

# **A Process Costing Simulation: Experiential Learning in the Introductory Managerial Accounting Course**

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## **Abstract**

"A process costing simulation: Experiential Learning in the Introductory Managerial Accounting Course" is an in-class, small-team, active learning simulation that is designed to assist introductory managerial accounting students in their understanding of the process costing topic. Students work in production teams and departments to produce a product that is not familiar to them. Results from pre- and post-simulation assessments suggest that the activity improved higher order thinking in students. Qualitative data suggests that students enjoy the activity and believe that it does enhance their understanding and comprehension of the process costing topic.

## **1. Student Materials**

### ***1.1 Background Information***

In this simulation activity, you will be assigned to production lines as well as departments. Your production line will produce two products and each production department will have individual tasks assigned that must be completed prior to the unfinished product moving from your department to the next. You will produce Alzheimer's Activity Squares (AAS). Alzheimer's patients are "fascinated" with textures and movement. Therefore, you need to ensure that the finished product has lots of textures and movement. For each production line there will be three departments: (1) coloring, (2) buttons/string/felt, and (3) ribbons/rope/finishing.

Using the provided prototype, each production line will complete two AASs. A table in the front of the classroom will be set up where the raw materials will be located. The raw materials include white potholders, markers, string, ribbon, felt, fabric glue, rope, and buttons (you should only procure raw materials that are required and only when something is needed to limit others waiting to acquire the needed materials). Each department must follow their respective guidelines when completing their portion of the AAS. You may be creative in the process, but the number and type of items required must be exact. You will have approximately 30 minutes to complete two of the products; therefore, you should watch your time as a production line to ensure all departments are moving at an appropriate pace to complete the task.

In addition to the simulation experience, you will complete other activities that will be provided to you that will help to solidify the concepts of process costing and the simulation that you experienced.

### ***1.2 Simulation Process and Learning Opportunities***

During the creation of your AASs, the instructor may stop production and inquire of your team/production line/department how far through the process you are. As a team, you should discern as to how far through the process you believe you are. At that point, you may be asked how many equivalent units you have as to materials and/or conversion costs. It is important for you to understand the concept of equivalent units and the assigning of costs to these units. This simulation will help you better conquer this challenging topic moving forward.

As introductory managerial accounting students, you should use this simulation activity to apply the concepts of process costing that you have been reading and studying about. For example:

- What are equivalent units and how are they calculated for both ending work in process and units completed and transferred out (to either a second or future department and/or finished goods)?
- What makes up conversion costs and why are they spread evenly over the production process?
- Why is it important when materials are added during the process and how does that affect units completed and transferred out and/or ending work in process inventory?
- How are costs assigned to units in process costing?
- What is the difference in a first department and a second and future department and how can you tell if a department is a first department or a second or future department?

### 1.3 Class Period 1

#### 1.3.1 Concrete Experience: Production of Alzheimer's Activity Squares

Responsibility of each department: You will be using fabric glue in this process; this glue takes some time to securely dry; therefore, as the AAS moves from one department to the next, you need to ensure that you are careful about this process so that your AAS does not fall apart (*see prototype for help with any department instructions – Figure 1*).

- Dept. 1 Coloring: Color one side of the AAS prior to moving to future departments (ensure that the artwork is completely dry before sending to future department) - You can choose any artwork that you like; please make it joyful with lots of color.
- Dept. 2 Buttons/String/Felt: This department is responsible for ensuring that there is 1 large button and three small buttons securely fastened to the AAS. In addition, the large button should be threaded with string and fastened securely to the AAS by the string in some way (the button itself should dangle). Small "pile" of string should be securely fastened to the AAS. Prior to the AAS moving to the final department, you should fasten a small piece of felt (any color; any shape) to the AAS.
- Dept. 3 Ribbons/Rope/Finishing: The responsibility of this department is to attach three looped ribbons to the AAS (these should be small loops such that they don't get caught on things too easily). In addition, this department will ensure that there are three small pieces of rope attached to the AAS. Finally, this department is responsible for ensuring that all attached items in this and previous departments are secure and ready for drying. Also, this department can use the fabric markers to fill in any blank areas with shapes, squiggly lines, etc.

