

PROBLEM-BASED LEARNING IN MANAGERIAL ECONOMICS WITH AN INTEGRATED CASE STUDY

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ABSTRACT

Engaging students in managerial economics courses at the upper undergraduate and M.B.A. levels is challenging as these courses are often a theoretical standout compared with more applied business disciplines. This study describes the efforts to increase student learning with an interactive case integrated into a managerial economics course at multiple points over the semester. The underlying pedagogy utilizes principles of problem-based learning, a student-centered approach that structures learning around team-based problem solving. An analysis of assessment results suggests a positive and significant impact on student learning.

INTRODUCTION

A number of pedagogical challenges arise in teaching managerial economics courses at the upper undergraduate and M.B.A. levels. One of them is the fact that the economics component in business curriculum may be seen as a theoretical standout in comparison to the more applied business disciplines. Students may fail to see real-life application of course concepts and lose their motivation. One solution recommended in the economics education literature is case-based learning (Becker and Watts, 1995, 1998; Christensen and Hansen, 1987). A number of studies (Carlson and Schodt, 1995; Carlson and Velenchik, 2006) suggest that case-based learning (CBL) serves as a way of increasing student involvement, motivation, and learning in the economics classroom.

Another popular pedagogical strategy that originated outside of the business and economics fields and is also aimed at enhancing real-life application of theoretical concepts is problem-based learning (PBL). PBL was originally designed in medical education to address the lack of problem-solving skills in medical students (Savery 2006). In contrast to the traditional lecture-based model, PBL uses realistic problems and case studies to structure student learning around problem solving. Utilizing the PBL approach encourages students to learn not only from the instructor but also from their peers. The role of the instructor is transformed to that of a mediator. Existing empirical evidence on the impact of PBL (Dochy et al., 2003) demonstrates a positive effect on learning and problem-solving skills. Some studies in fact claim that PBL is “perhaps the most innovative instructional method conceived in the history of education” (Hung et al., 2008, p. 486).

While the implementation of CBL and such pedagogies as team-based learning (TBL) has been studied extensively in the business and economics education literature, studies on the implementation of PBL in those fields are sparse, particularly for M.B.A. courses. In this study, we present a teaching approach that integrates PBL into an M.B.A. managerial economics course at multiple points over the semester. To our knowledge, this is the first attempt to document and assess the use of the PBL approach to such a cohort. It is important to note that the M.B.A. audience is different from secondary-level or even undergraduate-level cohorts which were the focus of prior research on PBL in business and economics (Ravitz and Mergendoller, 2005; Smith and Ravitz, 2008). On one hand, M.B.A. students are usually mature, practically minded, motivated, and willing to engage, which makes them good candidates for the PBL method. On the other hand, prior studies recorded a diminishing positive effect of PBL on learning (Ravitz and Mergendoller, 2005). In other words, the biggest gain in educational goal attainment was observed among weaker students whereas the effect on stronger students was positive but insignificant. That finding may question the effectiveness of PBL in the M.B.A. classroom. The desire to examine this combination of factors has motivated our study.

The primary contribution of this study is in detailing how the PBL-based pedagogical approach is applied in the M.B.A. economics course. Furthermore, our implementation of PBL used an integrated case study to frame the students' learning experience. Our pedagogical approach thus integrated elements of the case study method with PBL. We tested this pedagogical method at two business schools over several semesters. A secondary contribution of this study is in using assessment of student learning performed in eight sections of managerial economics courses to evaluate the impact of PBL. Our analysis of assessment results suggests a robust positive impact of this integration of PBL.

The paper proceeds in the following fashion. The next section reviews the pedagogical foundations of problem-based learning. The third section describes our integration of PBL into the managerial economics curriculum. The fourth section reports the observed impact of PBL on student learning. The final section concludes with a discussion of implications for business school curricula.

PROBLEM-BASED LEARNING: A REVIEW

Problem-based learning (PBL) originated and achieved its greatest popularity in the realm of medical education. It was developed in the latter half of the 20th century based on ideas advocated by various education and psychology researchers (e.g. Bruner, 1959, 1961; Dewey, 1910; Rogers, 1969). PBL served as a response to criticisms of traditional lecture-based education in the medical field (Barrows, 1996). In recent years, PBL has seen applications in a variety of secondary and higher education settings (Hung et al., 2008). The essence of the PBL approach is to let students learn by solving realistic problems that may not have a uniquely correct answer. This provides the students an opportunity to solidify their knowledge of theoretical concepts by trying out various solutions without being punished for mistakes (Gijssels et al., 1995).

