Active Versus Passive Teaching Styles: An Empirical Study of Student Learning Outcomes

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This study compares the impact of an active teaching approach and a traditional (or passive) teaching style on student cognitive outcomes. Across two sections of an introductory business course, one class was taught in an active or "nontraditional" manner, with a variety of active learning exercises. The second class was taught in a passive or "traditional" manner, emphasizing daily lectures. Although the active learning approach does not appear to have improved overall mastery of the subject, we did find evidence that active learning can lead to improved cognitive outcomes in class-specific materials. The discussion emphasizes the role of delivery style on learning outcomes.

Because of increasing competitive demands both in the business world and in the academic community, management educators strive to provide the most productive classroom experience for their students in order to prepare them for careers in the business world. To achieve this objective, management educators constantly search for new and improved teaching methods. For many years, college instructors and professors in the United States operated under a paradigm in which they sought to impart knowledge to students in a form of information transfer (Boyer, 1990). In this approach to teaching, students passively receive information from the professor and internalize it through some form of memorization. This process is characterized as passive learning (Stewart-Wingfield & Black, 2005). Although passive learning has been the dominant teaching method, many educators argue that students require more than a mere transfer of knowledge. The search for the best approach to business education has led educators to explore many different teaching techniques, ranging from the traditional lecture class to

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various experimental approaches such as active learning (Bonwell & Eison, 1991).

Although researchers intuitively suppose that active learning should be superior to passive learning, such superiority has proved somewhat difficult to quantify (Whetten & Clark, 1996). Although some studies claim that active learning is more effective than passive learning (Benek-Rivera & Matthews, 2004; Dorestani, 2005; Sarason & Banbury, 2004), quantitative research directly comparing both methods is the exception. The fact that much of the active learning research has focused on attitudinal reactions (student satisfaction) rather than cognitive outcomes has complicated matters even more. Another difficulty in comparing previous studies is the wide range of activities that can be defined as active learning.

The main purpose of the present study is to compare the impact of an active teaching approach and a traditional or passive teaching style on student cognitive outcomes. Our research is guided by the question, "Is the active teaching approach more effective than the passive teaching approach in regards to learning outcomes?" Aside from our findings, our study differs from most of the previous research by (a) using a dual-factor criteria (broad and specific learning) that facilitates comparisons between teaching styles; (b) clearly separating teaching approaches across two classes for a full semester; (c) studying a broad (and relatively large) sample of students; and (d) explicitly controlling for various student-specific factors as well as survivor bias.

Literature Review

In response to the increase in competition both in the business world and among business schools, excellence in teaching is becoming an essential avenue for faculty members to produce a competitive advantage for their colleges (McKeachie, Pintrich, Lin, & Smith, 1986). Given the significance of the need to improve teaching approaches, it is not surprising that many different teaching methods have been developed within the past 30 years. In management education, variations of active learning include experiential learning (Kolb, 1984), problem-based learning (Miller, 2004), participative learning (Mills-Jones, 1999), and cooperative learning (Johnson, Johnson, & Smith, 1991). We will briefly describe active learning and some other related teaching approaches that are commonly categorized as active learning, and then compare these methods with the traditional or passive approach. Lastly, we will explain how our research builds on previous studies.

Active Learning. Active learning is a broadly inclusive term, used to describe several models of instruction that hold learners responsible for their own learning. The leaders in the field of active learning, Bonwell and Eison (1991) have contributed heavily to its development and to the acceptance of active learning as a viable approach. Proponents of active learning describe a process in which students engage in "doing things and thinking about what they are doing" in the classroom (Bonwell & Eison, 1991, p. 2). Active learning encompasses various practices, such as pausing in lectures for students to consolidate their notes, interspersing short writing exercises in class, facilitating small-group discussions within the larger class, incorporating survey instruments, quizzes, and student self-assessment exercises into the course, leading laboratory experiments, taking field trips, and using debates, games, and role play (Bonwell & Eison, 1991; Ebert-May, Brewer, & Allred, 1997; Sarason & Banbury, 2004). Bonwell and Eison (1991) suggest that active learning provides the following benefits: students are more involved than in passive listening; students are engaged in activities such as reading, discussing, and writing; student motivation is increased; students can receive immediate feedback; and students may engage in higher-order thinking, such as analysis, synthesis, and evaluation.

In order to have a positive effect on students, the management educator must apply the principles of active learning to the practical setting of the classroom. Auster and Wylie (2006) suggest that four dimensions are necessary to create a systematic approach to promote active learning in the classroom: context setting, class preparation, class delivery, and continuous improvement. Context setting refers to creating an open and relaxed atmosphere for learning in the classroom. Class preparation involves thought, planning, and creativity before the class session. Class delivery refers to the implementation of the planned lesson in the classroom. Continuous improvement entails seeking and using feedback concerning the teaching approach.

Other Related Teaching Approaches. Experiential learning is an associated concept in which students learn from relevant experiences provided in the course of instruction (Kolb, 1984). Management educators should be aware of two cautions. First, experiential exercises alone may not be sufficient to induce learning and, secondly, students will need time to reflect on the experience (Stewart-Wingfield & Black, 2005). Kolb (1984) explains that learning is a process, not an outcome; that learning comes from experience; that learning requires resolution of dialectically opposed demands; that learning is holistic and integrative; that learning requires interplay between a person and an environment; and that learning results in knowledge creation.