Calculating equivalent units: As products are moving through the process (i.e., in and out of departments) you should be thinking about the concept of equivalent units. In each department, materials are added at the beginning of the process; Labor and OH (i.e., conversion costs) are added evenly throughout the process. If a unit goes through one entire department it is considered 1/3 complete as to materials and to conversion. At the beginning of each department, as materials are added at the beginning of each process, the unit is considered complete as to materials for that department and zero percent complete as to conversion.

#### 1.3.2 Reflective Observation on Experience

Questions for reflection - Reflect on these observations to discover the personal meaning that the situation had for you:

- What did I observe in the experience and what possible meanings could these observations have?
- Try to look at this experience and describe it from different perspectives. For example, how did other participants view the situation and what did it mean to them?
- What would a neutral ("objective") observer have seen and heard?
- If some time has passed since the experience, do you now see the situation differently?
- Look beneath the surface and try to explain why the people involved behaved the way they did.

**In-class reflection:** Discuss the experience with others who were involved to gain their views and to help you clarify, reinforce, or question your own perceptions.

**After-class reflection:** Answer the following questions after you have given some thought regarding the activity that you experienced. You should remove yourself from the experience and meditate about it in a relaxed atmosphere. Mull over your observations, experiences, and feelings during the activity until the personal meaning becomes clear.

- Why did people, and yourself in particular, behave as they did?
- What can you learn about yourself, looking back on the experience?
- If you write about a conflict or interaction, attempt to analyze both sides and put yourself in the shoes of the other people involved.
- Do you believe the concrete experience (i.e., the simulation activity) was beneficial in your understanding of process costing and the equivalent unit analysis/calculation? Explain your answer.

## 1.4 Class Period 2

### 1.4.1 Abstract Conceptualization

Activity 1: Terms and concepts recognition

From the list of terms/phrases below, determine which items would be considered a process costing term (*anything to do with process costing or the process costing process or affected by the process costing process*) and those that would not. If the term/phrase is **not** a process costing term/phrase, signify this by drawing a line through the term.

- |                                  |                                 |
|----------------------------------|---------------------------------|
| 1) Transferred-in costs          | 11) Internal Controls           |
| 2) Completed and transferred out | 12) Conversion Costs            |
| 3) Master budget                 | 13) Accrual Accounting          |
| 4) Break-even point              | 14) Activity-Based Costing      |
| 5) Statement of Cash Flows       | 15) Allocation Base             |
| 6) Bank reconciliation           | 16) Predetermined Overhead Rate |
| 7) Depreciation                  | 17) Current Ratio               |
| 8) Financial Statement Analysis  | 18) Balance Sheet               |
| 9) Target operating income       | 19) Liquidity                   |
| 10) Make-or-Buy Decision         | 20) Cost of Goods Sold          |

Activity 2: Fact verification

Decide whether the following statements are true or false and then designate how confident you are with your decision with the 3-point scale provided (1 - no idea of the answer; 2 - somewhat confident; 3 - very confident).

- |   |   |   | <u>How confident are you?</u> |   |   |
|---|---|---|-------------------------------|---|---|
| 1) Transferred-in costs never appear in the first department in a process costing system  | T | F | 1                             | 2 | 3 |
| 2) Completed and transferred out items from every department are always transferred to finished goods.                                      | T | F | 1                             | 2 | 3 |
| 3) DM may be added at any point during the process of each department.  | T | F | 1                             | 2 | 3 |
| 4) Conversion costs are always added evenly throughout a production process   | T | F | 1                             | 2 | 3 |
| 5) If materials are added at the beginning of the process, then none of the units are completed as to materials halfway through the process | T | F | 1                             | 2 | 3 |

### Activity 3: Concepts/Terms grouping

Below you are provided with a few categories of concepts as well as terms. Your objective is to match the term(s) provided with the over-arching concept that encompasses the terms (all terms and concepts will be used/matched at least once). Draw a line connecting the term(s) with the matching concept.

<u>Concepts:</u>	<u>Terms:</u>
Process Costing	Transferred-in costs
Product Cost	Equivalent units
Prime Cost	Producer of Yachts
Conversion Costs	Direct Labor
Period Costs	Overhead
Job-Order Costing	Administrative Expenses
	Selling Expenses
	Producer of #2 pencils
	Direct Materials
	Producer of cereal

### Activity 4: Cued recall

Using the terms provided, fill-in the blank with the appropriate term (terms may be used more than once or not at all).