A basic description of the PBL approach presented by Barrows (1996) as well as Hung et al. (2008) involves the following elements. First, unstructured questions or problems are assigned to groups of five or more students. They work to define and bound the problem based on what they already know, and develop hypotheses or conjectures that lead them to identify what they need to find a solution. Next is the self-directed study stage in which individual students or the entire group complete their learning assignments. Individual results are reported back to the group. The instructor or tutor serves as a facilitator who supports reasoning and helps organize group and interpersonal dynamics, rather than provides direct answers to student questions. Finally, at the end of the learning period students summarize and integrate their findings and solutions.

Overall, PBL is a structured pedagogical approach that is distinct from simple problem-solving embedded in a traditional course. When the solution mechanism is well-defined as in traditional textbook problems, there is little to no pressure on the learner to formulate their own approach to finding a solution. Note that in PBL this role of the student is enhanced as problems are not clearly defined at the outset. The student-centered approach in PBL requires that the students find the information and techniques necessary for the solution on their own. As a result, problem-solving in PBL often replaces traditional lectures and serves as the main mechanism of learning (Savery, 2006).

PBL is also distinct from other popular group pedagogies such as case-based learning (CBL) and team-based learning (TBL). CBL combines two elements: the case itself and the classroom discussion. A teaching case is a rich narrative in which individuals or groups must make a decision or solve a problem. This narrative provides information, but not analysis. The analysis of the events in the case, identifying options, evaluating choices and consequences of actions is performed by students during the classroom discussion (Carlson and Schodt 1995; Carlson and Velenchik 2006).

There are a number of similarities between CBL and PBL as both methods include student-centered learning facilitated by the instructor. The differences lie in the focus of these pedagogies. The case method focuses on real-life examples, whereas PBL problems, while being realistic, are often synthesized. For CBL implementations the group size is of secondary importance, and the discussion - a key element of CBL pedagogy - typically involves the entire class. Meanwhile, PBL implementations typically involve groups of around five students, and group-level discussion is often more prominent than the classroom-level one since the group assumes responsibility for their findings.

There are also similarities and differences between PBL and team-based learning (TBL). TBL is another teaching method that has been used effectively both in medical and science education (Michaelsen et al., 2002) as well as business schools (Hernandez, 2002). In TBL, students cover the assigned reading prior to class and then work in groups to solve problems by applying the knowledge they acquired in the readings (Fink, 2002; Parmelee and Michaelsen, 2010). These problems may often incorporate case studies that allow the students to see a realistic application of their analysis (Quarstein and

Peterson, 2001). Peer pressure is a characteristic of TBL, as students are held accountable by their group members for absences and failure to perform (Kreie et al., 2007). While both TBL and PBL use group dynamics and peer feedback to promote learning, there is a distinct difference as the group work in TBL involves traditional structured case studies and problems covered after the assigned readings or lectures. In contrast, PBL requires the groups to determine what information or content is necessary to learn in the process of problem-solving and presents unstructured problems.

While PBL is an established pedagogy in medical education, studies on the effectiveness of PBL implementation have become increasingly popular outside of the medical disciplines (Barrows, 2000; Gallagher, 1997; Hmelo-Silver, 2004; Tan and Hung, 2007). Dochy et al. (2003) conclude based on a meta-analysis of 43 empirical studies of PBL that there is a robust positive impact on students' ability to apply their skills and the retention of learning. Dochy et al. (2003) report that students in PBL classrooms gained slightly less knowledge but retained their knowledge better. Similarly, Norman and Schmidt (1992) conclude that PBL might not improve the initial acquisition of knowledge by the students while the deeper processing of information in PBL classes leads to better retention of knowledge over a longer period of time.

In the business and economics education, the implementation of PBL has not been as common. While Gijssels et al. (1995) as well as Stinson and Milter (1996) propose PBL as a way to enhance problem-solving skills in business students, fewer empirical studies on the impact of PBL in business education exist. Maxwell et al. (2001) report that PBL may be an effective way to engage students in high-school microeconomics classes. Meanwhile the studies of Mergendoller et al. (2000), Ravitz and Mergendoller (2005), and Smith and Ravitz (2008) report mixed evidence on PBL effectiveness in comparison to traditional lecture- and discussion-based economics classes.

