THE IMPACT OF AN ACTIVITY-BASED LEARNING ENVIRONMENT AND GRADE POINT AVERAGE ON STUDENT FINAL COURSE GRADE IN AN UNDERGRADUATE BUSINESS STATISTICS CLASS

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ABSTRACT

The use of an activity-based learning environment as part of a blended learning course has become popular in recent years. Many studies suggest that an activity-based learning environment, which may require more active engagement and additional effort by students, universally leads to positive student learning outcomes. However, since not all students may actively engage or put in the required additional effort, it may be that some students in fact perform more poorly in an activity-based learning environment. Yet, little research has empirically studied this phenomenon. This article examines three research questions: i) does an activity-based learning environment directly and positively impact final course grade, ii) does entering grade point average positively impact final course grade, and iii) does grade point average moderate the effect of an activity-based learning environment on final course grade. These questions are addressed using data from undergraduate business statistics courses at a large Midwestern public university. Results indicate that grade point average moderates the relationship between an activity-based learning environment and student learning outcomes. Specifically, students with high grade point averages respond differently than students with low grade point averages to an activity-based learning environment. Students with high grade point averages perform better in activity-based learning environments, while students with low grade point averages perform better in lecture-based learning environments.

INTRODUCTION

“I hear and I forget. I see and I remember. I do and I understand. – Confucius”

The undergraduate business statistics (UBS) course provides students with an important business foundation. An understanding of basic statistical concepts can be critical to graduates' success (Lohr, 2009). While we, the authors, would like to think that we prepare our students to evaluate, analyze, and apply what they learn in UBS to real-world business problems, we reluctantly acknowledge that many of them fail to achieve these higher-order learning outcomes. One reason is that for many, statistics is a difficult quantitative subject in which one must learn numerous techniques. Frequently, the application of these techniques requires that students manually crunch numbers—often using only hand-held calculators. Students’ anxiety over these expected computations often interferes with their ability to understand the relationship between statistical techniques and the objectives of associated analyses (Rynearson & Kerr, 2005) Moreover, instructors often introduce statistical concepts in an abstract form that emphasizes theory rather than application. As a result, students do not learn how to apply these concepts.

Accordingly, a lecture-based learning environment (LBLE) that provides only a passive learning experience—typical of the learning environment of many UBS courses —may provide little value to many students.

Research suggests that instructors may improve learning outcomes by moving beyond the LBLE to an activity-based learning environment (ABLE) (Kayes, 2002; Kolb & Kolb, 2005; Roehl et al., 2013). While instructors have used elements of active learning in the classroom for decades (Strayer, 2012), considerable recent efforts to improve student learning outcomes have focused on improving ABLEs further by incorporating online technology into a blended learning environment in which some instruction takes place inside the classroom and some instruction takes place outside the classroom (Garrison & Vaughn, 2008; Arbaugh, Godfrey, Johnson, Pollack, Niendorf, & Wresch, 2009; Strayer, 2012; Roehl, Reddy, & Shannon, 2013; Myxter, 2014). Online technology lends itself well to an activity-based, blended learning environment, because it improves instructors' opportunities to offer learning activities, and it extends instructors' abilities to monitor students. It enables students to learn basic concepts outside the classroom, leaving more classroom time for active learning experiences. Cited research led to our attempt to improve learning outcomes in UBS by employing technology to help create an ABLE.

