The Effect of Student Learning Styles, Race and Gender on Learning Outcomes: The Case of Public Goods

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ABSTRACT

We investigate the impact of active learning techniques, specifically experiment based learning, in a Principles of Economics class. Our case study demonstrates that when using pedagogical techniques intended to facilitate active learning, teachers should be intentional about incorporating components of learning that appeal to students with different learning preferences and demographic characteristics. Drawing upon an earlier study by Emerson and Taylor (2005) we explore the effectiveness of alternative teaching methods conditional upon their learning style preferences, race and gender. We find no significant evidence of gains in learning outcomes from a single case study of experiment based learning. We conclude that experiment based learning as a pedagogical tool is most effective when it is adopted as the dominant teaching/learning strategy for an entire course. Repeated participation in experiment based learning has the potential to foster strategic thinking and provides catch-up opportunities for different groups of students. The use of experiment- based learning as an occasional teaching tool, while engaging students in the classroom, does not appear to translate into significant learning gains.

INTRODUCTION

Several studies in the area of economic education have demonstrated the need for and the effectiveness of active teaching/learning techniques in the classroom[1]. As a result various active pedagogical tools such as experiments, cooperative learning and class discussions have been adopted in Economics classrooms. The efficacy of these teaching techniques have been tested against measures of learning such as Test of Understanding in College Economics (TUCE Scores)[2] and course grades[3].

A significant number of studies in this area have demonstrated that measured learning outcomes measured are improved specifically by the implementation of experiments in the classroom. "Classroom Experiments are activities where any number of students work in groups on carefully designed guided inquiry questions. Materials provide students with the means of collecting data through interaction with typical laboratory materials, data simulation tools or a decision making environment, as well a series of questions that lead to discovery based learning" (Starting Point: Teaching and Learning Economics).

However, subsequent studies found that learning gains were not equal across all student groups. The literature in this area investigated student performances across learning and personality types. Ziegert (2000) incorporated both student and faculty personality temperaments as per the Myers-Briggs personality type indicator (MBTI) to study its impact on course grade and TUCE scores. They find that personality type does affect student performance with implications for the "gender gap" in economics. Emerson and Taylor (2007) combine these two strands of literature to research the impact of personality types in conjunction with teaching methodology, i.e. traditional lecture based versus experiments based, on student achievements measured by the TUCE score in the course. They largely find that the learning gains associated with experiment based teaching methods are widespread across most personality types and that the "gender gap"

1 Becker (1997) and Emerson and Taylor (2004)

2 Wetzel et al (1982) and Emerson and Taylor (2004, 2007)

3 Borg and Shapiro (1996) and Borg and Stranahan (2002)

in economics disappears when controlled for personality types.

Even as the pedagogical literature shows evidence of the benefits of experiment based learning, universities and colleges face increasing resource constraints requiring in some cases, curriculum standardization across introductory Economics classes. A standardized curriculum may also be needed to facilitate the program needs jor. the flexibility of instructors to adopt active learning demand for the Business major of a growing cohort of Business majors[4].The above developments have required instructors to teach larger classes to an increasingly diverse student body and at the same time teach a broad portfolio of courses. Our mid-sized Midwestern University, for instance, is a private university that has followed a model of small class sizes that maximize student-teacher interaction and is now planning for enrollment growth. Additionally, faced with the constraint of conforming to a standardized curriculum, instructors could be hampered by lack of time in incorporating active learning techniques, such as experiments, in their classrooms[5]. Further, while earlier studies have demonstrated gains in learning outcomes from experiment based learning, these gains in learning outcomes were measured through comprehensive testing at the end of a semester. For instance, the Emerson and Taylor (2004, 2007) findings are based upon a series of eleven experiments that were conducted over an entire semester. We investigate whether experiments could be strategically used as a teaching technique within a traditional lecture based class to reinforce understanding of key concepts.

We propose to build upon Emerson and Taylor's (2007) study to answer the following questions:

- Are there gains from experiment based learning when the constraints of a common curriculum limits the ability of the instructor to adopt active learning techniques? In other words, is an active learning technique equally effective when the dominant teaching style is traditional-lecture based, interspersed with a few active learning modules?
- Are there differential eriment based learning persista across race and gender? is one that
- s dominated by g. gains from experiment based learning across learning styles and do they persist across race and gender?

