvement in students' written test scores is important.

SUMMARY AND CONCLUSION

This study has examined the effect on student performance of an active teaching method combining interactive lecture style, role-playing, and in-class writing. It extends existing research wherein specific techniques have been individually tested. The findings indicate no advantage for the active method over lecture in students' mean scores on a 10-item test instrument.

The study also extends existing studies by attempting to identify the level at which an active technique begins to have an advantage over lecture. At lower levels of learning, no difference in student outcomes emerges. When the analysis focuses on student learning at the highest level studied, the synthesis level,

evidence of an advantage for the active technique does emerge, although the effect size is modest. It should be noted that essay questions were used at the synthesis level and multiple choice at lower levels; an interesting extension of this research would be to include both multiple choice and essay questions at all levels, particularly in light of the findings of Almer et al. (1998). Almer et al. also found an active method improved scores on essay questions and not multiple choice, but they did not manipulate the level of the test questions, only the format. Therefore, it is not clear whether it is the format or level of test questions that matters, which provides an interesting avenue for future research.

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DOI: 10.58809/ECKA5323

Appendix 1

Teaching Instrument

You are the kitchen manager of the Sunset Cafe. Your annual salary of $40,000 is supplemented by a $10,000 bonus which is earned if the annual budget for food cost is achieved. Your suggested cost target is very important because once the budget is set, it is strictly adhered to; if actual food cost exceeds budget, even by a small amount, you do not receive a bonus. You must soon forward to the general manager your suggested budget target for next year's food cost. You and the general manager agree that next year's food sales will be $1,000,000. In the past, food costs have ranged from 40% to 45% of food sales depending on market prices for food items.

Your personal feel for the market leads you to believe that you can achieve a food budget of $410,000 (41% of sales) for the upcoming year. You prefer a budget of $450,000 to allow for any unexpected price increases, however you also know the general manager frowns on "cushioned" budgets and tends to see a budget of greater than $400,000 (40% of sales) as having a degree of "cushion" or "slack."

You and the general manager have a good working relationship and share mutual respect. Once you submit your suggested target, the general manager will be hesitant to change it unless s/he feels it contains an unacceptable degree of slack, in which case s/he will impose a budget of $400,000.

Please select your suggested budget target for next year's food cost from the following list:

Your Suggested Target	Slack Perceived by General Manager
$450,000	$50,000
$440,000	$40,000
$430,000	$30,000
$420,000	$20,000
$410,000	$10,000
$405,000	$ 5,000
$400,000	$ 0

Write your suggested target here: _____

Briefly describe why you chose the budget target for food cost that you did:

Appendix 2

Sample Test Questions

Sample Knowledge Question

A system in which operating managers are made personally accountable for costs considered to be under their control is known as:

- participatory budgeting
- operational budgeting
- responsibility accounting
- top-down budgeting

Sample Synthesis Question

In a participatory budgeting process, the operating manager faces a dilemma1 in deciding on a suggested budget target to submit to his/her superior manager. Discuss the kitchen manager's decision in regard to suggesting a target for food cost.

	High Target	Low Target
Advantage	Easier to achieve, making a bonus more likely	Will not be seen as containing slack
Disadvantage	May be seen by upper management as containing slack	Hard to achieve, making a bonus less likely

https://scholars.fhsu.edu/jbl/vol1/iss1/25
DOI: 10.58809/ECKA5323