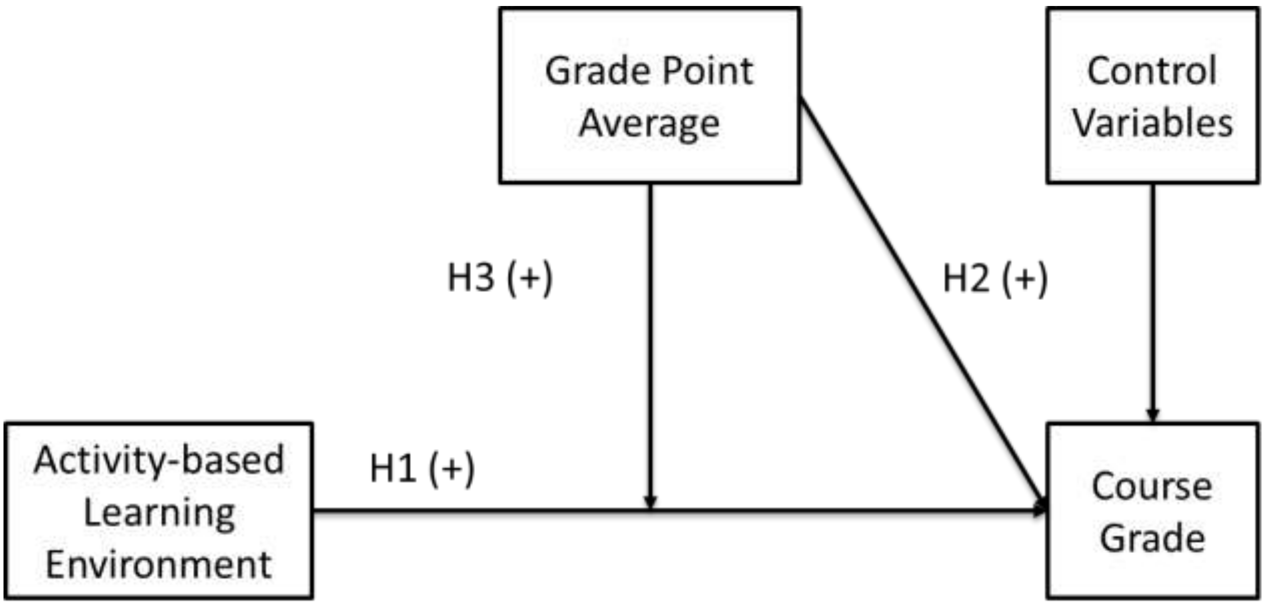
Numerous studies have suggested that using an activity-based approach may universally improve learning outcomes. However, two recent studies (i.e., Garrison & Vaughn, 2008; Strayer, 2012) have anecdotally suggested the benefits may be more limited because activity-based approaches may require additional student effort, they could diminish learning outcomes for students, who are less motivated to put in the additional effort). In a commentary literature stream, Whittingham (2006) and Noftle & Robins (2007) suggest that GPA is related not only to learning outcomes, but also to conscientiousness—that is, to the tendency for a student to put in effort. Students with higher GPAs are more conscientiousness and thus may put in more effort than those with lower GPAs. Taken together these two complementary literatures suggest that students with above-average GPAs may tend to put in more effort than students with below-average GPAs, and as a result have better learning outcomes. In other words, the relationship between the learning environment and learning outcomes may be influenced or moderated by the student's entering GPA, thus suggesting that an activity-based learning environment may not be universally beneficial. However, this dilemma has not been empirically investigated. Is it the case that activity-based learning environments universally improve student learning? Alternatively, does an activity-based learning environment improve the performance of high GPA students, while decreasing the performance of low GPA students? We contribute to the extant literature by empirically investigating these questions. This paper investigates (i) the direct impact of learning environment on final course grade (FCG); (ii) the direct impact of GPA on FCG and (iii) the moderating effect of GPA on the relationship between learning environment and FCG.

The remainder of this paper includes a review of relevant literature, a description of the methodology used, results of analyses and implications, and a discussion about the study's limitations and future research opportunities.

THEORETICAL BACKGROUND AND HYPOTHESES

The blended learning literature addresses the benefits of an ABLE over an LBLE. This literature suggests that both learning environment and student ability have an impact on learning outcomes. Based on our understanding of existing literature, we expected the study to show that (i) an ABLE has a direct and positive effect on FCGs when compared to an LBLE, (ii) students' entering GPAs have a direct and positive influence on FCGs and (iii) students' entering GPAs moderate the relationship between an ABLE and FCG. We represent these relationships in the model depicted in Figure 1.