Job	Process	Transferred-in
Direct Materials	Conversion Costs	Direct Labor
Overhead Costs	Equivalent Units	Allocate
Tracing	Prime Costs	Cost driver

\_\_\_\_\_ costs are fully added in a prior department and all units are complete as to these costs in future departments.

\_\_\_\_\_ are made up of direct labor costs plus overhead costs allocated to a job/product.

\_\_\_\_\_ costing is used when identical products are produced over and over.

Direct Labor costs plus Overhead costs allocated to a job covert \_\_\_\_\_ into a finished good.

\_\_\_\_\_ costing is used when a company creates “made-to-order” products or small batches of products.

Direct Materials costs plus Direct Labor costs are called \_\_\_\_\_ .

A predetermined overhead rate is calculated using a \_\_\_\_\_; the rate is then used to \_\_\_\_\_ overhead costs to process.

### Activity 5: Development of theories to improve the process

This activity requires that you think back to the process costing simulation completed in class. When you are developing your answers, think about the process costing/equivalent unit analysis/calculation in general and how the activity ties into that concept.

- Quickly summarize the activity/process.
- What do you think made the process effective?
- What do you think may have improved the process?

### 1.4.2 Active Experimentation

Thinking back to the activity that you recently completed (i.e., production of the Alzheimer's Activity Squares), your objective is to complete the following process costing exercise while recalling the steps and processes that you experienced when producing the AASs).

Process Steps for each department (use the spreadsheets provided to complete the following tasks):

- 1) Summarize flow of units
- 2) Compute output in terms of Equivalent units
- 3) Summarize the Costs to account for
- 4) Summarize the cost per equivalent unit
- 5) Assign total costs to units completed and to units in Ending WIP
- 6) Journalize all transactions occurring in each department (samples provided)
- 7) Summarize results in a WIP t-account for each department (samples provided)
- 8) Describe what could make up OH costs in this production process

#### Department 1 Information:

Information about units:

Beginning WIP	1 unit
Started in production during period	2 units
Completed and transferred to dept. 2	2 units
Ending WIP (DM added at beginning of process, 50% complete as to Conversion)	1 unit

Information about costs:

Beginning WIP (DM, \$1.25; Conversion costs, \$3.65)	\$ 4.90
DM used	\$ 3.00
Conversion Costs incurred (\$6.50 = \$2.50 DL + \$4 OH)	

#### Department 2 Information:

Information about units:

Beginning WIP	2 units
Transferred in from Dept. 1	2 units
Completed/Transferred out to Dept. 3	2 units
Ending WIP (DM added halfway through the process; 65% complete as to conversion)	2 units

Information about costs:

Beginning WIP (transferred-in, \$8.20; DM, \$2.75; Conversion costs, \$5.15)	\$ 16.10
Transferred in from Dept. 1 this period	\$ 10.95
DM cost added this period	\$ 4.10
Conversion cost added this period (DL, \$3.50; OH, \$6.75)	\$ 10.25

Department 3 Information

## Information about units:

Beginning WIP	2 units
Transferred in from Dept. 2	2 units
Completed/Transferred out to Fin. Goods	1 unit
Ending WIP (DM added at the end of the process; 80% complete as to conversion)	3 units

## Information about costs:

Beginning WIP (transferred-in, \$8.45; DM, \$3.10; Conversion costs, \$6.05)	\$ 17.60
Transferred in from Dept. 2 this period	\$ 23.48
DM cost added this period	\$ 3.70
Conversion cost added this period (DL, \$5.00; OH, \$3.25)	\$ 8.25

Journal Entries and T-accounts (in \$)

Dept. 1

WIP - Dept. 1  
    Materials

WIP - Dept. 1  
    Wages Payable

WIP - Dept. 1  
    Overhead

WIP - Dept. 1  
    WIP - Dept. 2

Dept. 2

WIP - Dept. 2  
    Materials

WIP - Dept. 2  
    Wages Payable

WIP - Dept. 2  
    Overhead

WIP - Dept. 3  
    WIP - Dept. 2

Dept. 3

WIP - Dept. 3  
    Materials

WIP - Dept. 3  
    Wages Payable

WIP - Dept. 3  
    Overhead

Finished Goods  
    WIP - Dept. 3

<u>Department 1</u> <u>WIP</u>	
Beg.	
DM	Trans. to Dept. 2
DL	
<u>OH</u>	
End.	

<u>Department 2</u> <u>WIP</u>	
Beg.	
Trans. In	Trans. to Dept. 3
DM	
DL	
<u>OH</u>	
End.	