Another approach is problem-based learning (Albanese & Mitchell, 1993; Miller, 2004), which structures a course around the resolution of a real-world problem. This approach traces its beginnings to the philosopher and educator, John Dewey, who claimed that problems are a stimulus to thinking (Miller, 2004). To discover the solution to a problem, students must learn the basic principles of a subject. Having borrowed the concept of problem-based learning from service learning in which students learn by performing some service for the community, Miller (2004) applied the approach to organizational behavior classes in the business school.

Participative learning is defined as engaging the student in the learning process by giving him or her an opportunity to take part in selecting activities and/or assignments in the class (Mills-Jones, 1999). For example, students may be allowed to choose elements in the syllabus, to write exam questions, or to participate in the grading of some class projects. By involving students in choosing some direction for the course, students should take on responsibility and become accountable for positive outcomes in the class.

In cooperative learning, students are required to work together in small groups and class discussions. In order for small groups to develop cooperative learning, five basic elements are necessary: positive interdependence, face-to-face interaction (promote each other's success), individual and group accountability (no social loafing), social skills, and group processing or feedback (Johnson et al., 1991). When the five elements are present, cooperative learning in small groups can maximize each student's learning as one helps another.

Passive Learning. Passive learning is prevalent in the traditional teaching approach taken by many professors in business schools. In traditional classes, professors deliver lectures for the majority of the class time and there is little opportunity for student input through discussion or experiential exercises (Stewart-Wingfield & Black, 2005). Additionally, professors provide a syllabus and class schedule and determine grades in traditional classes by a small number of exams, typically based on multiple-choice, true–false, or matching questions. The traditional lecture approach has been used for many years in higher education because it provides a convenient and expeditious mode to impart knowledge and introduce basic principles to large classes of undergraduate students (Whetten & Clark, 1996). By using the traditional lecture method, professors can present a large amount of material in a relatively brief amount of time (Miner, Das, & Gale, 1984).

Although the traditional lecture method is still predominant, some studies have shown that students fail to retain as much material after the class has been completed in comparison to classes taught in an active environment (Van Eynde & Spencer, 1988). Another drawback to this method appears to be a lack of student attention, which many educators have observed in their own classes (Dorestani, 2005). Educators conjecture that many students are not actively engaged in most traditional lecture classes. Therefore, it is common for some students to drift off to sleep, for others to talk among themselves, and for some students to play games or send messages on their laptop computers during class. To counter the above-listed behaviors, educators have turned to active methods of teaching.

Summary of Previous Empirical Studies. Although active teaching methods have been developed specifically to improve upon passive teaching, attempts to quantify its effectiveness have met with mixed results. Table 1 provides an overview of previous empirical research (listed alphabetically) in this field and shows the wide variety in what has been studied and what has been found. The table is not meant to include all active learning research, only to provide an overview of the variables examined and the research findings in

Table 1. Literature Review of Active Learning Empirical Studies in the Business School Context

Empirical Study	*Study Variables*	*Findings*	*Assessment*
Benek-Rivera and Matthews (2004)	Student class participation Student teamwork Student learning	Active > passive Active > passive Active > passive	Qualitative
Berg, Dickhault, Hughes, McCabe, and Rayburn (1995)	Student course grades	Active > passive	Quantitative
Berger (2002)	Student research and field work Student accountability for learning Student reflection exercises	Active > passive Active > passive Active > passive	Qualitative
Cook and Hazelwood (2002)	Student class participation	Active > passive	Qualitative
Dorestani (2005)	1. Student exam grades (3) under same teaching approach 2. Student exam grade (1) under different teaching approach 3. Student teacher evaluations	1. No difference 2. Active > passive 3. Active > passive	Quantitative
Ebert-May et al. (1997)	1. Student answers to a "self-efficacy" instrument 2. Student scores on the content portion of a standardized test 3. Student scores on the process portion of a standardized test	1. Active > passive 2. No difference 3. Active > passive	Qualitative
Krumweide and Bline (1997)	Student ability to develop and solve problems/cases	Active > passive	Quantitative
Miller (2004)	Student ability to develop problems and solutions	Active > passive	Qualitative
Miner, Das, and Gale (1984)	1. Student satisfaction 2. Student exam grades (tested each class) 3. Student exam grades (tested one month after last class)	1. No difference 2. No difference 3. No difference	Quantitative

(*Continued*)

Table 1. (*Continued*)

Empirical Study	*Study Variables*	*Findings*	*Assessment*
Sarason and Banbury (2004)	Student class participation	Active > passive	Qualitative
Seipel and Tunnell (1995)	Student writing assignments	Active > passive	Qualitative
Serva and Fuller (2004)	Student evaluation of instructional performance	Active > passive	Quantitative
Stewart-Wingfield and Black (2005)	1. Student class grades 2. Student perceptions of: (a) how well the class was run; (b) usefulness for future job 3. Student satisfaction with course	1. No difference 2(a). No difference 2(b). Active > passive 3. No difference	Quantitative
Strow and Strow (2006)	Student class participation	Active > passive	Qualitative
Van Eynde and Spencer (1988)	Retention of student learning 1. Near term (2 weeks) 2. Long term (13 weeks)	 1. No difference 2. Active > passive	Quantitative

most of the business-related studies. (For a broad survey of the evidence on minimally guided instruction, see Kirschner, Sweller, & Clark, 2006.)