We, therefore, measure learning performance by testing students on learning outcomes from a single experiment instead of an overall course assessment. This study is an improvement on an earlier paper wherein we compared mean differences in learning outcomes between the experiment and control groups. In this study, a similar comparison is made subsequent to controlling for student characteristics pertaining to gender, race, ability and learning preferences. We also investigate whether female and non-white learners experience differential learning gains relative to male and white students, in an experiment setting. Learning style of students is identified using the VARK (Fleming, 1995) or Visual-Auditory-ReadWrite- Kinesthetic[6] method. This technique identifies student learning preference directly unlike the MBTI Indicator method where personality type is used to draw inferences about the learning style of the student The VARK methodology was developed to identify the ways by which individuals prefer to receive and/or impart information. This method of identifying learning styles was developed solely to assist with optimizing the information intake and communication experience of learners and does not account for their personality types, physical and social environment. While these other factors also impact learning ability, in focusing specifically on the best method by which students prefer to learn, it enables us to determine the best method of communication in the classroom. Bernardes and Hanna (2009) use VARK methodology and find that while student learning styles vary by student gender, they are invariant by student major. The study by Boatman, Courtney and Lee (2008) uses the VARK methodology and finds that students with a visual learning preference perform better in an Introductory Economics Course. Their findings, however, do not factor in the teaching

4 According to the National Center of Education Statistics, in 2010, one-fifth of graduating students are Business majors and the percent of Bachelor's degrees conferred by degree granting institutions has increased by 32% over the period 2000-2010.by Bu

5 Becker and Watts (2001) find from a national survey of American institutions of higher learning in 2000 that in four types of undergraduate Economics courses (Principles or Introductory, Intermediate Theory or Upper Level, Statistics and Econometrics and other Upper-Division courses), though instructors spend more time teaching, the typical instructor continues to be a person "who lectures to a class of students as he writes text, equations or graphs on a chalkboard, and who assigns students reading from a standard textbook". Becker coined the term "chalk and talk" for this type of teaching and finds that the median time spent lecturing in all courses in all institutions is 83%.

6 See Appendix A for a description of each of the VARK learning style preferences.

methodology used by the instructors. Emerson and Taylor (2007) combine these two strands of literature to research the impact of personality types in conjunction with teaching methodology, i.e. traditional lecture based versus experiments based, on student achievements measured by the TUCE score in the course. They find that the learning gains associated with experiment based teaching methods are widespread across most personality types and that the "gender gap" in economics disappears when controlled for personality types.

DATA

Students in our study were enrolled in one of three sections of the Principles of Economics: Macro course and one section of the Principles of Economics: Micro course at the University during the 2013 spring semester. The micro section consisting of 28 students was the control group, while the three macro sections, consisting of 84 students, was the experiment or treatment group. Students at VU use the same textbook for both the micro and macro portions of the course and the first 5 chapters of both these courses are identical in content. The experiment chosen for this study pertained to a topic from one of these five chapters with relevance for both courses.

The control group was taught using the traditional lecture based method of instruction. Information on student characteristics were obtained from an informed and voluntary consented survey approved by the Institutional Review Board of Valparaiso University (VU). We classified students into learning style preferences by scoring and classifying responses to a questionnaire designed by Fleming (1995). Classification of students by major, year, race, gender and learning style are presented in Table 1. A limitation of small sample size is that there is some heterogeneity across sections in terms of sub-sample distribution by student characteristics, as evident from Table 1, a factor to keep in mind while analyzing learning outcomes.

The experiment information sheet and design for each section was identical. After the experiment was completed, we compared learning outcomes by handing out a questionnaire on concepts pertaining to the topic. We chose this format to lower grading time in contrast to our earlier study (Raman and Devaraj, 2012) where the format was one of short response questions.