<u>Department 3</u> <u>WIP</u>	
Beg.	
Trans. In	Trans. to F.G.
DM	
DL	
<u>OH</u>	
End.	

## 2. Teaching Note

### 2.1 Introduction

From 2006 through 2020, 85 cases/instructional resources were published in the managerial accounting area in six accounting education journals reviewed annually or bi-annually in the *Journal of Accounting Education* (Apostolou et al., 2015, 2020, 2021; Apostolou et al., 2019; Apostolou et al., 2016, 2017, 2018; Apostolou et al., 2013; Apostolou et al., 2010). Of the 85 cases/instructional resources, only 11 are explicitly identified as pertaining to methods of costing products in their title. In addition, of the 220 cases pertaining to introductory managerial accounting and cost accounting from 1988 through 2020, listed in the Notre Dame accounting case list, only 12 pertain to methods of costing products in their title<sup>1</sup>.

This case is important as it adds to the current literature on costing methods, the accounting education literature, and adds a teaching option for an oftentimes challenging topic for students. There are other simpler, less involved case studies available using a production process to assist with students elementary understanding of the process costing topic (e.g., Kelly, 2018). However, to the authors' knowledge, no published case requires students to create and fully cost multiple homogenous products they are not previously familiar with, going through three distinct production departments, using the process costing topic to complete the costing function and the computation of equivalent units utilizing the 5-step process. In addition, students journalize and post the transactions. The entire case leads the student and the learning process through all four stages of Kolb's Experiential Learning Model. Additionally, the current case has statistical data to show its efficacy in the accounting classroom and it integrates the three competencies outlined in Lawson et al. (2015): analytical thinking and problem solving, planning analysis and control, and management decision making.

The prior literature in higher education suggests that students who are exposed to active learning methods (e.g., simulations) remembered more information than students in a standard lecture format course (Goldwater & Acker, 1975; Vanderstoep et al., 2000). Specifically, in a meta-analysis of 225 studies, researchers found that average exam scores improved by 6% when using active instructional approaches in science, engineering and mathematics (STEM) and that students in sections utilizing only traditional lecture were 1.5 times more likely to fail than the students in the active learning classes (Freeman et al., 2014). As an example of these findings, Kirchhoff et al. (2014) found a 25% improvement on exam scores using a computer aided active learning approach when identifying plants.

Simulations can facilitate experiential learning and students being active participants in their own learning, solving unstructured problems, learning by doing, and working in groups. "Incorporation of business simulations in accounting curricula helps achieve objectives outlined in The Pathways Commission (2012) report as well as those described in the American Institute of Certified Public Accountants 'Core Competencies (AICPA, 2000)" (Riley et al., 2013, p. 801-802). "Simulations ... challenge students to work in unstructured situations, developing their tolerance for and appreciation of ambiguity" (Riley et al., 2013, p. 801).

Simulations can facilitate the ideas of experiential learning and students being active participants in their own learning, solving unstructured problems, learning by doing, and working in groups. "Incorporation of business simulations in accounting curricula helps achieve objectives outlined in The Pathways Commission (2012) report as well as those described in the American Institute of Certified Public Accountants 'Core Competencies (AICPA, 2000)" (Riley et al., 2013, pp. 801-802). "Simulations ... challenge students to work in unstructured situations, developing their tolerance for and appreciation of ambiguity" (Riley et al., 2013, p. 801).

The AAS simulation is one way the process costing topic can be addressed in an in-class, small-group/team, active-learning exercise. Ideally, students work in teams/production departments of 2-3 individuals to enhance the learning and allow each student the opportunity to fully participate in the simulation. As an introduction to the topic and due to limited class time and difficulty of the topic, students are encouraged to watch eLectures videos, prepared by the

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<sup>1</sup> 100% of the cases pertaining to product costing methods found in the Notre Dame accounting case list contained Job Costing and/or Activity-Based Costing in the title and did not appear to relate to process costing.

instructor and posted to the course learning assessment software, covering the process costing material. There was no significant difference in the number of students, between groups, that watched the eLectures and those that did not ( $M=0.92$ ,  $SD=0.28$ ),  $t(129.83)=-1.2$ ,  $p=0.23$ . Student comments collected suggest that the simulation helps to better clarify this complicated material.