The "Study Variables" column in Table 1 demonstrates that active learning research has examined everything from class participation and problem solving to student satisfaction and grades. The "Assessment" column groups studies as "Qualitative" or "Quantitative," but it should be noted that some of the studies classified as quantitative are merely univariate analyses. The "Findings" column expresses whether active learning methods were found to be superior or inferior to passive teaching methods with a $>$ or $<$ sign, respectively. The term "no difference" is used where the two teaching methods did not produce different outcomes.

Of the 15 papers listed, 8 can be considered qualitative and 7 quantitative. All of the qualitative studies found active learning to be "better" than passive learning, regardless of the variables used in the study. The quantitative research findings, however, are not as one sided. Although two of the quantitative papers unambiguously find active learning superior to passive learning, four find active learning superior in only some instances, and one unambiguously finds no difference between active and passive learning. Furthermore, two of the six quantitative studies that find the active teaching approach superior to the passive one do not consider cognitive outcomes. Overall, the bulk of the evidence in favor of active learning is either qualitative in nature or fails to measure student learning outcomes.

The present study can be classified as a quantitative one that emphasizes student learning outcomes rather than emotional reactions (satisfaction). Although there is nothing inherently wrong with considering how satisfied students are, recent meta-analytical findings indicate that satisfaction should not be used as a surrogate of learning (Alliger, Tannenbaum, Bennett, Traver, & Shotland, 1997). In fact, training criteria theory has long demarked the uniqueness of affective reactions and participants' learning as independent outcomes (Kirkpatrick, 1976).

In general, there are substantial methodological differences between this study and previous quantitative work that should be highlighted. For instance, Dorestani (2005) tested the active learning approach versus the traditional lecture method and found positive results for active learning. The present study extends Dorestani's work by clearly separating teaching approaches across two classes, using larger samples, and explicitly controlling for student-specific factors and survivor bias. Ebert-May et al. (1997) found that students in active learning sections scored higher than those in control groups on specific course material, but not on standardized tests. However, they studied only one specific learning model, failed to control for any student-specific factors and survivor bias, and did not provide robust quantitative results. Our research improves upon Ebert-May et al. (1997) by examining a broader range of active learning activities, controlling for student-specific characteristics (as well as survivor bias), and providing robust quantitative results.

Another study within this branch of research, Stewart-Wingfield and Black (2005), reports that an active course design did not result in higher student grades or satisfaction with the class, but that students did perceive the class as more relevant and helpful for their future careers. Our article builds upon Stewart-Wingfield and Black (2005) by incorporating more active learning elements into the experimental design, employing a direct comparison of two large classes, more rigorously focusing on cognitive outcomes, and controlling for various student-specific factors as well as survivor bias. Lastly, Miner et al. (1984) found no significant differences in learning outcomes between two types of active learning and a control group. The present article differs greatly from Miner et al. (1984) in both its experimental design and methodology. Our study clearly separates teaching approaches across two classes for a full semester, studies a wider range of active learning activities, and controls for additional student-specific factors and survivor bias. In summary, with respect to previous quantitative research, the present study contributes to the literature by: (a) directly confronting two conceptually opposed approaches, (b) emphasizing participants' cognitive outcomes as the key criterion, and (c) utilizing standardized measures in large samples that allow robust between-groups comparison.

Hypotheses

On the basis of the above discussion, we posit that the active teaching approach should have a greater positive impact on student cognitive outcomes than the passive teaching approach. To study this theory, we examine two cognitive outcomes that differ in their knowledge scope: class-specific and broad subject. Although the latter emphasizes a deeper grasping of the subject by assessing participants' ability to understand applications or extrapolation of the knowledge learned in class, the former is intended to assess the mere acquisition of knowledge specifically addressed in each class. This separation parallels notions of knowledge acquisition and knowledge creation in Yang's (2003) learning theory. According to this theory, knowledge acquisition is assimilated to learning cognitive outputs (declarative knowledge), and knowledge creation assimilates learning to further elaborations, wherein acquired information is integrated into mental structures (procedural knowledge). The former can be thought of as retrievable informational gains from educational events, and the latter can be envisioned as contextualized learning outcomes that render information more applicable. The underlying assumption is that individuals gather specific information in class (declarative), and then are able to extrapolate knowledge to a broader context (procedural). We argue the use of this dual dependent variable enhances our understanding on the effect of teaching approaches (passive, active) over learning outcomes.