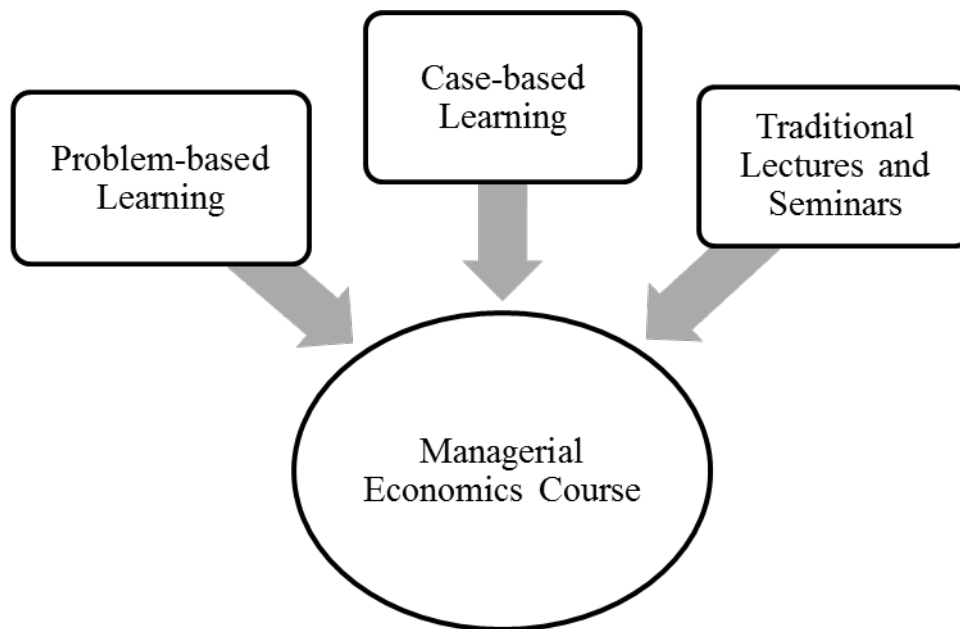
INTEGRATION OF PROBLEM-BASED LEARNING INTO MANAGERIAL ECONOMICS CURRICULUM

The managerial economics component in a typical undergraduate or graduate business program is often presented in a stand-alone course. The characteristics of the M.B.A. student population along with the more theoretical focus of such a course relative to other business disciplines made us consider utilizing PBL principles in the M.B.A. economics classroom. At the same time, the need to address a list of pre-set learning outcomes in a managerial economics course places a constraint on the implementation of pure PBL in such a course. As noted by Norman and Schmidt (1992) as well as Dochy et al. (2003), PBL classes typically are not designed to take students over a long list of content-related learning outcomes. We addressed this challenge by adopting a pedagogical strategy that supplemented PBL with an integrated case study and traditional lectures. Our pedagogical approach is illustrated by Figure 1.

In order to improve student experience with PBL, we decided to structure the PBL component of the course around an integrated case study that focuses around a common theme and presents a series of ten PBL assignments. We used the modular case

assignments published in Chulkov and Nizovtsev (2012) and organized PBL coursework around these. Each assignment in this case looks at a problem faced by the management of a car rental agency serving a small regional airport in a US Midwestern college town. The assignments are unstructured problems presented in the form of ‘memos’ simulating communication with the upper management.

Figure 1



The assignments in the case are both quantitative and qualitative. Examples of qualitative questions include such issues as advertising media choices or critical analysis of price match guarantees and price discrimination. Quantitative assignments ask students to perform statistical analysis for demand estimation, and use those results for forecasting and optimization. This case is well-suited for PBL because the student groups need to organize the analytical process on their own and perform such tasks as selecting appropriate variables for analysis and analytical techniques. The instructor provides only a subset of the entire case dataset to each group. In the end, no two groups have exactly the same sample of data and exactly the same results of the analysis. This provides the instructor with the opportunity to teach the methodology of analysis in managerial economics by comparing various approaches and their effect on results.

In order to integrate PBL into this managerial economics course, we reviewed the list of the eight learning outcomes for the course and identified ones to be used for our implementation of PBL. While it is possible to create PBL assignments for all the learning outcomes in a managerial economics course, this implementation covered only five of the learning outcomes presented in Table 1.

The three learning outcomes not included in the PBL component of the course were covered exclusively with traditional lectures and discussion. Meanwhile the other

five learning outcomes, such as outcome 1 “Demonstrate knowledge of optimization techniques” and outcome 2 “Apply regression tools to the analysis of real business problems” were the focus of the PBL. Following brief traditional lectures on these topics, the students were presented with the case assignments. They were organized in small groups. As required by the PBL process, the groups needed to structure and bound the problems presented to them, determine the information needed to work out a solution, select analytical methods such as optimization or regression analysis, and then organize the process of solving the problem. Each case assignment was discussed in more than one class period, so the groups often divided the work and then brought together the solutions developed by different group members. The students also searched the textbook and additional learning resources as they were working on their solutions. Each group worked out a final solution to the case assignments and presented these in the appropriate format for a business audience. The final solutions were presented to the other groups in the course, which provided the instructor and the students with the opportunity to focus on the analytical processes used and highlight the role of various assumptions and analytical techniques.