## 2.2 Learning Objectives

- Compare and contrast the traditional costing systems (job-order costing and process costing) with the activity-based costing system
- Identify key terms associated/not associated with the process costing topic
- Calculate equivalent units, cost per equivalent unit, costs associated with units in ending work in process and units completed and transferred out using the 5-step process
- Define key terms associated with the process costing topic
- Define transferred-in costs and determine what departments transferred-in costs are associated
- Explain how events in a process costing system affect financial statements
- Journalize and post process costing transactions for first departments as well as second and future departments

## 2.3 The Simulation

For purposes of this activity, simulation refers to the concrete experience within Kolb's Experiential Learning Model, accompanied by three additional activities that allow students the ability to experience all four stages of the Model: concrete experience -> reflective observation -> abstract conceptualization -> active experimentation (Kolb, 1984, p. 38).

### 2.3.1 Concrete Experience

The concrete experience is the first stage in Kolb's Experiential Learning Model: "The experience should involve critical thinking components such as problem articulation, research, decision modeling, risk analysis, or decision-making" (Butler et al., 2019, p. 4). On the first day of the experiential learning simulation, students had a concrete experience producing an original unique product called the AAS.

In the concrete experience stage, students should be provided with rope, ribbon, string, felt, buttons, markers, bottles of fabric glue and white potholders (these can be all placed on a table at the front of the classroom). A prototype should be provided for students to follow (e.g., Figure 1) but instruct the students that they can "make the AAS's their own and be creative" as long as they follow the directions on number of pieces, etc. Students should be allowed the opportunity to work for 10-15 minutes on a "product". At that point, the instructor should stop production and conduct a discussion regarding each production line and where they are in the process with a focus on equivalent unit calculation. In addition, hypothetical data can be produced and provided to the production lines and, using the 5-step process of equivalent unit calculation and assignment of costs to those units, the forms may be completed as a class.

After the discussion, primarily of department one calculations, the teams should be allowed to begin working again on the production of units for an additional 10-15 minutes. Once again, a discussion should be held regarding the calculation of equivalent units on what the production lines have produced, specifically on 2<sup>nd</sup> and 3<sup>rd</sup> department equivalent units and the concept of transferred-in costs. After this discussion, allow all production lines to complete two AASs. The concept can be reinforced using hypothetical data for departments two and three using the 5-step process with the forms provided in the appendix.

The following example can be used to help clarify the calculation at the end of the concrete experience using AASs as the product being produced. Make it clear that this is "new" data separate from the process the students just completed (*blank spreadsheets for use by students and solutions are in the appendix*).

Department 1 Information:

## Information about units:

Beginning WIP	0 units
Started in production during period	1 unit
Completed and transferred to dept. 2	1 unit
Ending WIP (DM added at beginning of process, 60% complete as to Conversion)	0 units

## Information about costs:

Beginning WIP	\$ 0.00
DM used	\$ 2.00
Conversion Costs incurred (\$4.50 = \$2.50 DL + \$2 OH)	

Department 2 Information:

## Information about units:

Beginning WIP	1 unit
Transferred in from Dept. 1	1 unit
Completed/Transferred out to Dept. 3	1 unit
Ending WIP (DM added at beginning of the process; 70% complete as to conversion)	1 unit

## Information about costs:

Beginning WIP (transferred-in, \$5.20; DM, \$2.85; Conversion costs, \$3.15)	\$ 11.20
Transferred in from Dept. 1 this period	\$ 6.50
DM cost added this period	\$ 4.10
Conversion cost added this period (DL, \$3.50; OH, \$6.75)	\$ 10.25

Department 3 Information:

## Information about units:

Beginning WIP	2 units
Transferred in from Dept. 2	1 unit
Completed/Transferred out to FG	1 unit
Ending WIP (DM added at end of the process; 90% complete as to conversion)	2 units

## Information about costs:

Beginning WIP (transferred-in, \$7.20; DM, \$2.55; Conversion costs, \$5.85)	\$ 15.60
Transferred in from Dept. 2 this period	\$ 17.21
DM cost added this period	\$ 3.20
Conversion cost added this period (DL, \$2.50; OH, \$3.75)	\$ 6.25

**2.3.2 Reflective Observation**

"Reflection ... can be enhanced by the practices of deliberately viewing things from different perspectives and empathy ... Information skills of sense making, information gathering, and information analysis can aid in the development and expression of the reflecting mode of learning" (Kolb & Kolb, 2013a, p. 32). The key task in this second stage of Kolb's Experiential Learning Model is to gather as many observations as possible by observing the experience from different perspectives/points of view (Butler et al., 2019).