Because the active teaching approach engages the student and stimulates student involvement in the course, we propose that this enhanced involvement and interest will result in a higher understanding of the subject. This improved learning outcome will manifest itself when students are tested on the general subject matter of a course. Therefore, we propose the following hypothesis:

HYPOTHESIS 1: *Broad student learning outcomes are stronger in active teaching contexts than passive ones.*

Next, we directly investigate student mastery of the specific material covered in a class. Active learning, according to the leading proponents in the field, Bonwell and Eison (1991), should involve the students to a greater degree than the passive approach. When students are engaged in active exercises, their motivation to work in the class should increase. Given immediate feedback as the active approach suggests, students should more readily engage in higher-order intellectual activities, such as analysis and synthesis of class material. We propose that this enhanced feedback and intellectual activity will lead to increased student learning that will result in higher cognitive outcomes for those exposed to active (rather than passive) teaching when students are tested on the specific material covered in the class. Therefore, we also propose the following hypothesis:

HYPOTHESIS 2: *Class-specific learning outcomes are stronger in active teaching contexts than passive ones.*

Methods

The following sections describe the methods used in our study.

Procedures. The main goal of our experiment was to test whether active learning methods, compared to passive learning methods, can improve cognitive outcomes among students. The study was undertaken at a southern regional university with an enrollment of approximately 7,000 students. Nearly 70% of the university's students attend full-time, 88% of first-time students receive some type of financial aid, 18% of all undergraduates live on campus, and 25% of degree-seeking undergraduates are at least 25 years old. We conducted our study in two sections of an Introduction to Business class, each taught by a different instructor, during the course of one semester.

Both instructors are assistant professors in the college of business, have between 5 and 10 years of teaching experience, and regularly receive "good" student evaluations. Additionally, both instructors are coauthors of the present paper. The two sections of the class were taught in consecutive time periods in the same classroom. The earlier class was taught with the active learning approach and is referred to herein as the active section. The later class was taught with the passive learning approach and is referred to herein as the traditional section. Each section started with approximately 150 students enrolled, nearly all of whom were first-semester freshmen.

In the active section, students were placed into groups of four to five individuals at the beginning of the semester using Kolb's (1984) learning styles. The groups were designed so that students with different learning styles were placed in each group with as much variation as possible. The instructor assigned business projects for each group (due at the end of the semester) that required students to make many group-specific decisions throughout the semester. The instructor facilitated group-based critical thinking exercises and students engaged in class discussions in every class. All of the class discussions and exercises were geared toward integrating the class topics with the business plan projects. At the beginning of each class, students were given a short quiz assessing knowledge of the material covered in the prior class period (a total of 21 quizzes were given).

Overall course grades in the active section were compiled (equally) from quiz averages and grades on the business projects. Following Ebert-May, Brewer, and Allred (1997), the daily quizzes were used to provide an incentive for taking part in the class discussions and group exercises. As described, the active learning in this section consisted of elements of experiential, problem-based, participative, and cooperative learning. In contrast, the instructor in the traditional section employed the typical lecture method. Grades in the traditional section were predicated on three in-term exams and one final exam. All quizzes and exams across the two sections consisted of machine-graded multiple-choice/true–false questions.

Manipulation Check. A survey assessing participants' perceptions of teaching styles was applied. Three items inquired about delivery of instruction with respect to in-class activities, involvement opportunities, lecturing emphasis, and group work. Examples of these survey items were "The instructor devoted extended periods of time to lecturing in class" and "Teamwork was highly encouraged in class." A 7-point Likert scale was utilized to assess items. Because measure reliability reached standard levels (0.72), items were aggregated. Then, both classes (active versus traditional) were contrasted via a t-test aimed at testing the extent to which participant perceptions of teaching styles differed. The t-test results indicate a significant difference (3.33, $p < 0.05$) between classes.

Cognitive Outcome Measures. The instructors in both sections designed their classes to teach the broad topics found in most introductory business courses. For example, both professors provided a broad survey of all functional areas of business. At the end of the semester, the instructors compiled a common exam, with each professor contributing 25 multiple-choice questions. This 50-question common exam was then administered to students in both sections as a bonus exam. As such, a standard questionnaire was utilized to test learning outcomes (both class-specific and broad-knowledge outcomes) across sections. To provide performance incentives, students were awarded 5 points on their final grade if they scored at least 90%, and 3 points if they scored at least 80%. The bonus exam only modestly impacted students' grades, and the scores were not allowed to impact grades negatively. The exam was voluntary; no coercion or other pressures were placed on students to participate in the study, and the university's institutional review board (IRB) approved of the study in September, 2007.

To utilize the exam scores for testing class-specific knowledge, we relied exclusively on matching students' scores on the 25 questions provided by their instructor. To use the exam scores for testing broader knowledge, we relied on the overall score with one caveat. Because both teachers were aware of only the broad topic areas taught in both classes, several exam questions assessed topics covered in only one section. Although this feature of the exam caused us to rely on only 38 questions out of the original 50, it also prevented the possibility of either instructor teaching to address specific questions covered in the other section.

Experimental Issues. Three experimental issues are addressed as follows.

Random Assignment. As with any experimental study of this nature, potential bias-related issues exist. One problem is that students were not randomly assigned to the two sections of the course. This lack of random assignment would be most problematic if students registered for either section knowing that it would be taught by one particular method. Although it is possible that this sort of self-selection exists in our data, it is highly unlikely, because more than 70% of the students in both sections were first-semester freshmen and neither professor made the experiment known to students prior to the start of the semester.