EXPERIMENT DESIGN AND ASSESSMENT

The concept illustrated using the experiment method was public goods as a special case of market failure. Our Principles of Economics classes are largely taught within the framework of a market capitalist economic system. Students are taught that the "invisible hand framework" of a competitive market leads individuals to make voluntary choices that are in their own and ultimately society's interest. This is an idea that the largely conservative students at our university find ideologically appealing. Moreover, this concept is continuously reinforced in many Economics and Business classes as it forms the theoretical basis of many economic models. However, as the debate on the role of government in a market economy intensifies both within the Economics discipline and in the popular press, we feel that it is imperative that students be aware that the markets could fail when individual decisions do not lead to socially desirable outcomes. Therefore, we made a strategic choice to adopt an experiment based approach to demonstrate to students that market failure, and specifically public goods, is cause for government intervention to improve social efficiency. A public good is one that is nonexclusive, i.e., that no one can be excluded from its benefits and non-rival, i.e., consumption by one does not preclude consumption by others. Once a pure public good is supplied to one individual, it is simultaneously supplied to all whereas a private good is only supplied to the individual who bought it. This gives rise to the free rider problem where the individual can benefit from the good without paying for it. Under these conditions, the competitive market will either fail to provide or underprovide the good relative to the socially optimal quantity.

We used the game designed by Holt and Laury (1997) to illustrate the concepts of non-rivalry and non-excludability and the subsequent market failure rising from the free rider problem. From a deck of playing cards, students are each distributed cards, 2 black and 2 red, each. In their formulation of the experiment, each student was asked to play two cards by putting them on top of a stack in the instructor's hand. Students "earned" four dollars for each of the red cards that they kept. They also earned a dollar for each red card placed in the stack, by themselves or by anyone else. Playing a red card amounted to making a contribution to the public good. Black cards did not affect an individual's earnings. This game provided students with three choices:

a. to play two red cards
b. to play one red and one black card
c. to play two black cards.

The game illustrates the principles of non-excludability in that individuals cannot be excluded from the benefits of contributions and non-rivalry, i.e., one person's earnings from the group contribution do not reduce anyone else's earnings. It also articulates the public goods dilemma and the resulting market failure, as, in a given round an individual can maximize earnings by not contributing but earnings for society as a whole are maximized when

Table 1
Student Profiles by Learning and Teaching Style

Gender	Male		Female	
	Count	Percent	Count	Percent
Control	18	*64.29%*[a]	10	*35.71%*
Experimental	47	*55.95%*[b]	37	*44.05%*
Total	65	*58.04%*[c]	47	*41.96%*

Race	White		Nonwhite	
	Count	Percent	Count	Percent
Control	22	*78.57%*	6	*21.43%*
Experimental	65	*77.38%*	19	*22.62%*
Total	87	*77.68%*	25	*22.32%*

Major	Business		Social Science		Arts		Humanities		Science/ Engineering	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Control	16	*57%*	2	*7%*	2	*7%*	2	*7%*	6	*21.43%*
Experimental	47	*55.95%*	15	*17.86%*	0	*0%*	3	*3.57%*	16	*19.05%*
Total	63	*56.25%*	17	*15.18%*	2	*1.79%*	5	*4.46%*	22	19.64%

Year	Freshman		Sophomore		Junior		Senior	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Control	7	*25%*	13	*46%*	6	*21%*	2	*7%*
Experimental	19	*22.62%*	43	*51.19%*	14	*16.67%*	7	*8.33%*
Total	26	*23.21%*	56	*50.00%*	20	*17.86%*	9	*8.04%*

Learning Style	Visual		Auditory		ReadWrite		Kinesthetic		Multimodal	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Control	0	*0%*	6	*21%*	8	*29%*	11	*39%*	3	*10.71%*
Experimental	11	*13.10%*	26	*34.67%*	13	*15.48%*	24	*28.57%*	10	*11.90%*
Total	11	*9.82%*	32	*28.57%*	21	*18.75%*	35	*31.25%*	13	*11.61%*

a The percent in each sub-category calculated as a percentage of the total number of students in the control group (28).

b The percent in each sub-category is calculated as a percentage of the total number of students in the experiment group (84).

c The percent value in calculated as a percentage of the total number of students in the survey (112).

everyone contributes fully. The experiment, thus, allows students to visualize the concept of market failure and conclude from discussions with the class that society's earnings can be maximized only when everyone is compelled to contribute by an outside agency, like the government.

We modified the game by incorporating the use of clickers. Instead of physically collecting and returning the cards to each student after each round we presented the above options to students on a projector and required them to choose one of the above three options using clickers. The total number of red cards contributed was reported to the class after each round. Using clickers not only allowed the students to keep their decisions private but also reduced the "dead time" in between rounds that were spent collecting, tabulating and redistributing cards[7] and freed up more time for class discussion. Any discussion pertaining to the experiment and the applicability of its outcomes to the concept of public goods were conducted only after all rounds were completed.

