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# **Lumberjack Construction: Job-Order Costing & Manufacturing Simulation**

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*This paper describes a classroom Job-Order Costing and manufacturing simulation called Lumberjack Construction. This simulation is used in introductory managerial accounting and cost accounting courses to help students understand the various parts of the manufacturing process and the application of Job-Order Costing principles. For this simulation, students are placed into manufacturing groups. Each group is responsible for manufacturing a building and calculating the cost of that building using job-order costing.*

## **INTRODUCTION**

Concepts in introductory managerial accounting and cost accounting courses can be challenging for students and faculty because many of these concepts are rooted in manufacturing. However, few students have been exposed to a manufacturing environment. In these courses, students are also introduced to multiple ways of allocating costs to jobs and products. The combination of an unfamiliar work setting and the introduction of multiple abstract allocation concepts make it difficult for faculty to help students grasp these principles. Nevertheless, it is important for students to understand how costs are distributed among different products, as this information is vital not only to accounting majors, but across numerous business disciplines such as marketing, management, economics, and finance. This paper describes a Job-Order Costing and manufacturing simulation that promotes understanding of the cost allocation process, the manufacturing environment and the tracking of costs within this environment.

The remainder of this paper is organized as follows. First, the Job-Order Costing/Manufacturing simulation is described. Second, learning objectives along with guidance on simulation implementation is discussed. Third, evidence supporting the efficacy of the simulation is considered.

## **JOB-ORDER COSTING AND MANUFACTURING SIMULATION**

Students often have difficulty understanding managerial accounting concepts that are based in a manufacturing environment. Most introductory managerial accounting textbooks initially teach cost terminology and then introduce job order costing to assign direct materials, direct labor, and to apply manufacturing overhead costs to products. Students are often confused with these concepts as they have never been exposed to a manufacturing environment. Consequently, terminology such as direct labor.

direct materials, and materials requisitions is difficult to understand because they are not able to apply this terminology to a real-life scenario. In order to improve comprehension of these concepts, this simulation lets students complete a small scale building project within the classroom and calculate costs of their building.

At the beginning of this project, students are divided into groups to model a manufacturing facility. Once groups are assigned, each group is required to choose one student in their group to be the designated student supervisor. The supervisors assemble at the front of the room to get their production assignments from factory management. Each supervisor receives a packet that contains the following: Supervisor Handout, Materials Requisition Form, Time Report Sheet, Overhead Application Sheet, Job Cost Sheet, and blueprints for their construction project. Sample forms are provided in Appendices A - E.

Each group supervisor chooses a Materials Handler within their group, and assigns assembly jobs based on the information in their Supervisor Handout. The Materials Handler fills out the Materials Requisition Form for the number of items needed to manufacture their building and calculates the total cost of these materials. The supervisor reviews this form and if the materials requisition form is filled out correctly, the Materials Handler comes up to the front of the room to receive materials for construction from the Materials Inventory warehouse manager, a.k.a. the instructor. Each group then works through the blueprints to understand how the building will be manufactured. As Direct Labor employees begin construction, group supervisors start monitoring their time, with one minute equivalent to 100 hours of Direct Labor construction time. Once they have completed the manufacturing process, students in the group work together to determine the cost of the building their group has manufactured. Student supervisors are responsible for ensuring that each student participates and Job Cost calculations, including Direct Materials, Direct Labor, and Applied Manufacturing Overhead, are agreed upon by all group members before a project is deemed complete. Once the Materials Handler's job is complete and construction has started, their position converts to Quality Control Inspector, where they must examine and approve all finished products.

## **LEARNING OBJECTIVES AND SIMULATION IMPLEMENTATION**

### **Learning Objectives**

The Job-Order Costing/Manufacturing Costing simulation provides three specific learning objectives. The first objective illustrates a simulated manufacturing environment using a building project. Requiring students to work in groups to construct a building and complete source documents related to this project reinforces concepts such as direct labor, direct materials and indirect costs.