Demographic Issues. Table 2 presents basic summary statistics for each section of the course. As seen in Table 2, the students in the traditional course had slightly lower high school GPAs and ACT scores. Freshmen accounted for 72% of the students in the traditional class, whereas they accounted for almost 80% in the active section. A slightly higher percentage of females were in the active course (50 vs. 47), and a slightly lower percentage of enrolled students withdrew from the active course (15 vs. 19). More than two-thirds of students in both sections attended public high schools. Table 2 also shows that students in the traditional class had lower final and core assessment grades. The core assessment grades consist of only quiz averages for the active section, and only exam averages for the traditional class. In both the traditional and active classes, all cognitive outcome assessments consisted of multiple-choice/true–false questions that were machine graded.

Student Withdrawal. Range restriction (or survivor bias) challenges our analysis in that withdrawing students are left out of the final sample. Our approach for handling student withdrawals is based on the work of Grimes and Nelson (1998), where two distinct styles of teaching introductory economics were studied. Because student attrition has been shown to bias ordinary least squares (OLS) estimators (Becker & Walstad, 1990), we

Table 2. Descriptive Statistics of Students Sampled

	Traditional Teaching Style Class				*Active Teaching Style Class*			
Measures	*Mean*	*Median*	*SD*	*%*	*Mean*	*Median*	*SD*	*%*
HSGPA	2.48	2.81	1.24	–	2.99	3.21	1.14	–
ACT	17.35	19.5	7.6	–	20.66	21	4.63	–
Age	21.79	20	6.87	–	19.62	19	3.68	–
Final grade	77.7	77	10.59	–	85.35	87.32	8.42	–
Core assessment	74.87	74.5	10.9	–	75.74	82.9	20.47	–
Absent	16.63	17.64	12.5	–	18.41	9.1	24.94	–
Freshman	–	–	–	0.72	–	–	–	0.80
Female	–	–	–	0.47	–	–	–	0.50
Withdrew	–	–	–	0.19	–	–	–	0.15
Public school	–	–	–	0.75	–	–	–	0.69

Note: HSGPA = high school grade point average; ACT = American College Testing composite score; Core Assessment = average scores for all quizzes and exams; Absent = percentage of classes missed; Freshman = percentage of freshman students; Female = percentage of female students; Withdrew = percentage of students that formally withdrew from the class; Public School = percentage of students that attended public high school; *SD* = standard deviation.

use the propensity score approach to account for the likelihood students will withdraw from a class. Under this approach, the propensity (probability) for dropping the course is estimated with a probit equation and then included as an independent variable in the main regression. Grimes and Nelson use the Heckman (1979) selection model in a similar fashion. We have checked our results by the Heckman approach, and the overall results are virtually identical to those reported in the article.

Analysis. Probit and OLS equations are provided in the following analysis.

Probit Equation. The probit equation is as follows:

$$\text{Withdraw} = \alpha + \beta_1\text{Gender} + \beta_2\text{Age} + \beta_3\text{HSGPA} + \beta_4\text{ACT} + \beta_5 EACT + \beta_6\text{Absent} + e. \quad (1)$$

In the probit model, Withdraw is the student's binary choice of dropping the course through formal withdrawal (set to 1 for withdrawal and 0 for remaining enrolled), Gender is set to 1 for males, Age is the student's age in years, HSGPA is the student's cumulative high school GPA, ACT is the student's composite ACT score, EACT is the student's score on the English portion of the ACT, and Absent is the percentage of total classes the student missed. The strongest predictor of whether students would withdraw from the class is the variable for the percentage of classes missed (see Table 3). Each student's predicted probability of withdrawing is then included in our

Table 3. Probit Equation Results to Control for Bias Caused by Student Withdrawal

Independent Variables	*Coefficient*	*SE*
Gender	0.59	0.76
Age	−0.01	0.04
HSGPA	0.19	0.40
ACT	0.24	0.19
English	−0.35	0.22
Absent	3.96**	1.82
Constant	−2.03	1.47
Pseudo R^2	0.32	
N	199	

Note: Table 3 presents results from the probit model where Withdraw (the student's binary choice of dropping the course through formal withdrawal) is the predicted outcome and is set to 1 for withdrawal. The independent variables are as follows: Gender = set to 1 for females; Age = student age; HSGPA = grade point average from high school; ACT = American College Testing composite score; English = American College Testing English score; Absent = percentage of classes missed. In the results columns, "coefficient" indicates the (unstandardized) parameter estimate, SE indicates the standard error, and statistical significance is identified as follows: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

main regressions. We also checked the robustness of our results against several alternative probit equations (all probit models are run with the use of robust standard errors) and found virtually the same results (available upon request) as those reported in the article.