We went through multiple rounds of the experiment and also changed the value of a red card in subsequent rounds. The expectation is that as "earnings" and therefore net benefits from playing a red card decreases, participants will be more inclined to play red cards. (See Holt and Laury, 1997 for the instruction sheet handed out to the students in the experiment class). We measured learning outcomes by including 6 multiple choice questions on public goods (See Appendix B) in the student survey[8]. A comparison of total points on these provided a measure the impact of experiment based teaching by student learning type.

Table 2
Comparison of Learning Outcomes across Groups

	Control Group (N=28)	Experiment Group (N=84)
Average Total Score[a,c]	5.39	5.11
Average Q1 Score[b,c]	0.93	0.83
Average Q2 Score[b,c]	0.96	0.98
Average Q3 Score[b,c]	0.86	0.81
Average Q4 Score[b,c]	0.82	0.86
Average Q5 Score[b,d]	0.96	0.86
Average Q6 Score[b,c]	0.86	0.79

a Out of a maximum of 6 points.

b Out of a maximum of 1 point each.

c The t-statistic shows that the mean values of the control and experiment group are not significantly different from each other.

d The t-statistic shows that the mean value of the control group is significantly greater than the experiment group at the 10% level of significance.

RESULTS

Contrary to expectation, the control group scored higher in the post experiment questionnaire than the experiment group. A breakdown of the average overall score and by question per student in presented in Table 2. Female students score significantly higher than their male counterparts in the experiment group, at the 5% level of significance whereas nonwhite students score significantly less than white students in both control and experiment groups at the 5% level of significance.

We also investigated whether learning outcomes varied across learner preferences. Except for multimodal learners, no learning preference group experienced any learning gains in the experiment group relative to the control group though once again the difference in average scores is not significant (see Figure 2). It is worthwhile to note that these results could be driven by the heterogeneity in the relative weights of learning style in the two groups (see Table 1). Figures 1 and 2 show no evidence of gains from experiment based learning, unlike in an earlier study by

7 Ball, Eckel and Rojas (2006) demonstrate that using handheld devices and wireless technology facilitates the use of experiments in large classes, a fact of budget realities. These handheld devices uniquely identify students and enable tracking of decisions and scores. They assessed the effectiveness of this methodology using pre and post-test assessments and parallel final exams for an experiment classes and a control class. Amongst the gains in learning outcomes, was a statistically significant difference in final exam grades of 3.2 points for the experiment group.

8 Emerson and Taylor (2004) criticize the choice of a common set of multiple choice questions as a testing instrument due to its susceptibility to potential bias. These criticisms arose from aspects that were specific to their experiment design wherein the majority of instructors writing the exam taught the control sections. In our experiment all sections were taught as well as questions designed by the same instructor.

us that was largely based on univariate analysis. In this paper, we control for student year, ability, effort, major and previous participation in a similar experiment in addition to race, gender and learning preferences. To test for the impact of gender, race and learning style preferences on learning outcomes (total points) we estimated the following equation using the Ordinary Least Squares method.

Variable descriptions and the results of the regression analysis are presented in Table 3. Model 1 is our basic model while Model 2 includes gender, race and learning preference interacted with experiment. Model 2 helps us to test whether female (male), nonwhite (white) and various learning preferences[9] experience learning gains or losses relative to the base group in an experiment based learning format. The R-squared and adjusted R-squared