Figure 1
HYPOTHESIZED MODEL

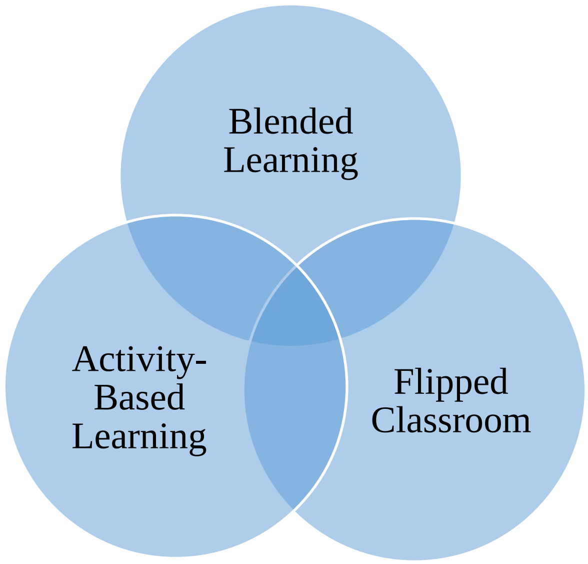


Activity-Based Learning Environment

Active learning (frequently manifested as experiential learning) is a process by which the learner creates meaning through activities and experiences (Dewey, 1938). An ABLE focuses on creating active learning by engaging students in activities and experiences when face-to-face with their instructors. Popular teaching methods (TMs) such as blended learning and the flipped classroom frequently use an ABLE.

Figure 2 illustrates the relationship among the concepts of three influential active learning approaches, blended learning, the flipped classroom, and activity-based learning. Blended learning may exist outside the flipped classroom and without activity-based learning; use of the flipped classroom does not mandate either a blended learning environment or the presence of activity-based learning; and activity-based learning may occur without a blended learning environment or use of the flipped classroom. Our interest is in the area where all three topics intersect.

Figure 2
RELATIONSHIP BETWEEN BLENDED LEARNING, ACTIVITY-BASED LEARNING, AND FLIPPED CLASSROOM



In designing our classroom ABLE, we incorporated many ideas from the literature. Melton (2008), Hakeem (2001), Grandzol (2004), and Rynearson & Kerr (2005) describe their use of activity-based learning in a UBS class. Van de Rhee (2010), Biesterfield (2001), and Carlton & Mortlock (2005) describe their use of segments from television shows such as *Numb3rs* and *The Price Is Right* to illustrate concepts of likelihood of events, random numbers, hypothesis testing, and conditional probability. Rappaport and Richter (2008) describe using racetrack betting markets to teach probability and sensitivity analysis.

In blended learning, knowledge is conveyed to students through complementary delivery modes in an effort to promote learning (Singh, 2003). In its most traditional sense, "blended learning" might refer to a course that delivers knowledge through a combination of lectures and film clips. Today, "blended learning" typically refers to a course that pairs face-to-face instruction with instruction delivered in an environment that enables students to interact online with the instructor, with other students, and with course content (Garrison & Kanuka, 2004). The blended learning approach enables instructors to exploit the strengths of both face-to-face interaction and online technology to create an appropriate pedagogic balance tailored to improve student learning and facilitate activity-based learning (Osguthorpe & Graham, 2003).

The flipped classroom extends the blended learning environment by using online technology to convey fundamental course concepts, while using classroom activities to foster a deeper understanding of those concepts (Fulton, 2012; Tucker, 2012; Roehl et al., 2013). The flipped classroom makes it possible to replace a traditional lecture-based classroom with an activity-focused approach by moving lower-level learning activities (such as lectures) to outside the classroom, while focusing on higher levels of application, analysis, and creation within the classroom (Hamdan, McKnight, McKnight, & Arfstrom, 2013).

In addition to the aforementioned theoretical literature that links an ABLE to positive learning outcomes, several studies (Hakeem, 2001; Alonso, 2010; Asef-Vaziri, 2015) have found support for this relationship. Therefore, we hypothesize that:

H1 An ABLE has a direct and positive influence on FCGs.

Grade Point Average and Student Learning

The literature shows that a student's preexisting cognitive and learning abilities may have a significant impact on learning outcomes (Whittingham, 2006; Bradley et al., 2007; Palocsay & Stevens, 2008; Hollister & Berenson, 2009). Several studies have found support for this proposition. For example, Bradley et al. (2007) examined the relationship between GPA and perceptions of improved higher-order cognitive skills in business courses. Bradley and his colleagues found that students with above-average GPAs tended to perceive greater improvement in higher-order cognitive skills than did students with below-average GPAs. Palocsay & Stevens (2008**)** examined the relationship between GPA and students' overall grade in a college calculus course, and the grade they received on a multiple-choice final exam in a UBS class. The researchers found that both the overall calculus grade and GPA have a significant correlation with the UBS final exam score. However, student GPA provided the best predictor of the final exam score. Hollister and Berenson (2009), noted that, after controlling for GPA, they were unable to show statistical differences between various methods of exam administration. They found this to not be surprising, given the numerous studies that indicate that GPA tends to be the primary determinant of student performance. Therefore, we hypothesize:

H2 A student's entering GPA has a direct and positive influence on FCG.