OLS Equation. Our main OLS equation is as follows:

$$\begin{aligned}\text{Exam Score} = \alpha &+ \beta_1\text{GrLev} + \beta_2\text{HSGPA} + \beta_3\text{Priv} + \beta_4\text{ACT} \\ &+ \beta_5\text{Gender} + \beta_6\text{Age} + \beta_7\text{Absent} + \beta_8\text{SectionID} \\ &+ \beta_9\text{p-hat} + e. \end{aligned} \tag{2}$$

For our dependent variable in model (2), we initially use the measure for broad student learning outcomes, the exam scores on the 38 common-question exam. The independent variables in model (2) are as follows: GrLev is the student's grade level, HSGPA is the student's cumulative high school GPA, Priv is an indicator set to 1 for students who attended a privately funded high school (included as a proxy for socioeconomic status), ACT is the student's composite ACT score, Gender is set to 1 for males, Age is the student's age in years, Absent is the percentage of total classes the student missed, and p-hat is the propensity score (predicted probability of withdrawing) from the probit model. The private school indicator variable is included because many education experts maintain that a family's socioeconomic status can have a lasting impact on an individual's educational development (see Ramey & Ramey, 1994).

The remaining independent variable, SectionID, is an indicator variable set to 1 for students in the active course and 0 for those in the traditional course. This variable, therefore, represents the marginal difference in the cognitive outcome for students in the active section. A statistically significant positive coefficient for SectionID, for instance, would indicate that students in the active course performed better on the exam questions than students in the traditional course. The above analytical procedures are then repeated with the use of our second student learning outcome measure (for class-specific knowledge) as the dependent variable.

Results

Table 4 highlights summary statistics related to our cognitive outcome measures. These statistics show that when students were assessed on only their respective teacher's questions, the active students scored approximately 4 percentage points higher than the traditional students at both the mean and median. This finding could indicate that active learning improved cognitive outcomes, but these are strictly univariate measures. In other words, without controlling for any other factors, such as intelligence or absenteeism, students in the active section learned the material taught in their course better than the students in the traditional section learned the material taught in their class.

Because the general subject matter taught in both courses was the same, we also use the overall score on the bonus exam as a measure of how well students mastered the subject (with one important caveat). As mentioned above, because both teachers were aware of only the broad topic areas taught

Table 4. Summary Statistics for Learning Outcomes

	Traditional Teaching Style				*Active Teaching Style*			
Learning Outcome	*Mean*	*Median*	*SD*	*n*	*Mean*	*Median*	*SD*	*n*
Class-specific learning	66.25	68.00	12.73	105	70.17	72.00	19.17	116
Broad learning outcomes	74.90	74.00	10.13	105	74.40	78.00	12.29	116
Fifty-question outcomes	63.41	64.00	11.82	105	56.64	58.00	13.83	116

Note: Class-specific learning reports students' percentage of correct answers on questions only related to their class. Broad learning outcomes reports scores on the 38-question common test. For the sake of completeness, results for the 50-question test are also provided.

in both classes, several exam questions assessed specific items covered in only one section. For example, one of the bonus exam questions tested knowledge of Frederick Taylor's theory on motivation, a subject that was covered only in the traditional course. Given the nature of the experiment, it is unreasonable to expect students in the active learning section to have acquired knowledge of Frederick Taylor. Although including these types of questions on the exam necessitated that we use only 38 questions out of the original 50, it did prevent the possibility of either instructor teaching to address specific questions covered in the other section.

A total of 12 questions were eliminated from the exam, of which 7 were contributed by the traditional teacher and 5 by the active teacher. These results show, at the mean, students in both sections performed nearly the same on the 38 common-question exam (74.9 in the traditional section vs. 74.4 in the active section). At the median, the active section scored slightly better than students in the traditional section (78 vs. 74), indicating a more skewed left distribution in the active section. Because of this finding, we use both OLS and median regression for our main hypothesis tests (all OLS regressions are run with the use of robust standard errors).

The first set of results from running model (2) is presented in Table 5 (in all regression result tables, whether the estimated coefficient is approaching statistical significance is identified as follows: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$). The variable of interest is the estimated coefficient on SectionID, which estimates the marginal difference in the cognitive outcome for students in the active section. Because the dependent variable is the score on the 38 common-question exam, the cognitive measure represents how well students learned the broad subject matter taught in the typical Introduction to Business class. In other words, we are testing Hypothesis 1, that broad student learning outcomes are stronger in active teaching contexts than passive ones. The first column of results shows that the OLS point estimate for the coefficient on SectionID is -0.69, with a standard error of 1.52. In this case, there is no significant difference across the two sections. Therefore, Hypothesis 1 is not supported by these results. In regards to the broad subject area of the course, there is no significant difference between student learning outcomes of those exposed to the active and passive teaching approaches.

Because we know that the scores in the active section are more skewed-left, we rerun model (2) using median regression. These results (the second set of columns on Table 5) also indicate there is no statistically significant difference across the two sections. Although the estimated coefficient does increase to 2.48, with a standard error of 1.83, the estimate is still above conventional significance levels (with a p-value of 0.18). Therefore, we do not have enough evidence to support Hypothesis 1, that active learning improves mastery of the broad subject matter.