Figure 1
Comparison of Learning Outcomes by Race and Gender

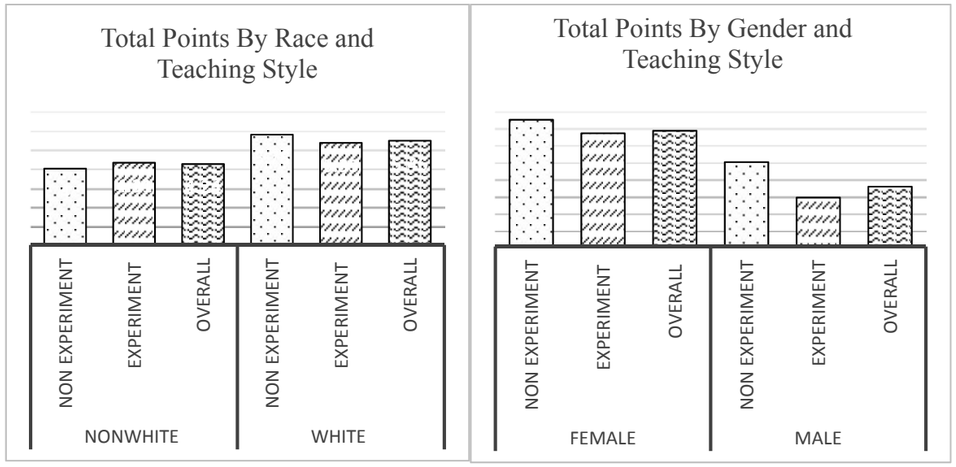
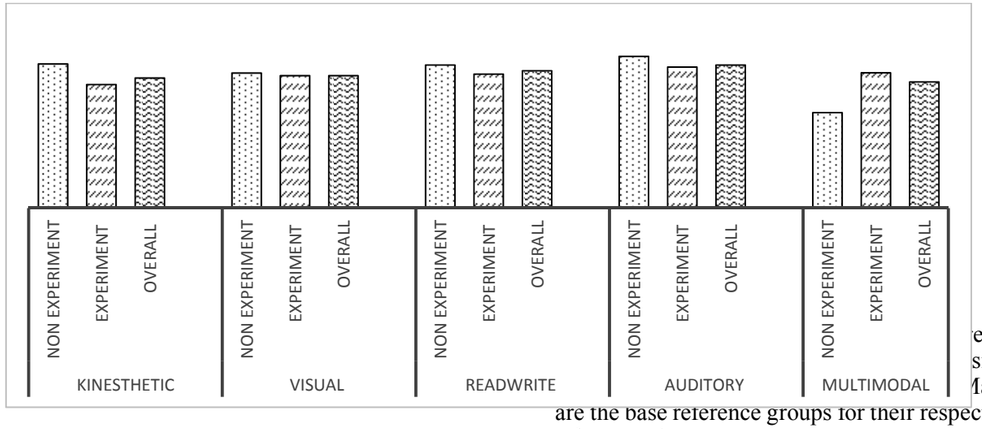


Figure 2
Comparison of Learning Outcomes by Learning Preference and Teaching Style



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sion.
Major
are the base reference groups for their respective subcategories.

Table 3
Impact of Race, Gender, Learning and Teaching Styles on Learning Outcomes

Total Points	Variable Definitions	MODEL	
		1	2
Experiment Class	Dummy var. equal to 1 if student is in an Experiment Class	Ø.36 (Ø.3Ø)	Ø.58 (Ø.95)
Female	Dummy var. equal to 1 if gender is Female	Ø.53 (Ø.25)**	Ø.58 (Ø.48)
Nonwhite	Dummy var. equal to 1 if student is Nonwhite	-Ø.97 (Ø.28)***	-1.54 (Ø.67)**
High School GPA	Student High School GPA	Ø.44 (Ø.25)*	Ø.45 (Ø.25)*
Study Hours	Dummy var. equal to 1 if student studies more than 15 hours per week	Ø.17 (Ø.46)	Ø.Ø4 (Ø.46)
Freshman	Dummy var. equal to 1 if student is a Freshman	-Ø.57 (Ø.47)	-Ø.53 (Ø.48)
Sophomore	Dummy var. equal to 1 if student is a Sophomore	-1.Ø5 (Ø.45)**	-1.1 (Ø.46)**
Junior	Dummy var. equal to 1 if student is a Junior	-1.38 (Ø.49)***	-1.43 (Ø.48)***
Econclass1	Dummy var. equal to 1 if student has taken 1 or more Econ classes	-Ø.2Ø (Ø.29)	-Ø.14 (Ø.3)
Business	Dummy var. equal to 1 if student's major is Business	Ø.48 (Ø.73)	Ø.54 (Ø.73)
Social science	Dummy var. equal to 1 if student's major is in the Social Sciences	1.Ø1 (Ø.76)	1.Ø4 (Ø.75)
Arts	Dummy var. equal to 1 if student's major is in the Arts	Ø.42 (1.11)	Ø.Ø9 (1.12)
Humanities	Dummy var. equal to 1 if student's major is in the Humanities	Ø.4Ø (Ø.89)	Ø.52 (Ø.92)
Science	Dummy var. equal to 1 if student's major is in the Sciences or Engineering	Ø.Ø7 (Ø.76)	Ø.16 (Ø.76)
Previous Experiment	Dummy var. equal to 1 if student participated in Public Goods exp. in a previous class	Ø.15 (Ø.29)	Ø.14 (Ø.29)
Kinesthetic	Dummy var. equal to 1 if the dominant learning type is Kinesthetic	Ø.42 (Ø.38)	1.71 (Ø.78)**
Auditory	Dummy var. equal to 1 if the dominant learning type is Auditory	Ø.8Ø (Ø.39)**	1.52 (Ø.93)
Visual	Dummy var. equal to 1 if the dominant learning type is Visual	Ø.19 (Ø.5Ø)	-Ø.14 (Ø.52)
ReadWrite	Dummy var. equal to 1 if the dominant learning type is Readwrite	Ø.31 (Ø.43)	Ø.71 (Ø.93)
Kinesthetic Experiment	Dummy var. equal to 1 if student is a Kinesthetic learner and in an exp. class	--	-1.82 (Ø.89)**
Auditory Experiment	Dummy var. equal to 1 if student is an Auditory learner and in an exp. class	--	-1.Ø4 (1.Ø3)
Visual Experimenta	Dummy var. equal to 1 if student is a Visual learner and in an exp. class	--	dropped

