ASSEMBLIOS: EXPERIENTIAL LEARNING FOR OPERATIONS MANAGEMENT

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ABSTRACT

This paper presents an experiential learning activity for an introductory Operations Management course. The activity is intended to be implemented early in the course schedule. It provides a manufacturing context for students who may not have much experience with manufacturing decisions as they enter such a course. Student response to the activity is presented, along with ideas for future enhancements to the activity.

INTRODUCTION

I teach at an urban commuter campus located in our nation's "Rust Belt." One of the courses that I teach is the ubiquitous Introduction to Operations Management (OM) required of all Business majors. Over the years, our student body has shifted away from a nontraditional (older, part time students with some work experience) majority. Our student body has been getting younger, with a growing proportion of traditional-aged full-time students matriculating to our campus directly from high school.

Due to the dynamics in our local economy and in our student body, the level of preparation amongst my OM students has changed dramatically. Today, they enter the class with a much more sophisticated understanding of the computing technology that we apply in the course. However, an ever-growing segment of the students in the course have no direct experience, nor connection to, the manufacturing management environment that still comprises an important part of the knowledge we wish to impart in such a course.

I sought to create an experiential exercise through which I could offer my students a basic manufacturing context. I wanted to have them face decisions associated with managing a manufacturing operation in a safe classroom environment. I hoped to provide a touchstone to which we could return when we introduce more sophisticated topics later in the semester. I wanted to have the exercise relevant to new students so that we could use it early in the semester. That way, we can establish a shared context for future discussions. In this paper, I will describe the Assemblios case that I have developed for this purpose.

ASSEMBLIOS

I wanted my students to have an experience dealing with manufacturing decision-making early in our course. I wanted to organize them in small groups, so they could share and verbalize decision-making situations with their colleagues. I also wanted them to create some tangible product during the experience – to make something! At about the same time, I was walking across my living room, feeling the sharp corners of my young sons' plastic building bricks embedding in the soles of my bare feet for seemingly the $5{,}000^{th}$ time. From pain came inspiration, and I used the plastic building bricks as the basis for my student's exercise.

An Assemblio is a compact tower of plastic bricks. The bricks follow a very specific pattern of colors and shapes to create the tower. In this way, it is similar to the complex assembly tasks required to plug chips into a circuit board, or the tasks needed to assemble a small machine. Many recently designed products require the same sort of "snap-together" assembly. The process of assembling these towers is

easy enough to have students progress up the learning curve in a short time period. I wanted to create an experience that could simulate several decision periods in a single class meeting.

If a typical student is given all of the necessary parts and the specifications for building an Assemblio, they can complete the work in a reasonable amount of time. However, if there is time pressure involved – the need to improve productivity – the students need to decide how they might best use the resources available to them. Their primary productive resource is workforce – the students on their team. They need to design the process that their team will employ to make the Assemblios as quickly and accurately as they can.

The goal was to present this shared manufacturing context in a way that would require each student team (and hopefully, each member of each student team) to identify these key questions:

- How will we build our products in a quick and effective way (process design)?
- How many Assemblios should we make available for sale this period?
- How many parts should we purchase this period?

These are sophisticated questions that comprise major portions of the OM knowledge base we discuss throughout the rest of the semester. I wanted my students to face the questions, and understand their context and relationships, before we attempted to address sophisticated models used in support of such decisions.

THE EXERCISE

Students receive a handout (available upon email request from the author) on the first day of class. Starting with the handout, I strive to establish an environment where the students will be less worried about their team's performance in the game than in their experiencing the decisions encountered during the game. There is no direct effect on students' grades based on their performance in the game – only a nominal prize is awarded to the "winning" team. Usually, I award a package of miniature candy bars, which the winning team immediately shares with their opponents.

Students arrive at class on the day of the exercise and are randomly assigned to groups of three or four. Each group is assigned a team name, and they are handed a complete Assemblio for their study. They are encouraged to consider how they will build the product (will each student build a complete Assemblio, or will each student be assigned a couple of layers from every Assemblio?). The groups are given about ten minutes to get to know each other (remember, this is the second day of class), get organized, study the product, and start to consider their decisions.

After about five of those minutes, I hand out their first Purchase Order Form (each period the team needs to order the materials used to assemble their product). This document acts as a cue that they must begin to make decisions that they face during the game:

- How are we going to build our Assemblios?
- How many Assemblios do we think we can sell during this period?
- How many Assemblios should we build?
- How many of each part should we order from our supplier?

I allow considerable time (about seven to ten minutes) for the first decision iteration. Students are not told what decisions they must make, but the groups typically discover them quickly. They also realize that the parts order is dependent upon how many Assemblios they intend to build.

The student groups submit their parts orders to me as their central parts supplier. They are warned that I occasionally make a "mistake" and may ship them an incorrectly colored part. However, I rarely ship such a bad part unless one team seems to be performing far better than the other teams in the competition. I compose each team's parts order by placing the parts in a plastic cup. Each team then proceeds to assemble product. Again, the first assembly iteration will take significantly more time

(perhaps as much as five minutes) than will future iterations. While the students are building, I am recording their orders on a spreadsheet that I maintain for their financial performance scoreboard. There is a cost assessed to each team based on the number and type of parts that they order.

Once all teams complete their assembly work, I roll a single fair die to represent demand. They know in advance that the die roll will be our "demand generator." Each team may sell between one and six Assemblios per period, depending upon what I roll and how many they have available in finished goods inventory. We observe the roll, determine how many units each team is able to sell (I check quality for each unit they attempt to sell: on occasion a team will lose a sale due to error in assembly during early game iterations). We then check the financial status of each team, and begin the next period of plans, orders, assembly, and sales.

Inventory enters in during subsequent periods. Some teams may have built too many Assemblios. Other teams decide they wish to hold parts unassembled (and less expensive to hold) rather than complete an assembly. Over time, teams tend to develop decision rules for ordering and assembly that are dependent upon their closing inventory status from the previous period.

The game continues through several iterations. Usually, I am able to complete six to eight iterations within a single 75-minute class period, allowing for introductory time and de-briefing after the experience. By the fifth or sixth iteration, teams settle into a routine decision pattern, and few of them break from their pattern unless they are "way ahead" or "way behind" on the scoreboard. By the fifth or sixth iteration, teams are typically making their decisions and assembling their product in less than one-half the time taken for the original decision iteration. Students are not told ahead of time which period will be the last iteration of the game to prevent end-game behavior. After the last iteration is played, we review the scoreboard, and I award the "winning" team their nominal prize.

We then have about fifteen minutes remaining in class for de-briefing, the "what have we learned" portion of the experience. We review what questions they needed to answer as they proceeded through iterations. The students often introduce rather sophisticated ideas about inventory management or production planning that I use as opportunities to link their experience to concepts we will study later in the semester.

The Assemblios activity has given my students a context for decision-making in manufacturing. Scheduling the activity early in the semester establishes key questions that we address throughout the semester. The activity has made OM a more relevant aspect of my students' business study.

A complete copy of this paper, including the Assemblios hand-out, is available upon email request to the author.