Table 1
LEARNING OUTCOMES IN THE MANAGERIAL ECONOMICS COURSE

	Learning Outcome	Included in PBL Implementation
1	Demonstrate knowledge of optimization techniques	Yes
2	Apply regression tools to the analysis of real business problems	Yes
3	Explain variations in market structure across industries and the effect of market structure on optimal behavior of firms	No
4	Analyze pricing strategies used by firms in the marketplace	Yes
5	Model strategic interactions between firms in the marketplace using tools of game theory	No
6	Apply principles of making business decisions under uncertainty	No
7	Analyze diverse and unstructured real-world problems and cases using cost-and-benefit analysis and marginal analysis	Yes
8	Critically and objectively evaluate decisions made by businesses and policymakers	Yes

This pedagogical method based on PBL structured around an integrated case study has been applied in M.B.A. managerial economics classes at two business schools over several semesters with total class sizes ranging from fifteen to thirty-six students. The size of the teams working on PBL assignments ranged from three to five students. An important component of PBL is peer feedback, which was provided during presentations of teams’ findings at several points in the semester. As the teams worked on the assignments, the instructor also provided feedback on each submitted or presented

part of the overall case. The final grade for the PBL project was based on the final written summary of all answers to the case assignments due at the end of the semester.

IMPACT ON STUDENT LEARNING

The impact of PBL on student learning was evaluated as part of assessment of student learning, in which the attainment of course learning outcomes was tested on a comprehensive final exam given at the end of the semester. The advantage of this approach was that the course learning outcomes, and the mapping of these outcomes to specific assessment instruments could not be influenced by the researchers. Both were created for the general assessment process within the assurance of learning system that was present in the two accredited business schools that were part of this study. We use these existing assessment data to evaluate whether cohorts that were subject to PBL exhibit any systematic differences in the attainment of course learning outcomes. A limitation of the study is posed by the fact that the assignment of students to PBL and non-PBL treatments was based on their course section cohort, making it a quasi-experiment rather than a pure randomized trial.

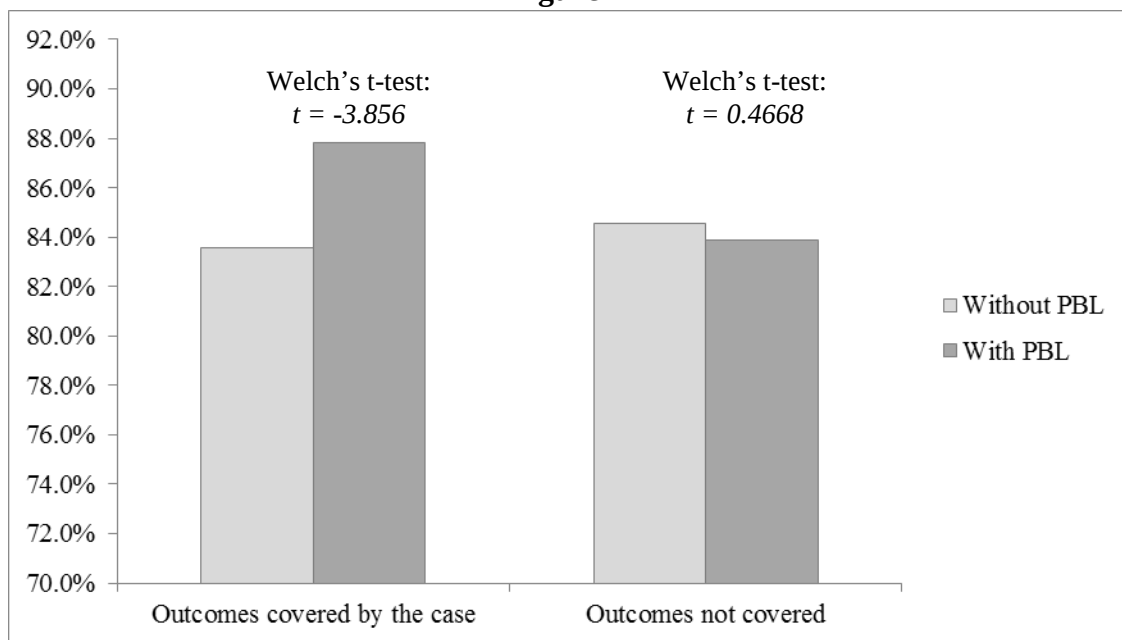
Each course learning outcome was assessed using a mix of quantitative, short-answer, and multiple-choice questions appropriate for that outcome. Student performance was measured as the percentage of the maximum possible score for each learning outcome. Assessment data were collected from a total sample of 160 students representing eight different sections of M.B.A.-level managerial economics courses taught between 2008 and 2012. Four of these sections with a total of 65 students relied on the traditional lecture-based approach, while the other four sections with a total of 95 students utilized PBL throughout the semester. Both institutions were equally represented in the sample. Throughout the period covered by the study, both the completely lecture-based sections and the PBL-based sections of the courses were taught by the same two instructors in the same proportion. The mix of assessment questions and the grading rubrics did not vary across institutions or course sections. Test papers from different sections were mixed, and each test was graded twice independently by two different graders.