Table 3
Impact of Race, Gender, Learning and Teaching Styles on Learning Outcomes

Total Points	Variable Definitions	MODEL	
		1	2
ReadWrite Experiment	Dummy var. equal to 1 if student is a Readwrite learner and in an exp. class	--	-0.63 (1.05)
Female Experiment	Dummy var. equal to 1 if student is Female and in an exp. class	--	-0.07 (0.56)
Nonwhite Experiment	Dummy var. equal to 1 if student is Nonwhite and in an exp. class	--	0.71 (0.75)
Constant		4.12 (1.15)***	3.40 (1.4)**
R-squared		0.3611	0.4084
Number of observations		111	111

Standard Errors reported in parentheses; ***significant at 1% **significant at 5% *significant at 10%

a This variable is dropped as there are no visual learners in the control group.

values in Model 2 are higher than Model 1 indicating the robustness of the Model 2 specification.

We find that experiment based learning has no significant impact on the learning outcomes as measured by the total points scored by a student in the post experiment questionnaire. In fact we find that participating in the experiment has a negative and significant at the 10% impact on the total score in Model 2. This result reinforced to us that experiment based learning and active learning techniques cannot be adopted in isolation and require a more substantial shift in teaching methodology. Active learning techniques as learning/teaching tools are effective only if learners get continuous practice at participating in and relating experiment outcomes to economic concepts. Also, non-native English speakers may be at a disadvantage in processing experiment instructions and understanding concepts as this learning technique relies on class discussions and student interaction for the student to successfully relate the experiment to theory.

Female students significantly outperform their male counterparts in Model 1. From Model 2 it is evident that there is no significant difference in the average performance of female students relative to males in an experiment class. Similarly nonwhite students experience no differential gains in learning relative to white students in an experiment class. However, nonwhite students score consistently lower than their white classmates. The variable nonwhite does not capture the ethnic and racial diversity amongst nonwhite students, a variable that includes international students. Minority students' performance could be adversely impacted by the absence of a cohort of students of similar backgrounds and of significant orientation and retention programs for minority students.

In Model 1, auditory learners experience positive and significant gains in learning outcomes. They also tend to be the highest scorers across both class groups (see Figure 2). Auditory learners learn best from lectures and have a preference for information that is heard and spoken. In the experiment group these students probably benefited from the post-experiment discussion while in the control group the lecture based format most likely matched their learning preferences the most. However, auditory learners do not experience significant gains from experiment based learning, thus the coefficient on the interaction term is insignificant.

In Model 2, kinesthetic learners outperform the base group of multimodal learners though kinesthetic learners in the experiment class are worse off by 0.11 points on average relative to kinesthetic learners in a non-experiment class. Though we would expect kinesthetic learners to experience gains from simulated learning, the above results suggest that the design and implementation of the experiment did not allow for them to maximize their learning potential from the experiment.

High School GPA, a measure of student ability and effort is a significant predictor of the total points scored by the student in both models.