The Moderating Influence of Entering Cumulative GPA on the Relationship between ABLE and Student Learning

An ABLE engages students in higher-order thought processes such as evaluation, analysis, and synthesis that encourage student learning (Bonwell & Eison, 1991). It also requires that students a) be motivated enough to learn independently, b) self-direct their learning efforts and c) actively participate in the learning experience (Cybinski & Selvanathan, 2005). Since a student's GPA reflects traits such as conscientiousness (Whittingham, 2006; Noftle & Robins, 2007) that are related to their motivation, a student's entering GPA may correlate with student learning in an ABLE. Specifically, students with higher entering GPAs tend to have higher levels of conscientiousness and as a result may manifest greater degrees of motivation. As such, we would expect higher-GPA students to perform better in an ABLE, while lower-GPA students might actually achieve less than they otherwise would have in an LBLE. Strayer (2012) provides support for this notion. He observed that some students struggle to remain engaged in an ABLE, resulting in their feeling lost. This ultimately results in demotivation and poor performance in the course. He further suggests that lower GPA students tend to be the ones struggling with the ABLE, which implies that entering GPA may shape or moderate the relationship between an ABLE and student learning outcomes. He concluded his research by recommending that future research empirically investigate this phenomenon. On the basis of this prior research, we hypothesize:

H3 *Entering GPA moderates the relationship between an ABLE and FCGs such that students with above average entering GPAs enrolled in an ABLE will have higher FCGs than their counterparts in an LBLE and students with below average entering GPAs enrolled in an ABLE will have lower FCGs than their counterparts in an LBLE.*

METHODOLOGY

Experimental Design

This study focused on an ABLE's impact on student performance in a UBS class. Given the literature which supports the proposition that a student's entering GPA can have an impact on learning, we pursued an experimental approach in which we manipulated the learning environment and objectively observed learning outcomes. Following previous practice, we used an experiment to compare different educational outcomes across learning environments to allow for the explicit control of learning outcomes and the mitigation of possible effects of exogenous variables on findings (Clouse & Evans, 2003; Cybinski & Selvanathan, 2005; Strang, 2012).

The experiment had one treatment group and one control group. The factor that distinguished treatment from control was the type of classroom learning environment. We investigated how students' entering GPAs interacted with the classroom learning environment to affect FCGs (learning outcome) (Figure 1).

Subjects and Experimental Environment

The study sample comprised 512 student subjects enrolled in an entry-level UBS course at a public university in the Midwest. Of the eight sections of the UBS course, two were taught in fall 2012, one in spring 2013, two in fall 2013, and three in spring 2014. The LBLE courses occurred during fall 2012, spring 2013, and fall 2013. The ABLE courses occurred during spring 2014. Of the 512 student subjects, 71 were excluded from the final sample because they withdrew from the course, did not have an available cumulative entering GPA, or did not receive a grade for the course due to incompletes, academic integrity violations, or other circumstances.

Because students self-selected into course sections, the learning environment treatments in our study lacked random assignment; therefore, our study was potentially influenced by selection bias. To test for potential selection bias that might influence our results, we examined the two treatment groups across three measures that might indicate such a bias. The measures included (i) a chi-square comparison of the proportion of students who withdrew from an ABLE course versus the number who withdrew from an LBLE course, (ii) a t-test comparison of teaching evaluations, and iii) a t-test comparison of cumulative entering GPA across TMs. Results indicated the following: First, no statistically significant difference ($\chi^2 = 2.54$, $p > 0.10$) in the proportion of students that withdrew from courses when compared across learning environments existed. This finding suggests that there was not a selection issue from students self-selecting into or out of a particular TM. Second, no statistically significant difference ($t = -0.67$ [df = 6], $p > 0.10$) in the teaching evaluations based on the learning environment existed. This suggests that students' perceptions of instructor effectiveness did not vary significantly across learning environments. Third, a small but statistically significant difference ($t = 0.19$ [df = 439], $p < 0.001$) in the cumulative entering GPA for all the class sections based on the learning environment existed. While significant, we believe this difference is not substantive. The average cumulative GPA for the LBLE is 2.89; for the ABLE, it is 2.70. This difference *could have* indicated that slightly higher-achieving students self-selected into the LBLE; however, this possibility is unlikely because i) all the ABLE treatments occurred in the same semester, ii) students had no alternative to the ABLE versus LBLE UBS courses in any given semester, and iii) students had no prior knowledge of the change in learning environments. Taken together, we believe these findings indicate that the potential for selection bias in our study was minimal.