In order to determine whether the introduction of PBL affected the attainment of learning outcomes by students, the two-tailed heteroscedastic t-test for equality of sample means (Welch's t-test) was performed on samples of individual student assessment scores recorded in the sections with and without PBL implementation. As mentioned above, these assessment scores were reported as a percentage of the maximum possible score on the section of the exam linked to a specific learning outcome. There were five learning outcomes that were featured in the PBL assignments in the course sections that utilized PBL, and three learning outcomes that were only featured in traditional lectures in all of the sections. The null hypothesis was that the two sample mean scores were equal, and the alternative hypothesis was that the mean score for the sample that used PBL was different from the sample that did not use PBL. The descriptive statistics and results of this analysis are shown in Table 2 and Figure 2 below.

Table 2				
IMPACT OF PBL ON STUDENT PERFORMANCE				
	Performance scores for five learning outcomes covered by PBL		Performance scores for three learning outcomes not covered by PBL	
	Section with no PBL	Section with PBL	Section with no PBL	Section with PBL
Mean score	0.836	0.879	0.845	0.839
Variance	0.023	0.023	0.020	0.031
Observations	325	475	195	267
Degrees of freedom	687		457	
t-statistic	- 3.856**		0.467	
p-value	0.0001		0.6409	
* <i>p</i> < .05; ** <i>p</i> < .01 Two-tailed heteroscedastic t-test was used.				

Our findings indicate a significant variation in the way PBL affected student learning. The mean performance for the three learning outcomes not addressed by the PBL approach in either of the course sections did not change significantly between sections. Based on the result of the Welch's t-test, we are unable to reject the null hypothesis about the equality of the two sample means for these data. For those three learning outcomes, the presence of PBL in the course did not improve average student performance.

Figure 2



The results for the five learning outcomes addressed by the PBL component of the course are, however, strikingly different. For these five outcomes, the null hypothesis about the equality of sample means from sections that used PBL and sections that did not

use PBL is confidently rejected. Average student performance metrics are significantly higher for sections in which PBL was used as seen in Table 2 as well as Figure 2 below.

Overall, these findings suggest that improvement in the attainment of student learning outcomes correlates with the utilization of the PBL-based pedagogical method. Student subjective satisfaction with the course as reported by end-of-semester evaluations has also been higher in the sections that utilized PBL.

CONCLUSION

Problem-based learning (PBL) uses realistic problems and case studies to embed student learning into problem solving. PBL pedagogy encourages students to learn not only from the instructor but from their peers as well. Learning occurs as students bound and define an unstructured problem, select proper problem-solving techniques, and present solutions. These characteristics make PBL a potentially powerful tool for improving student engagement and content retention in managerial economics courses, especially at the M.B.A. level.

While PBL is a well-known pedagogical method in a number of academic areas (Hung et al., 2008), its impact on business and economics education particularly at the M.B.A. level is not well documented. This study attempts to fill this gap. We describe an implementation of PBL within the M.B.A. managerial economics curriculum at two business schools. Our implementation of PBL was centered around an integrated case study that presented ten PBL assignments at various points of the semester. Chulkov and Nizovtsev (2012) present the full text of the case study assignments used in this integration of PBL. Analysis of assessment of student learning data demonstrates a robust positive impact of this integration of PBL in the managerial economics curriculum.

Overall, we find the results encouraging. They suggest it is possible to replace some of the traditional assignments and delivery methods with cases optimized for PBL and by doing so improve the student knowledge and skills achieved in the course. Instructors teaching managerial economics courses are encouraged to consider this approach for integrating PBL into the classroom and engage in an active discussion of PBL ideas in order to plan and enact PBL assignments effectively.

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