Sophomores and juniors tend to score significantly lower than the base group of seniors. Seniors, potentially, can tap into a larger knowledge base of related topics and more importantly could have experience with experiment based learning enabling them to convert experiment behavior and outcomes to conceptual understanding.

In analyzing learning outcomes by question (results not reported here), we find that students in an experiment class score higher than the control group in their responses to question 2.Question 2 requires students to be able to apply the theoretical concepts of non-rivalry and non-excludability to classifying goods as public or private and experiment based learning is superior in providing these skills to students relative to the traditional lecture format. Q1, Q3-5 are more factual and consist of concept definitions.Q6 requires students to draw upon their knowledge of markets covered in earlier chapters and relate it to the topic of public goods. There is no significant difference in the performance of the experiment class and the control group in this question.

CONCLUDING REMARKS

In sum, we find no conclusive evidence of gains from experiment based learning. Race, gender and ability are the most significant predictors of student performance. However, these findings do not refute the conclusive evidence established in the literature that experiment based learning in particular results in significant gains in learning performance of students. Our findings reinforce to us that instructors cannot rely on a hybrid teaching technique of experiments and lectures, unless they adopt a threshold number of experiments based topics. With practice, students can be trained to be active participants in experiments, engage in strategic behavior that most experiments require and contribute to post-experiment discussion that is key to relating the experiment to theory. Therefore, flexibility in curriculum design is a precondition to successful use of experiment based learning.

Our findings also prompt us to make the following changes to our experiment design and research methodology:

First, we propose to hand out experiment instructions to students at least a class in advance so that the disadvantages experienced by non-native English speakers and students with learning disabilities are minimized.

Second, instead of testing students on learning outcomes immediately after the topic was covered, both in the control and experiment groups, we propose to test for concept retention by students in either group by testing at least two weeks later.

Third, in the experiment class we propose to minimize peer group advantages of some groups (whites for instance) by changing class seating through some pre-determined formula so that students feel equally (dis)advantaged for engagement in the post-experiment discussion.

Fourth, the post-experiment questions need to be rewritten to test students not merely on factual knowledge but on higher levels of learning as described by Bloom's taxonomy. Our questions have to be rewritten to test for comprehension and critical thinking.

Fifth, we propose to recruit more instructors so that our study findings can be tested for broad applicability despite the consequent variation in instructor methodology. An advantage of doing so would be to increase sample size both across control and experiment groups, thus decreasing heterogeneity in sub-sample characteristics.

In conclusion, this study reinforces to us instructors that teaching techniques cannot be one size fits all. It also provides us with the opportunity to start a conversation with our colleagues on the future of Economics teaching in the context of increasing classroom diversity, size and technological advances in education.

REFERENCES

Ball, S., Eckel, C. and Rojas, C. (2006), "Technology Improves Learning in Large Principles of Economics Classes: Using our WITS", American Economic Review Papers and Proceedings, v96, 442-46.

Becker, W.E. (1997), "Teaching Economics to Undergraduates", Journal of Economic Literature, 35 (September), 1347-73.

Becker, W.E. and Watts, M. (2001), "Teaching Economics at the Start of the 21st Century: Still Chalk and Talk: American Economic Review, 91(2), 446-451.

Bernardes E. and Hanna, M. (2009), "How Do Management Students Prefer to Learn? Why Should We Care?", International Journal for the Scholarship of Teaching and Learning, 3 (1), 1-13.

Bloom, B.S. (1984), Taxonomy of Educational Objectives Book 1: Cognitive Domain, Addison-Wesley Publishing Company,2nd edition.

Boatman, K., Courtney, R. and Lee, W. (2008), "See How They Learn: The Impact of Faculty and Student Learning Styles on Student Performance In Introductory Economics", The American Economist, 52 (1), 40-48.

Borg, M.O., and Shapiro, S.L. (1996), "Personality Type and Student Performance in Principles of Economics", Journal of Economic Education, 27 (Winter), 3-25.

Borg, M.O., and Stranahan, H.A. (2002), "Personality Type and Student Performance in Upper-Level Economics Courses: The Importance of Race and Gender", Journal of Economic Education, 33 (Winter), 3-14.

Emerson, Tisha L.N. and Taylor, Beck A. (2004), "Comparing Student Achievement Across Experimental and Lecture-Oriented Sections of a Principles of Microeconomics Course", Southern Economic Journal, 70 (January), 672-93.