In terms of demographics, 35.6% of the students in our study were females with an entering GPA of 2.82. Sixty-eight percent of the students self-identified as business majors, while 31.1% were undeclared and 0.9% were pursuing nonbusiness degrees. The number of undeclared students is not surprising, since many students were freshman (7.3%) or sophomores (44.4%) and had not yet selected a major. The remaining students in the study were juniors (34.5%) and seniors (13.8%). A summary of the student demographics can be seen in Table 1.

Table 1
DEMOGRAPHIC INFORMATION

Cumulative GPA μ = 2.82, σ= 0.58

Gender	***Count***	***Percent***	***Major***	***Count***	***Percent***
Female	157	35.60%	Accounting	94	21.32%
Male	284	64.40%	Economics	14	3.17%
Total	441		Finance	43	9.75%
			Human Resource Management	25	5.67%
Class standing	***Count***	***Percent***	Management	39	8.84%
Freshman	32	7.26%	Marketing	49	11.11%
Sophomore	196	44.44%	Management Information Systems	26	5.90%
Junior	152	34.47%	Supply Chain Management	10	2.27%
Senior	61	13.83%	Undecided	137	31.07%
Total	441		Other	4	0.91%
			Total	441	

Main variables

The main variables in our study are FCG, entering GPA, and learning environments.

Final course grade

Learning outcomes are measured in many different ways [(e.g., student performance on a common final exam (Palocsay & Stevens, 2008), exam scores (Clouse & Evans, 2003; Anstine & Skidmore, 2005), or overall academic performance in a program of study (Whittingham, 2006)]. In our study, we used the FCG, measured numerically from 0 to 4.0. We did so for several reasons. First, numerous other studies use FCG as a measure of student performance, or achievement of learning outcomes (McLaren, 2004; Cybinski & Selvanathan, 2005; Schniederjans & Kim, 2005; Noftle & Robins, 2007; Hollister & Berenson, 2009). Second, the FCG reflects a student's understanding over the breadth of the material covered in assignments, quizzes, and tests. This is in contrast to timed tests that often restrict coverage. Third, other measures of learning outcomes may be influenced by factors beyond the interest of this study.

For example, individual exam scores, when used in isolation, may reflect test-taking anxiety rather than learning outcomes (Kirkland & Hollandsworth, 1980). Also, for example, overall academic performance in a program of study may reflect a student's performance across a broad range of qualitative and quantitative courses as opposed to his performance in any one qualitative or quantitative class (Whittingham, 2006).

Grade Point Average

The literature maintains that a student's existing cognitive and learning ability may have a significant impact on learning outcomes (Whittingham, 2006; Bradley et al., 2007; Palocsay & Stevens, 2008; Hollister & Berenson, 2009). Extending Whittingham's connection between GPA and conscientiousness (2006) we maintain that a student's GPA provides some measurement of ability, and greater ability can influence learning, particularly in an ABLE. This study drew upon university academic records to obtain entering GPAs for each student in this study. The average entering GPA was 2.82 on a four-point scale.

Learning Environments

In this study, the entry-level UBS courses were divided into two treatment groups: (i) courses using an LBLE, representing the control group, and (ii) courses using an ABLE, representing the test group.

Apart from the learning environment, the students in the two groups covered the same course topics and were assessed on homework, quizzes, and exams using a single question pool.

Course topics included theory and application of frequency distributions, measures of central tendency and variability, basic probability, discrete and continuous probability distributions, expectation, sampling and estimation, and one-sample hypothesis testing. Course materials—including the textbook and Excel-based spreadsheets for statistical analyses and example problems—were similar across the two groups. All students solved similar online homework problems administered through Pearson's online resource delivery system. All exams were administered through the learning management system Desire2Learn. While the actual questions assessed on the homework, quizzes, or exams across or within a semester differed numerically, the theoretical content coverage and the number of questions assessed on a given topic were similar.