The second learning objective is to enhance student comprehension of the application of job-order costing. During the construction process, students are required to be aware of the costs of their job. They must complete a materials requisition sheet for their building materials, keep a time sheet to record direct labor hours, and complete a job cost sheet to calculate the final cost of their building. These steps reinforce to students how source documents are used to determine the final cost of a job or product.

Finally, students gain awareness of the impact of various components of the manufacturing process on total job cost. Through group and class discussion toward the end of the simulation, students realize that assigning direct labor hours as a cost driver not only influences the direct labor cost associated with the job, but also the overhead applied to the project. This allows the students to understand why efficient use of labor time is important for cost control.

### **Implementation Guidance**

#### *Background*

The current version of the project has been developed as a result of many other trials. This project originally began as a key chain building project where students "manufactured" key chains during class. This experience led us to realize that there was value in having different groups complete different types of products. So, we developed a simulation where students "manufactured" small crafts (i.e., wooden airplanes, pinwheels, sail boats, etc.). This version of the project was not ideal either because it cost a

significant amount of money to purchase these items for use each semester. Consequently, we developed the current version of the simulation discussed in this article. This version allows students to construct multiple different types of products, but allows the instructor to reuse materials from semester to semester.

### *Courses*

This simulation was designed for an introductory managerial accounting course, which is normally the second accounting class that a college business student will take, after introductory financial accounting. It has been implemented in medium to large classes of up to 70 students. It is most effective in medium-sized classes of around 50 students. Students attending these courses include accounting, economics, finance, management, marketing, and general business majors. In addition, the project has been used as a review tool for cost accounting classes.

This project simulation is normally presented in class following the Job-Order costing lecture. It is important for the project to be placed at this point in the curriculum because students need a basic background in job-order costing to understand the various components of the simulation. Project points are included within the overall points awarded during the semester for the class, in order to persuade students to attend and participate.

### *Materials*

The simulation requires materials for two sets of each of the five different types of buildings. Two 100 piece sets of magnetic building tiles were purchased to provide the necessary materials. A sample of the buildings and materials required are included in the appendices. Students should be instructed to replace all materials back in their bag as soon as the project is over to ensure that building tiles are not lost and can be used for future classes. Materials cost is approximately \$200.00

### *In-class implementation*

The project takes approximately one hour of class time to complete. In order to create variation among students within the classroom and control project simulation outcomes, five different building projects were created. Two student groups are assigned to each building, for a total of ten groups. This allows for cost comparisons between the two groups who built the same building. A sample of the Townhome project blueprints are included in Appendix F. Sample source documents are included in Appendices A - E.

### **Evidence of Efficacy**

This simulation was initially used in four different introductory managerial accounting classes taught by two different accounting instructors over a period of two semesters. To determine effectiveness of the project, the same exam administered in previous semesters testing Job Order Costing concepts without this simulation project was administered during later semesters after the simulation project was implemented.

The pre-simulation and post-simulation exams were identical, the classes used the same textbook, the instructors were unchanged, and the exams were given at the same point during the semester calendar. In all classes, the average increase in exam scores was approximately 8 to 10 points, between the pre and post-simulation semesters. These results suggest significant improvement in student understanding of Job Order Costing methods and applications as a result of this project simulation. In addition, student approval measured by teaching evaluations indicated an increased appreciation for this experiential learning activity.

## **APPENDIX A SUPERVISOR HANDOUT**

It is your job to make sure that the manufacture of your product goes smoothly and that all costs are recorded and accounted for. This means that you must:

- 1) Appropriately assign jobs to individuals in your group
  - 1 supervisor
  - 1 materials handler
  - 1 quality control inspector
  - Remaining group members are construction workers
  
- 2) Make sure that you receive the materials requisition for your job.
  - a. This will be obtained from the materials handling personnel after they have received all materials from the warehouse and distributed the materials to the employees using those materials.
  - b. Materials will not be released without an accurate materials cost on your materials requisition.
  