Still, it is possible that active learning improved cognitive outcomes as measured by how well students learned the specific material taught in their

Table 5. Regression Results (Model 2): Broad Cognitive Learning Outcomes

	OLS Regression		*Median Regression*[a]	
Independent Variables	*Coefficient*	*SE*	*Coefficient*	*SE*
GrLev	2.50*	1.32	2.21	1.49
HSGPA	2.54*	1.48	1.29	1.46
Private	−1.87	1.78	0.36	1.99
ACT	0.60**	0.25	0.97***	0.24
Gender	0.41	1.48	0.92	1.78
Age	1.07***	0.25	1.23***	0.29
Absent	−0.9.84	8.11	−6.01	9.03
SectionID	−0.69	1.52	2.48	1.83
p-hat	30.63	34.35	9.38	31.53
Intercept	32.4***	8.81	23.7***	8.93
N	181		181	

Note: Table 5 presents results from running model (2) with the measure for broad student learning outcomes (the exam scores on the 38 common-question exam) as the dependent variable. The independent variables are as follows: GrLev = student grade level; HSGPA = grade point average from high school; Private = indicator set to 1 if attended private school; ACT = American College Testing composite score; Gender = set to 1 for females; Age = student age; Absent = percentage of classes missed; SectionID = indicator for the course section (set to 1 for the active section); p-hat = predicted probability of withdrawal. In the results columns, "coefficient" indicates the (unstandardized) parameter estimate, SE indicates the standard error, and statistical significance is identified as follows: $***p < 0.01$, $**p < 0.05$, $*p < 0.1$.

[a]Result from rerunning Model 2 with median regression.

section of the course. To test this possibility (formally, Hypothesis 2), we use a different dependent variable with model (2). Because we are testing whether class specific learning outcomes are stronger in active teaching contexts than passive ones, we use each student's score on the 25 questions contributed by the teacher from their section. In other words, we measure how well students from the traditional course did on "their" questions versus how well students from the active course did on "their" questions.

The results from this version of model (2) are presented in Table 6. Using both OLS and median regression, these results indicate that active learning had a positive impact on cognitive outcomes. For instance, with the use of OLS, the estimated coefficient on *SectionID* is 4.11, with a standard error of 2.21. Although not statistically significant at the 5% level of significance, this estimate is significant at the 10% level (the p-value is 0.065). With the use of median regression, the estimated coefficient on SectionID is statistically significant at the 1% level, and is twice as large in magnitude. This median estimate indicates that students in the active section scored almost

Table 6. Regression Results (Model 2): Specific Learning Cognitive Outcomes

	OLS Regression		*Median Regression*[a]	
Independent Variables	*Coefficient*	*SE*	*Coefficient*	*SE*
GrLev	1.66	1.88	2.39	2.36
HSGPA	3.24	1.99	1.41	2.25
Private	−1.13	2.58	2.17	3.03
ACT	0.83**	0.33	1.09***	0.37
Gender	−0.15	2.19	1.42	2.75
Age	1.63***	0.33	1.45***	0.44
Absent	−12.82	10.72	−13.24	13.90
SectionID	4.11*	2.21	8.38***	2.83
p-hat	34.88	43.47	−5.81	40.94
Intercept	7.36	10.99	8.34	13.37
N	181		181	

Note: Table 6 presents results from running model (2) with the measure for specific student learning outcomes (scores on the 25 exam questions from the respective section) as the dependent variable. The independent variables are as follows: GrLev = student grade level; HSGPA = grade point average from high school; Private = indicator set to 1 if attended private school; ACT = American College Testing Composite score; Gender = set to 1 for females; Age = student age; Absent = percentage of classes missed; SectionID = indicator for the course section (set to 1 for the active section); p-hat = predicted probability of withdrawal. In the results columns, "coefficient" indicates the (unstandardized) parameter estimate, SE indicates the standard error, and statistical significance is identified as follows: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

[a]Result from rerunning Model 2 with median regression.

8.5 points higher on "their" 25 questions than students in the traditional section scored on "their" 25 questions. Therefore, if we focus on how well students learned the specific material taught in their section of the course, students in the active learning section outperformed their counterparts by, on average, nearly an entire letter grade. These findings support Hypothesis 2. These results are also consistent with those found with "core assessment" grades used as the dependent variable (results available upon request).

Discussion

Overall, our results are broadly consistent with the literature. In general, it does not appear that the active learning approach is superior to passive learning when success is measured by broad cognitive outcomes. For instance, as in Ebert-May et al. (1997), we found that there were no significant differences in broad subject matter learning outcomes. Yet, also consistent with Ebert-May et al. (1997), we did find a significant improvement in class-specific learning outcomes for students exposed to the active learning approach. Interestingly, Ebert-May et al. (1997) also used daily quizzes as part of an active teaching approach. These results highlight at least one major challenge for researchers and educators: No common definition of active learning exists.

Researchers and educators are free to use a plethora of activities that qualify as active learning, making the comparison of studies very difficult. It could very well be the case that only certain aspects of what educators identify as active learning actually improve learning outcomes. The experimental designs in both the present article and Ebert-May et al. (1997), for example, could actually be flawed by the use of daily quizzes. Although students may be more "engaged" in the sense that they are studying more, the fact that they are graded on an ongoing basis—rather than any active learning exercises—may cause them to study more. In this sense, the results of both the present article and Ebert-May et al. (1997) could be driven by a factor that is almost outside the spirit of active learning (the spirit of which goes far beyond taking frequent quizzes).