Control Variables

The control variables in our study were class standing (CS) and gender (GDR).

Class Standing

Consistent with prior literature (Ford et al., 2007) we controlled for CS since learning outcomes may vary with a student's academic maturity (Anstine & Skidmore, 2005) or experience using web-based learning management systems (Davis & Wong, 2007).

Gender

Learning outcomes may vary by gender (Anstine & Skidmore, 2005; Ford et al., 2007; Strang, 2012), so our analyses controlled for student gender, as reported in their academic record (0 = female, 1 = male).

Model Specification

We used a multiple-regression model to investigate the relationship between cumulative entering GPA and TMs on the FCG. The final model, as seen below, included an interaction term between GPA and TM to account for differential learning outcomes. Also, the model included two control variables, GDR and CS. GDR coded "female" as zero and "male" as one. CS was a continuous variable which coded freshmen as one, sophomores as two, juniors as three, and seniors as four. Our final research model was:

$$FCG = \beta_0 + \beta_1 GDR + \beta_2 CS + \beta_3 GPA + \beta_4 TM + \beta_5 (GPA \cdot TM) + \varepsilon_1 \quad (1)$$

RESULTS AND DISCUSSION

Since we employed regression analysis to test our expected outcomes, we tested that model assumptions were met. A general assumption of regression is the homogeneity of variance across groups. We performed a Levene's test for equality of variance and found that the variance across the two treatment groups was significantly different ($p \leq 0.05$). Tests for homogeneity of variance are sensitive to sample size (Cohen, Cohen, West, & Aiken, 2003). Cohen et al. (2003) suggest that significance tests from violations of the homogeneity of variance assumption are robust if the samples are relatively balanced, that is, if the ratio of the largest group's sample size to smallest is less than 2. The ratio of our larger group—the lecture-based treatment—to the smaller group was 1.5, therefore regression analyses were deemed appropriate. Table 2 summarizes the regression results. Notice that the control variable GDR is found to be statistically significant, the control variable CS is not and the overall regression model is statistically significant ($F = 51.68$, [df = 435], $p < 0.001$, $R^2 = 0.37$). Therefore, analyses proceeded with an examination of the hypotheses. We summarize findings in Table 3.

H1 stated that the ABLE would have a direct and positive effect on students' FCG when compared to an LBLE. The results, as seen in Table 2, suggested that the direct effect of an ABLE was not statistically significant ($p \geq 0.10$). This finding suggests that an ABLE, which requires students to actively engage in the learning process, may not universally benefit students' FCGs more than an LBLE. Considering that an ABLE requires more self-directed effort from students than an LBLE (Kolb & Kolb, 2005; Tucker, 2012), our finding suggests that not all students put in the required additional effort. Moreover, students may perceive the ABLE as less challenging because it is fun (Strayer, 2012), and perhaps this perception may cause some students to put in less effort than in the LBLE.

H2 predicted that entering GPA would be directly and positively related to students' FCGs. Our analysis found that entering GPA was indeed significantly related ($p \leq 0.01$) to FCGs. This finding supports the extant literature, which indicates that students' past academic performance influences their course grade (Whittingham, 2006; Bradley et al., 2007; Palocsay & Stevens, 2008; Hollister & Berenson, 2009). The literature also indicates that a student's existing cognitive ability—which is, in part, represented by entering GPA—plays a significant role in student learning outcomes in a UBS course.

Table 2
RESULTS OF THE REGRESSION ANALYSIS
Coefficients (Dependent Variable: Course Score.**)**

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	0.823*	0.023		35.526	0.000
Control Variables					
Gender	0.04*	0.012	0.128	3.349	0.001
Class standing	-0.003	0.007	-0.015	-0.379	0.705
GPA	0.145*	0.016	0.562	9.088	0.000
ABLE	0.014	0.021	0.046	0.671	0.350
ABLE • GPA	0.143*	0.034	0.187	4.191	0.000
R^2					0.373
F					51.684
Df					435
p-value					0.000

*p<.01

Table 3
TESTING SUMMARY FOR EXPECTED OUTCOMES

	→→→Hypothesis	Result
H1: ABLE	→ (+) Course Score	Not supported
H2: GPA	→ (+) Course Score	Supported
H3: ABLE • GPA	→ (+) Course Score	Supported

H2 predicted that entering GPA would be directly and positively related to students' FCGs. Our analysis found that entering GPA was indeed significantly related ($p \leq 0.01$) to FCGs. This finding supports the extant literature, which indicates that students' past academic performance influences their course grade (Whittingham, 2006; Bradley et al., 2007; Palocsay & Stevens, 2008; Hollister & Berenson, 2009). The literature also indicates that a student's existing cognitive ability—which is, in part, represented by entering GPA—plays a significant role in student learning outcomes in a UBS course.

