# Using PBL Assignments in Undergraduate Operations Management Course

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*Problem-based learning (PBL) assignments may be embedded within the traditional format of undergraduate operations management course to enhance student understanding of the integrative nature of management decisions. This research investigates student response to the use of a Web-based supply chain management game as a PBL assignment in a lecture based operations management course in an undergraduate curriculum. The results of this research indicate that embedding PBL assignments in the lecture based operations management course has the potential for enhancing the course if the issue of increased workload for the students can be addressed.*

## INTRODUCTION

Traditional approach to business education involves delivering discipline-based courses relying on lectures, assignments, quizzes and examinations, and sometimes discussion of prepared cases among other activities. Discipline-based approach to management education assumes that business problems can be compartmentalized into different functional knowledge domains such as production and operations, finance, and marketing. However, real world business problems require a problem solving approach that integrates the functional areas. Except for the capstone business policy course in the senior year of the undergraduate curriculum, there is little opportunity for applying functional area knowledge in an integrative way in the traditional approach to business education. Thus, the traditional approach does very little to develop a student's ability to properly define problems, to synthesize information for dealing with complex situations, to think critically, and to act independently (Kanet and Barut, 2003).

Problem-based learning (PBL) approach has gained popularity as an alternative to traditional lecture-based education. Although originally created in the field of Medicine, PBL approach has been used in a number of business degree programs (Kanet and Barut, 2003). However, in spite of the demonstrated benefits of PBL approach, this radical approach may not be easy to implement for an entire business program or even for an entire course. A feasible approach for achieving benefits of PBL in traditional courses may be to embed PBL assignments in such courses. The success of the hybrid approach where PBL assignments are embedded in a traditional lecture based course depends on evidence that students like the approach and benefit from it. In the specialty area of the author, namely, Operations Management, very little published research seems to be available that sheds light on how well students, accustomed to the traditional structure of a lecture based undergraduate operations management course, respond to rigorous PBL assignments embedded in such a course. The objective of this research is to investigate student response toward PBL assignments embedded in a traditional lecture based introductory operations

management course in the undergraduate business curriculum. The next section presents relevant literature survey to help understand issues associated with this research.

## LITERATURE SURVEY

An understanding of the difference between traditional lecture based approach and PBL approach of teaching a course is needed to understand the results of this research. Keizer (1995) states that "the traditional approach centers on lectures given by well-trained teachers who are experts in the field, while the PBL approach is based on small groups of students working on tasks under the guidance of a well-trained tutor who is not necessarily an expert in the field to be studied." In PBL, students focus on discovering what one needs to know to handle ill-structured real world problems instead of focusing on acquiring a body of discipline specific knowledge to handle potential well-structured problems as taught in the traditional approach (Kanet and Barut, 2003). The instructor plays a combination role of a learning manager and a coach. In PBL approach, the role of the faculty is to be a "guide by the side" as opposed to a "sage on the stage" of the traditional approach (Stinson and Milter, 1996). Keizer (1995) points out three types of contacts in the learning environment: between instructor and individual student, between instructor and large or small groups of students, and between students within small groups. The primary contact in the traditional approach to learning is between the instructor and large groups of students. However, in PBL the primary contact is between students within small groups.

The benefits of PBL approach are claimed to include better self motivation for learning, more self directed learning, better reasoning ability, and longer knowledge retention (Kanet and Barut, 2003). Traditional approach to learning provides better content coverage while PBL encourages greater in-depth understanding of the material. In spite of the advantages of PBL approach, its use in management education is not yet widespread. There are serious curriculum design and implementation issues that make conversion from a traditional learning system to PBL difficult (Stinson and Milter, 1996). According to Stinson and Milter (1996), an important curriculum design problem is to create a structure that enables the learner to articulate a global framework that integrates all the bits and pieces of knowledge gained from dealing with specific situations in the PBL approach. A major implementation problem for PBL is that faculty have been trained to become experts in their narrow disciplines and are not trained in critical skills required for PBL, such as active listening, coaching, mentoring, and facilitation of small group learning (Stinson and Milter, 1996). Just as designing an effective PBL curriculum is not easy for most business schools, making the transition from the role of "sage on the stage" to "guide on the side" is not easy for the faculty.

Since PBL is student-centered, students are expected to take responsibility for their own learning. However, most students, accustomed to the traditional approach to learning, have difficulty initially adapting to the PBL approach (Stinson and Milter, 1996). The task to be performed by the students is fraught with uncertainty and demands some entrepreneurship (Keizer, 1995). A great deal of coaching involving instructor contact with small groups of students is needed as students make the transition into PBL (Stinson and Milter, 1996). Although the quality of education is guaranteed to be the best when a small group of students are under the guidance of an expert in the field who is well trained to stimulate students to take the initiative in searching for adequate solutions, it is very resource intensive and expensive (Keizer, 1995). Thus, switching over to a curriculum based on PBL could be beyond the budget of many business schools. It could require tremendous amount of effort without the guarantee of success, a risk that many business schools may not be prepared to take. However, the benefits of PBL can be explored in a curriculum by integrating PBL assignments and activities in management courses in a traditional curriculum.