- 3) Make sure that you keep track of the amount of direct labor time spent working on your jobs (Time starts when the first construction worker begins working and ends when the last construction worker finishes working.)
  - a. This will be used to calculate the cost of direct labor (see the time report sheet)
  - b. NOTE: 1 minute = 100 direct labor hours
  
- 4) Make sure that operations are running smoothly and that all employees are actively participating in the manufacturing process.
  - a. If there is an issue with operations, you should determine a solution to make operations run more smoothly.
  
- 5) Help your group calculate the total cost of your job using the materials requisition, time report, and overhead application sheets. Complete this cost calculation on the job cost sheet.

**APPENDIX B  
MATERIALS REQUISITION FORM**

**FIGURE 1  
Materials Requisition  
Townhome**

Materials Requisition Number: \_\_\_\_\_

Date \_\_\_\_\_

Job Number: \_\_\_\_\_

Description: \_\_\_\_\_

<b>Material Description</b>	<b>Quantity</b>	<b>Unit Cost</b>	<b>Total Cost of Material</b>
Equilateral Triangle-Green	6	\$9,000.00	
Equilateral Triangle-Red	2	\$9,000.00	
Equilateral Triangle-Orange	6	\$9,000.00	
Equilateral Triangle-Yellow	2	\$9,000.00	
Large Triangle-Yellow	2	\$52,000.00	
Small Square-Green	2	\$12,000.00	
Small Square-Yellow	6	\$12,000.00	
Small Square-Orange	3	\$12,000.00	
Small Square-Red	4	\$12,000.00	
Holey Square-Orange	2	\$16,200.00	
Rectangle-Purple	2	\$4,500.00	
Rectangle-Yellow	3	\$4,500.00	
Large Square-Red	2	\$75,000.00	

Total Cost of All Materials Used: \_\_\_\_\_

Authorized Signature: \_\_\_\_\_

**APPENDIX C  
TIME REPORT**

**FIGURE 2  
Time Report**

Date: \_\_\_\_\_  
 Job Number: \_\_\_\_\_  
 Description: \_\_\_\_\_

<b>Time Started</b>	<b>Time Ended</b>	<b>Total Time</b>	<b>Hourly Rate</b>	<b>Number of DL Employees</b>	<b>Total Amount</b>
			\$10.00		

**NOTE: 1 minute = 100 hours of direct labor**

Authorized Signature: \_\_\_\_\_

**APPENDIX D  
OVERHEAD APPLICATION SHEET**

**FIGURE 3  
Overhead Application**

<b>Total Estimated Yearly Overhead</b>	
Glue	\$20,000.00
Nails	\$40,000.00
Paint	\$60,000.00
Hammers	\$10,000.00
Trucks (Depr., Repairs, Main., Gas)	\$170,000.00
Materials Handlers Salaries	\$240,000.00
Trash Cleanup Personnel Salaries	\$100,000.00
Inspection Costs	\$360,000.00
<u>Supervisors Salaries</u>	<u>\$500,000.00</u>
<b>Total OH</b>	<b>\$1,500,000.00</b>

Cost Driver: Direct Labor Hours

Total Estimated Yearly Direct Labor Hours = 50,000 DLH

Step 1: Calculate the OH Rate

Step 2: Apply OH to your products

**APPENDIX E  
JOB COST SHEET**

**FIGURE 4  
Job Cost Sheet**

Job Number: \_\_\_\_\_  
 Time Started \_\_\_\_\_  
 Time Completed \_\_\_\_\_  
 Description: \_\_\_\_\_

Direct Materials		Direct Labor		Applied Manufacturing Overhead		
Requisition No.	Amount	Ticket No.	Amount	OH Rate	Actual Cost Driver	Amount

Cost Summary:

Direct Materials Cost		_____
Direct Labor Cost		_____
Applied Manufacturing Overhead Cost		_____
Total Cost of Job		=====

Authorized Signature: \_\_\_\_\_



**APPENDIX F  
SAMPLE BLUEPRINTS FOR TOWNHOME**