Our study found support for our third hypothesis that entering GPA moderates the relationship between ABLE and FCG ($p \leq 0.01$). Figure 3 shows this moderating effect. To help explain this statistically significant moderator, we examined pairwise comparisons, as seen in Table 4. When students had an above-average entering GPA (defined in our study as one standard deviation above the mean entering GPA), within the ABLE their FCG was significantly better than the FCG of students with similar entering GPAs enrolled in an LBLE (I-J = 9.52, p <

0.01). In contrast, when students had below-average entering GPAs (defined in our study as one standard deviation below the mean GPA), within the ABLE their FCG was significantly lower than the FCG of students with similar GPAs enrolled in an LBLE (I-J = 6.73, $p < 0.05$). These findings are consistent with conclusions reached by Cohen et al. (2003). Our findings also complemented previous research studies which indicate that GPA reflects student conscientiousness (Whittingham, 2006; Noftle & Robins, 2007).

The results of our study demonstrate that students with low entering GPA earned lower FCGs in an ABLE than in an LBLE. Therefore, we should be cautious in applying this approach until we have developed mechanisms to ensure that all students will benefit, not just those students with high GPAs. To accomplish this we need to understand why students with low entering GPAs are not as successful in an ABLE. If we understand these specific causes we can develop relevant tools to address these issues. For example, the literature cited in the previous paragraphs suggests that ABLEs require students to be more self-directed than students participating in LBLEs. Students with below-average entering GPAs may lack the required self-direction which limits their higher order thought processes (e.g., evaluation, analysis, and synthesis of business problems that involve statistics). This contrasts with high entering GPA students who put in additional effort and improve their learning outcomes by increasing their engagement in higher-order thought processes. Bonwell & Eison (1991), Kayes (2002), Kolb & Kolb (2005), Fulton (2012), Tucker (2012), and Roehl et al. (2013) support this assumption. Therefore, an important challenge is to provide mechanisms for low GPA students to achieve higher order learning.

These results also suggest that we could offer a UBS taught with an ABLE as an honors class that would be very beneficial to high GPA students. This would provide a superior learning environment for those high GPA students for whom our research shows ABLE provides the greatest advantage.