Notwithstanding this issue, our results imply that the active learning approach is not superior to the passive learning approach in terms of broad learning goals. For instance, our results imply that using the active learning approach instead of the passive approach will not necessarily produce better statistics students, better business students, better economics students, etc. Still, in terms of narrowly defined learning goals, the active learning approach may improve student learning outcomes. For example, if students in a particular course are "forced" to engage through active learning methods because their grades depend on how well they engage, student learning can improve with regard to their class material.

These results might be best explained in terms of different types of learning, which the literature separates into Declarative Knowledge (DK) and Knowledge Structures (KS) (Day, Arthur, & Gettman, 2001). DK refers to amounts of information gained in learning, whereas KS is based on the notion that information is part of complex entities (structures) wherein information is mentally arranged in patterns. Day et al. maintain that KS facilitates application of information into broader contexts as individuals learn to make sense of information by understanding its relationships with other concepts. In this context, our results imply that students in the actively taught class do a better job learning (memorizing) the material they are exposed to, compared to those in the passively taught section. However, it does not appear that students in the actively taught class translated DK into KS. When confronted with questions not directly covered in class, these students were unable to infer answers from knowledge gained. In other words, students were unable to apply the knowledge they acquired (there was a lack of development of knowledge structures). If these implications are accurate, we can say that further research should separate DK from KS as dependent variables in testing teaching style outcomes.

Further, because teaching with active learning methods can require additional class time, it is possible that using the active learning approach may result in sacrificing some base knowledge in a course. Perhaps active learning is more appropriate once students already have a foundation in the particular subject matter. Particularly in freshmen courses with high attrition, it may not be worth the time and effort to structure a course completely around the active learning approach. Teachers should instead consider which areas of their subject matter are best suited for the active learning approach in order to supplement those areas where the passive approach is best.

Because our findings indicate that active teaching styles enhance subject-specific knowledge gains, on-the-job training can benefit from the active style when the goal is to transmit focalized information. It might be the case that the higher involvement from the active style concentrates participants' attention in such a way that substantial knowledge gains are obtained on the subject matter at the cost of diminishing attention on the connections between training contents and subordinated subjects. The results of the study point to this direction by exhibiting stronger gains on subject-specific materials than on surrounding ones. Hence, human resource managers should consider this possibility when designing training. In particular, managers might consider expanding learning contents toward surrounding elements or, if broader understandings are unnecessary, acknowledging that learning might remain compartmentalized in participants' minds.

Limitations of the Study. Although we have tried to correct for the major statistical bias issues, there are surely explanatory factors for learning outcomes for which we have been unable to control. For instance, we have included ACT scores and high school GPAs in our regressions, but these measures are surely not perfect proxies for what likely matters most: student ability. We also acknowledge that different teaching styles and effectiveness—not merely teaching approaches—could partially explain the findings in our study. We did attempt to control for perceived differences in teaching styles, but those regression results showed no material differences from the main results presented in the article.

We believe that the single largest limitation of our study is that students in the active learning section were required to take a quiz each class, whereas the students in the passive learning section only had three in-term exams. Several students in the active section mentioned that they preferred the daily quiz format because it "forced" them to study throughout the semester rather than "cram" the night before a test. In fact, in a very well-designed experimental study, Myers and Myers (2007) showed improved student learning outcomes for students taking biweekly exams (in statistics) versus students taking only two midterm exams. This explanation could also be viewed in terms of "distributed" versus "massed" practice (see Dail & Christina, 2004; Goldstein, 1993; Willingham, 2002). These findings, along with our own anecdotal evidence, suggest that the daily quizzes in the active section partially explain the marginal improvements in learning outcomes for that class. Consequently, we should be cautious in attributing improved learning outcomes to active learning if the "active learning" simply refers to students studying their class material.

Finally, the environment where our study took place—academic—is a limitation for generalizing the study findings to labor environments, especially given the differences between the controlled and safe environment of our study and the complex conditions surrounding on-the-job training. Because lab settings lack the richness in clues and feedback that labor contexts provide, we can expect differences in participants' responses to active-learning exercises between settings. This restriction, however, does not rule out applications of our findings to organizations, for similarities in learning have been established between academia and training with empirical evidence reporting parallel motivational (Meece, Anderman, & Anderman, 2006; Noe, 1986), contextual (Jones, 2008; Tannenbaum & Yukl, 1992), and cognitive (Fitts, 1964) learning factors. Further, active learning implies some level of reflection, a concept that has attracted a great deal of attention in the adult learning literature (see Preskill, 1996).

In conclusion, our study contributes to the management education literature with quantitative evidence that the active teaching approach may have a greater positive influence on student learning than the passive teaching approach in some contexts. Our results show higher student cognitive outcomes on specific material covered in a class taught with the active learning approach as opposed to one taught with the passive teaching approach. In order to draw further and more general conclusions, future researchers may want to expand this type of study to include multiple subjects and/or even classes taught at multiple universities. Further research is especially needed concerning cognitive student outcomes as opposed to affective responses from students to determine the best teaching approaches for the advancement of management education.

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