One approach for embedding PBL in management courses is to use simulation exercises in the courses (Anderson and Lawton, 2004). Anderson and Lawson (2005) found that simulation exercises met the criteria for qualifying as the problems to be used in a PBL environment. Their research demonstrated that students found simulation exercises challenging, stimulating and engaging. In the area of operations management, Kanet and Stößlein (2008) report the use of a supply chain simulation game as the basis for

a senior level specialty course "Supply Chain Management Strategies" in their undergraduate operations management program. The approach in this course was predominantly PBL where the supply chain game required 40 percent of the semester schedule. Therefore, the findings of this research may not be directly applicable to an undergraduate introductory operations management course that is predominantly lecture based with much less time devoted to the PBL assignments.

In this paper, the author reports the results of a student opinion survey revealing student attitude to the use of PBL assignments in an introductory operations management course in the undergraduate business curriculum. The following section describes how the introductory operations management course was modified to accommodate the PBL assignments.

## PBL ASSIGNMENTS IN OPERATIONS MANAGEMENT COURSE

The operations management course involved in this research is the introductory survey course that is required for all business students in the undergraduate business curriculum. This is a traditional lecture based survey course that provides an overview of important topics in operations management. It is taught by the author as a quantitative course involving topic or chapter specific problem solving. These problems do not provide an opportunity to apply multiple concepts in an integrated fashion to make operations decisions in a dynamic problem environment. The objective of embedding PBL assignments in the operations management course is to give the students an opportunity to see first-hand how the concepts they learn in different chapters can be applied together to solve a problem in the dynamic real world situation. According to the objectives of PBL, this opportunity is supposed to create greater interest, deeper understanding, and longer retention of concepts learned in the course.

The supply chain simulation game used by Kanet and Stößlein (2008) was selected to be the vehicle for the PBL assignments because it seemed to have the requisite characteristics of a "problem" suitable for use in PBL. The supply chain game is a Web-based simulation that is offered by Responsive Learning Technologies. Features of this supply chain game have been reported by Kanet and Stößlein (2008). They summarize the scope of decisions available in the supply chain game into three categories: strategic, tactical, and operational. The strategic decisions include forecasting market demand in different regions and deciding which markets to serve, and locating factories and warehouses. The tactical decisions include determination of production lot sizes, reorder stock levels for managing inventory, shipping methods, production capacities, markets to be served by a warehouse, and factories that would supply to a warehouse. Operational decisions include deciding shipping priorities, monitoring and controlling capacity, orders, shipments, inventory, and cash flow.

Since the undergraduate operations management course is an introductory course, essential concepts and models that are required in making decisions in the game were introduced in the course prior to playing the game. Examples of such topics are forecasting, breakeven analysis, economic order quantity model, reorder point calculation, capacity determination, and supply chain basics. Teams, each with three students, were formed who would compete for accumulating the maximum cash flow at the game's end. The supply chain game was played twice during the 16-week semester with two different scenarios, one involving a simple supply chain consisting of one factory and one warehouse in a single region, and the other involving multiple factories and warehouses in multiple regions. Each team was asked to develop its own strategy with guidance from the instructor and to make team decisions while playing the game. Playing each scenario of the game required 7-days of continuous run during which the teams were required to monitor the impact of their decisions continually and implement new decisions to respond to situations they faced. At the end of each game, each team was required to submit a team report that described their initial strategy supported by data analysis, situations faced while playing the game and how they were addressed, and lessons learned. A total of 74 students (juniors and seniors) who enrolled in the enhanced introductory operations management course during spring semester of 2009 were administered an opinion survey at the end of the semester to help evaluate student reactions to including the supply chain game in the course.

## SURVEY RESULTS

The survey instrument administered to the 74 undergraduate students consisted of twelve statements to which students responded using a 5-point scale: strongly agree, agree, neutral, disagree, and strongly disagree. The first seven of the twelve statements related to whether participation in the supply chain game increased student skills. The next three statements related to how favorable was student attitude toward the supply chain game. The last two statements related to the time and effort needed for playing the game. The percentages of students responding to each statement are presented in Table 1.