Figure 3
THE MODERATING EFFECT OF GPA ON THE RELATIONSHIP BETWEEN THE LEARNING ENVIRONMENT AND COURSE SCORE

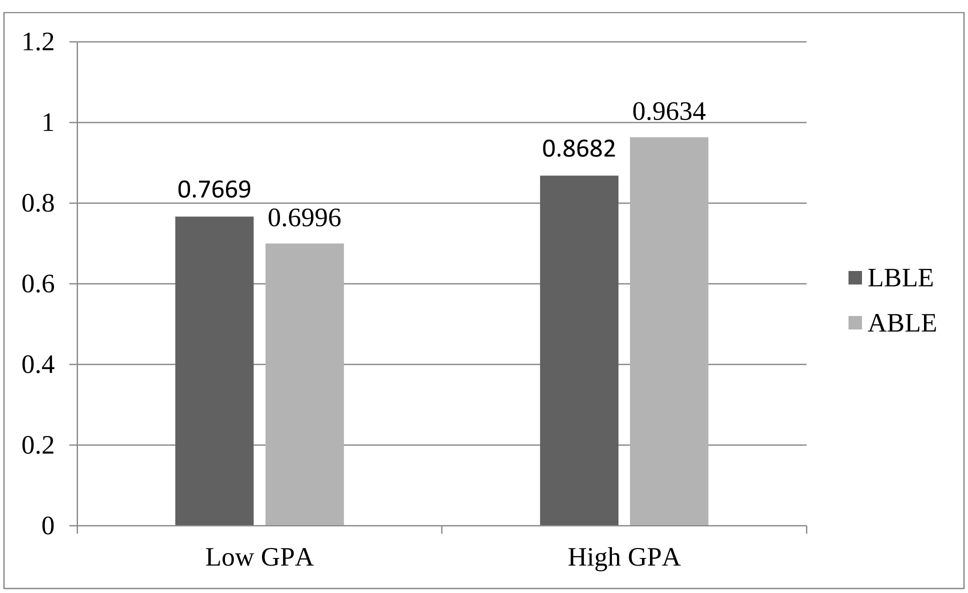


Table 4
PAIRWISE COMPARISONS

GPA Classification	Environment	Mean GPA	difference (I-J)
High (+1σ)	ABLE (I)	96.34	9.52*
	LBLE (J)	86.82	
Low (-1σ)	ABLE (I)	69.96	-6.73**
	LBLE (J)	76.69	

*$p \leq 0.01$; **$p \leq 0.05$

CONCLUSIONS

This study used a sample of 441 students selected from eight UBS sections utilizing either an ABLE or an LBLE. Aside from the in-class learning environment, all online and in-class outcome measurements (homework and exams) were similar. The control group used a traditional LBLE in which students functioned as passive learners and the faculty presented material with limited two-way interaction. The treatment group used an ABLE in which students actively learned and the faculty facilitated learning through a range of in-class exercises and simulations. These in-class experiences were supported by online learning resources.

Entering GPA was an observational variable and preexisting student characteristic. The dependent variable was the FCG, calculated numerically on a continuous four point scale (0 to 4.0). After controlling for GDR and CS, our results supported H2, which stated that entering GPA would positively impact learning outcomes, and H3, which stated that entering GPA would moderate the relationship between ABLE and students' FCGs. Surprisingly, the study did not support H1, which stated that use of the ABLE would directly and positively have an impact on FCGs. These results indicate that the use of activities to help students develop a deeper understanding of a topic (as suggested by Renkl et al., 2002; Prince, 2004; Westermann & Rummel, 2012) may not benefit all students in quantitative courses such as UBS.

In addition, our results have several practical implications for those who employ ABLEs. First, it may be most beneficial to differentiate instruction so that students with above-average entering GPAs participate in ABLEs and students with below-average entering GPAs participate in LBLEs. Second, students with below-average entering GPAs may require additional attention or effort from faculty in order to benefit from an ABLE.

LIMITATIONS AND FUTURE RESEARCH

The first limitation to our study was that assignment to the two treatment groups was not random. However, students had neither the prior knowledge of the study nor the choice to select into either treatment during any given semester, nor were they aware of future classroom environments that would be used in upcoming semesters. Consequently, self-selection bias was minimal. On the other hand, possible selection differences due to demographics remained. The second limitation is that UBS is a quantitative course, and our results may not generalize to non-quantitative subject areas. Third, use of an ABLE in a quantitative course such as UBS is unfamiliar to many students. The novelty of this approach could have had an impact on our results. Future research could seek to replicate our results in different courses to overcome these limitations. Fourth, we speculate that student motivation may explain the impact of an ABLE on student effort and FCGs, even though we did not specifically measure the effect of motivation in our study.

Effort as a manifestation of motivation is only one of several reasons that an ABLE may moderate the relationship between entering GPA and FCG. For example, the unexpected devotion of class time to activity-based learning may be perceived as a waste of time by students with a below-average entering GPA, because these activities mark a significant departure from an LBLE. As a result, these students may have difficultly linking the activities to learning objectives, course materials, or real-world business situations. In addition, in-class activities may be challenging, and therefore de-motivate students with below-average entering GPAs. This causes these students to disengage (Skinner & Belmont, 1993; Stipek, 1993). Future research could investigate this conjecture.

Further, future research should investigate the use of teaching practices and behaviors that affect student motivation, in order to increase the effort put in by students with below-average entering GPAs (Skinner & Belmont, 1993). For example, the faculty members assigned to an ABLE course may have less experience teaching in an ABLE than they have teaching in an LBLE. As a result, they may develop in-class activities that are less structured and scripted than material in an LBLE. We speculate that students with a below-average entering GPA may have a more difficult time adapting to this approach. All of these factors may explain the moderation effect.

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