

A Class Project to Increase Students' Understanding of Fundamental Operations Management Concepts

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Abstract. This article presents a project-based learning assignment designed to enhance student understanding of fundamental operations management course concepts. The interdisciplinary nature of operations education makes learning difficult for students and challenging for instructors to teach. The project detailed here has been tested over several years of implementation and is presented as a ready-to-use course activity. Included is a complete description of the project, necessary student prerequisites and preparation, and a rubric for how to assess performance. Students choose a product or service and research the production of that good from raw material to the hands of consumers. The final deliverable is in the form of a short video presentation. Data from post-project student surveys show the assignment enhanced student understanding of operations management concepts. Finally, we discuss the key takeaways for instructors and make suggestions for how to successfully integrate the project into an operations management course.

Keywords: project-based learning, class project, supply chain concepts, operations management.

This paper is dedicated to the memory of our dear friend and incredible colleague Dr. Jerry Evans.

1. Introduction

The introduction to operations management course can prove to be a difficult course for undergraduate business majors. At its core, Operations Management (OM) involves the planning, scheduling, and control of activities that transform inputs to outputs. APICS (2016) suggests that learning OM must include the study of concepts from design engineering, industrial engineering, production management, management information systems, quality management, inventory management, accounting, and other business functions that affect or are affected by OM. This interdisciplinary approach to OM makes learning the concepts difficult especially for business majors who may not have been exposed to several of these disciplines.

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Teaching introduction to OM can also be challenging for instructors because many students do not immediately comprehend the applications of operations principles and strategies (Jin *et al.* 2015; Sampson 2000; Wright and Ammar 1997). The complex subject is interdisciplinary and draws from a wide range of concepts, techniques and methodologies, and students may not understand how the course is relevant to their careers (Brandon-Jones, A., Piercy, N., Slack, N. 2012; Polito, Kros, and Watson 2004; Sower 1997). Instructors must clearly draw connections between topics and simplify the material to a level which fits students early in their business education. The abstract concepts, theories, and wide range of mathematical equations can be difficult to grasp without practical application. Additionally, since many students take the intro to OM class before taking specific classes in functional areas like accounting, finance, management, or marketing, it is up to the instructor to ensure understanding of all business basics. Although instructors generally have more education and experience than the students taking the class, they may not have exposure to various technical engineering and manufacturing topics. Effective instructors continually try to find pedagogical techniques to communicate difficult OM topics in a way which helps students understand these important concepts. It can be difficult to keep students engaged, but active learning strategies, experiential learning pedagogies, client-sponsored projects and project-based learning strategies can help students make the leap from classroom to real life.

The purpose of this article is to present the design and development of a project-based learning activity for students to grasp the fundamental concepts of operations management. The project brings together theoretical and practical applications in a way which traditional lecture-based learning cannot, by allowing students to engage in independent research related to a real business. This activity is a multi-week group-based project assigned in the undergraduate introduction to operations management course. At a high level, the project covers basic OM concepts ranging from the supply chain of the raw materials to the consumers, including sourcing and transportation, and the production processes and strategies. By covering all aspects of the supply chain, this project assists instructors by providing a specific integrative project to tie together learning from many different topical areas. The goal of this project is for the students to learn fundamental OM principles and concepts using a project-based learning technique. By researching a real business and critically considering how the course concepts apply to that business, student knowledge of course material is enhanced by participation in the supply chain project. The students learn not only how the supply chain functions, but also gain an understanding of how OM concepts apply to the various functional areas of a business.

This article starts by explaining why a project-based learning technique is an effective pedagogical technique. We then present the full class project. We

examine the prerequisite knowledge of the students and discuss lessons learned from attempting this project over the past several years. Finally, we provide evidence of the project's effectiveness based on student surveys.

2. Project-Based Learning

There are many effective pedagogical techniques that can enhance student learning. One technique is experiential learning. In this technique, students are given assignments, projects, or case studies in which they are required to apply the course material in a real-world scenario (Kolb and Kolb 2005). Experiential learning is an effective and long-lasting form of learning where students create a meaningful learning experience (Beard and Wilson 2006) and can lead to improved learning (Burch *et al.* 2016). However, experiential learning has disadvantages. The "real-world" activities of experiential learning can be uncomfortable for students, possibly causing disengagement in the material (Lund *et al.* 2012). In addition, experiential learning can be ineffective if minimal guidance is provided by the instructor (Kirschner *et al.* 2006). Experiential learning can be successful but must be implemented in an exhaustive and theoretically sound manner (Ewing and Ewing 2017).

Another technique is a client-sponsored project. Like experiential learning, client-sponsored projects are where students are assigned a real business client and work on a live, real-world problem. This technique is recognized as a powerful pedagogical tool and has many benefits (Lopez and Lee 2005). However, like experiential learning, there are some disadvantages to this technique. One disadvantage is that clients may not be fully engaged or responsive to the students' needs and students may not get regular feedback from the clients (Gorman 2010). Another disadvantage is the instructor might find it difficult to acquire appropriate projects and clients that meet the course objectives (Parsons and Lepkowska-White 2009).

The two techniques described above could be ideal for a capstone operations management course where the class size is manageable. However, given the introduction to operations management course is required for all business majors resulting in large class enrollments, we decided that experiential learning and client-sponsored projects are not ideal pedagogical techniques. Therefore, we designed a project centered around the project-based learning pedagogy technique.

Project-based learning is a student-driven, active learning technique that is organized around projects. A project gives students hands-on opportunities to work with concepts from the course material. Students can discuss their approach in peer groups and present their work to other groups and/or the instructor (Johnson and Delawsky 2013). Projects are defined as complex tasks where students are engaged in design, problem solving, decision making,

or investigative activities (Jin *et al.* 2015). In our project, students are asked to investigate the supply chains of real companies and integrate the supply chain with other course topics like sourcing strategies and quality control. Project-based learning provides for different student learning styles and allows students to perceive greater control and ownership of their projects (Lou and MacGregor 2004). Through projects, students can apply previously acquired knowledge (e.g., course concepts, tools, techniques) to real world business issues and gain a deeper understanding of the course concepts and/or the business issue (Jin *et al.* 2015).

Project-based learning has been used across many disciplines and its effectiveness has been studied. A 20-year meta-analysis of journal articles using project-based learning was conducted across multiple disciplines including social sciences, mathematics, technology and engineering (Chen and Yang 2019). After examining forty-six studies, Chen and Yang (2019) found project-based learning has a medium to large positive effect on students' academic achievement compared with traditional instruction. Specific to operations management education, several studies have used project-based learning. Examples of operations project-based learning include asking students to consider how the five dimensions of service quality could be evaluated in service businesses (Gabriel 2015) and using a service audit to identify mis-messages that an organization sends to its customers and to prepare corrective recommendations (Wicks and Visich 2006). The results of these studies demonstrate students felt that the activity was an effective technique that related to job performance and knowledge development (Wicks and Visich 2006) and students advocated for the continued use of these types of projects (Gabriel 2015). These examples demonstrate the effectiveness of the project-based technique.

3. Description of the Operations and Supply Chain Project

3.1. Student Prerequisite Knowledge and Preparation

The course in which this project is conducted is a variation of the typical introduction to operations management course offered at many AACSB-accredited business schools. The class is offered as an introductory level course for sophomores intended to provide foundational knowledge in the field. The course covers all aspects of business operations and supply chain management and presents it in such a way that the focus is on the big-picture integration of how operations management impacts all areas of business. This creates new challenges since most students may not have some of the prerequisite knowledge of managerial accounting, macroeconomics, or the