Emerson, Tisha L.N. and Taylor, Beck A. (2007), "Interactions between Personality Type and the Experimental Methods", Journal of Economic Education, 38 (Winter), 18-35.

Fleming, N.D. (1995), "I'm Different; Not Dumb. Modes of Presentation (VARK) in the Tertiary Classroom" in Zelmer, A. (ed.), Research and Development in Higher Education, Proceedings of the 1995 Annual Conference of the Higher Education and Research Development Society of Australasia, v18, 308-13.

Holt, C. and Laury, S. (1997), "Classroom Games: Voluntary Provision of a Public Good", Journal of Economic Perspectives, 11(Fall), 209-215.

National Center for Education Statistics (2010): http://nces.ed.gov/

Starting Point: Teaching and Learning Economics: http://serc.carleton.edu/econ/index.html

Wetzel, J.N., Potter, W.J. and O'Toole, D.M.O (1982), "The Influence of Learning and Teaching Styles on Student Attitudes and Achievement in the Introductory Economics Course: A Case Study", Journal of Economic Education, 13 (Winter), 33-39.

Ziegert, A.L. (2000), "The Role of Personality Temperament and Student Learning in Principles of Economics: Further Evidence", Journal of Economic Education, 31 (Fall), 307-22.

Appendix A
VARK Learning Preference Categories

Visual (V):
This preference includes the depiction of information in maps, spider diagrams, charts, graphs, flow charts, labeled diagrams, and all the symbolic arrows, circles, hierarchies and other devices that people use to represent what could have been presented in words.
Aural / Auditory (A):
This perceptual mode describes a preference for information that is "heard or spoken." Students (and teachers) with this as their main preference report that they learn best from lectures, group discussion, radio, email, using mobile phones, speaking, web-chat and talking things through
Read/write (R):
This preference is for information displayed as words. This preference emphasizes text-based input and output–reading and writing in all its forms but especially essays, reports and assignments.
Kinesthetic (K):
By definition, this modality refers to the "perceptual preference related to the use of experience and practice (simulated or real)." Although such an experience may invoke other modalities, the key is that people who prefer this mode are connected to reality, "either through concrete personal experiences, examples, practice or simulation" It includes demonstrations, simulations, videos and movies of "real" things, as well as case studies, practice and applications. People with this as a strong preference learn from the experience of doing something and they value their own background of experiences and less so, the experiences of others.
Multimodals (MM):
Those who do not have a standout mode with one preference score well above other scores are defined as multimodal. They are of two types. There are those who are flexible in their communication preferences and who switch from mode to mode depending on what they are working with. They are context specific. They choose a single mode to suit the occasion or situation.
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Appendix B
Public Goods Questions: Test of Learning Outcomes

1. As it relates to a public good, nonrivalry means that:
   a. the public sector is able to provide the good profitably.
   b. there is no need or demand for the good.
   c. either the public sector or the public sector can produce the good, but not both.
   d. one person's benefit from the good does not reduce the benefit available to others.
2. Which of the following is a public good
   a. A fireworks display.
   b. A hotdog
   c. A barbecue grill
   d. A personal computer
3. The market system does not produce public goods because
   a. There is no need or demand for such goods.
   b. Private firms cannot stop consumers who are unwilling to pay for such goods from benefiting from them
   c. Public enterprises can produce goods at lower costs than private enterprises.
   d. Their production seriously distorts the production of income.
4. Non-excludability is the idea that:
   a. government actions cannot remedy market failure.
   b. the presence of external costs and benefits produces a misallocation of resources.
   c. individuals cannot receive benefits from a good without paying for it.
   d. individuals who are unable or unwilling to pay for a good cannot be excluded from the benefits provided by that product.
5. The free-rider problem is that:
   a. free public transportation is overcrowded.
   b. people will not voluntarily pay for something that they can obtain without paying.
   c. government supplies goods at no charge to people who can afford to pay for them.
   d. public goods often create large external costs.
6. Government rather than private firms must provide economically desirable public goods because:
   a. high marginal costs preclude their production in the private sector.
   b. public goods have characteristics that make it difficult or impossible for private firms to produce them profitably.
   c. public goods have marginal costs that exceed marginal benefits.
   d. the law of increasing opportunity costs applies only to private goods.