The percentage figures presented in Table 1 show that, except for the skill in team work, 47 to 55 percent of the students either agreed or strongly agreed that their skill levels increased as a result of participating in the supply chain simulation game. Only 14 to 25 percent of the students either disagreed or strongly disagreed that their skill levels increased. About 30 to 32 percent students were neutral. As regards to the skills for working within a team, the figures show that about 37 percent of the students

**TABLE 1**
**STUDENT PERCEPTION OF THE SUPPLY CHAIN GAME**

| Statement | Percentage of Students Responding (Sample size 74) | | | | |
|---|---|---|---|---|---|
| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
| I increased my skills for forecasting demand. | 9.5 | 40.5 | 29.7 | 14.9 | 5.4 |
| I increased my skills for evaluating capital investment alternatives for locating facilities. | 6.8 | 37.8 | 31.1 | 20.3 | 4.1 |
| I increased my skills for making decisions in inventory planning | 8.1 | 47.3 | 29.7 | 13.5 | 1.4 |
| I increased my skills for evaluating transportation alternatives to make the right decision at the right time. | 8.1 | 40.5 | 32.4 | 17.6 | 1.4 |
| I increased my skills in analyzing relevant data to make managerial (SCM) decisions. | 9.5 | 37.8 | 31.1 | 17.6 | 4.1 |
| I increased my skills in written communication as a result of working in a team to prepare reports. | 5.4 | 31.1 | 33.8 | 23.0 | 6.8 |
| I increased my skills in working as a team member and making group decisions. | 6.8 | 45.9 | 28.4 | 13.5 | 5.4 |
| I enjoyed playing the game and liked the excitement of competing with other teams. | 6.8 | 31.1 | 21.6 | 23.0 | 17.6 |
| I consider the supply chain management game a valuable learning tool in a business curriculum. | 6.8 | 32.4 | 28.4 | 18.9 | 13.5 |
| The supply chain management game should be a part of the operations management course in future. | 13.5 | 29.7 | 24.3 | 20.3 | 12.2 |
| Playing the game required excessive time and effort compared with similar activities in other courses. | 37.8 | 35.1 | 18.9 | 5.4 | 2.7 |
| The benefits of playing the game were worth the time and effort it required. | 2.7 | 25.7 | 28.4 | 24.3 | 18.9 |

either agreed or strongly agreed that their skills increased whereas about 30 percent either disagreed or strongly disagreed that their skills increased. About 30 to 34 percent of the students were neutral in their opinion about increase in skills. Clearly, more students thought that participation in the supply chain game increased their skill levels although it is difficult to say how significant is this result based on a very limited study.

About 53 percent of students either agreed or strongly agreed that they enjoyed playing the game and the excitement of competing with other teams. Only about 19 percent of students either disagreed or strongly disagreed. About 28 percent of students were neutral. It is encouraging to see that more than 50 percent of students enjoyed playing the game. However, this result sharply contrasts the result that less percentage of students agreed or strongly agreed (i.e. about 38 percent) that the supply chain game was a valuable learning tool in a business curriculum. The percentage of students who either disagreed or strongly disagreed was about 41. About 22 percent of students were neutral. About 39 percent of students either agreed or strongly agreed that the supply chain game should be included in future course offerings. About 32 percent either disagreed or strongly disagreed in this matter. About 28 percent of students were neutral. Overall, as regards to how enthusiastic students were about the supply chain game, the results seem to be mixed.

A majority of students (about 73 percent) agreed or strongly agreed that the supply chain game required excessive time and effort. Only about 8 percent of students either disagreed or strongly disagreed that the time and effort required were excessive. About 19 percent of students were neutral. About 28 percent of students either agreed or strongly agreed that the benefits of playing the game were worth the time and effort. About 43 percent disagreed or strongly disagreed about the value of the game relative to the time and effort needed for it. It is interesting to note that although about 73 percent of students felt that the game required excessive time and effort, only about 43 percent thought that the benefits were not worth the time and effort. Thus, some students recognized the benefits of the game in spite of the extra work involved. The results presented in this section may be considered preliminary because of limited sample size and exploratory nature of the research.

## CONCLUSION

This research provides some insight into the question whether embedding PBL assignments in the traditional lecture based introductory operations management course for undergraduate business students would provide some of the benefits ascribed to PBL, such as increased student engagement, deeper understanding of the concepts, and increased skill levels. The results of this research indicate that there is potential for enhancing the traditional operations management course by embedding PBL assignments when full conversion to a PBL course may not be a feasible option. The main hurdle for greater enthusiasm by students seems to be the increased workload that is inevitable when PBL assignments are embedded in the introductory operations management course. Based on his single experience of offering the operations management course with embedded PBL assignments, the author believes that appropriate selection of PBL assignments and proper planning of course schedule can address the workload issue and attract more students to the pedagogical approach of embedding PBL assignments in the introductory operations management course. The author plans to explore this pedagogical approach further and continue further research to explore the efficacy of such an approach.

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