In the reflective observation stage, students are asked to complete two “reflection” activities: (1) in-class reflection – to discuss the experience with others who were involved to gain other student views and clarify their own perceptions; and, (2) after-class reflection – students are tasked with answering three short questions about their experience and whether they believe the concrete experience (i.e., the simulation activity) was beneficial in their understanding of process costing and the equivalent unit analysis/calculation. To accomplish this, students are asked to “unhook” themselves from the experience and meditate about it in a relaxed atmosphere while mulling over their own observations until those observations became clear.

### 2.3.3 Abstract Conceptualization

“Thinking requires the ability to represent and manipulate ideas in your head... enhanced by practicing theoretical model building and the creation of scenarios for action... Quantitative data analysis can aid in the development and expression of the thinking mode of learning” (Kolb & Kolb, 2013b, pp. 32-33). In this third stage of Kolb’s Experiential Learning Model, students were tasked with making sense of, interpreting, and attempting to better understand the first two stages of the learning model. Students made comparisons between what they had done, related assigned readings and lectures to the concrete experience (i.e., simulation), as well as their reflection of the experience, thereby demonstrating their ability to understand conceptually abstract material through their experiences.

Five activities were created to achieve the abstract conceptualization stage following from the Conway et al. (1991) study on long-term retention and Schema Theory: (1) Terms and concepts recognition – students are presented with a list of terms and concepts and are simply asked to discern which ones are included in the process costing topic; (2) fact verification – students are presented with statements in which they have to determine whether the statements are true or false and, in addition, designate the confidence level of their choice; (3) concepts/terms grouping – students are presented with a list of concepts and terms in which they have to match the term(s) with the appropriate concept (in this specific activity, there are concepts that do not pertain to process costing but that students are, or should be, familiar with from material presented PRIOR to the process costing topic – e.g., job costing, product costs, etc.); (4) cued recall – students are provided a list of terms from which they are to fill-in-the-blank of statements; and, (5) development of theories about the process (1. Summarize the activity/process; 2. What made the process effective; and 3. What could improve the process). This activity requires that students think back to the process costing simulation (i.e., production of the AAS) and answer questions regarding the process costing/equivalent unit calculation/analysis process in general and how the activity ties into that concept (*solutions to the objective questions are in the appendix*).

### 2.3.4 Active Experimentation

The final stage of Kolb’s Experiential Learning Model, Active Experimentation, is a follow-up to the first three stages: *Concrete Experimentation*, *Reflective Observation* on the experience and *Abstract Conceptualization*. “Acting requires... involvement in the practical world of real consequences... it is the ‘bottom line’ of the learning cycle, the place where internal experiencing, reflecting, and thinking are tested in reality” (Kolb & Kolb, 2013a, p. 33).

This final activity is meant to simulate a manufacturing environment and processes that occur in a process costing environment from the accounting side (i.e., on paper); the activity is meant to be very similar to the AAS production activity students previously experienced – both include three departments. The objective is for students to go through the manufacturing process, recording what happened when using the 5-step process for process costing, calculating equivalent units, journalizing the transactions, and posting the entries to t-accounts (*blank spreadsheets for use by students and solutions are in the appendix*).

## 2.4 Simulation Efficacy

### 2.4.1 Quantitative Analysis and Results

The simulation was run initially to determine efficacy followed by data collection over four semesters in an introductory managerial accounting course at two different colleges. One college was a mid-sized, midwestern, AACSB accredited, U.S. university and the other was a small, private, southern, AACSB accredited U.S. college. During the four semesters, data collected included 144 total participants using pre- and post-tests<sup>2</sup>. Qualitative data regarding the simulation was collected from the participants in the experimental group (72 students). All students under study were non-transfer students enrolled in daytime, face-to-face sections of an introductory managerial accounting course. Table 1 includes additional descriptive statistics about the subjects under study.

The pre-/post-tests included 10 multiple-choice questions and one short-answer problem<sup>3</sup>, determined by topic experts to assess one of the first three levels of Bloom's Taxonomy: *Knowledge/Remembering*, *Comprehension/Understanding* and *Application*. The testing instrument was validated by having multiple topic experts analyze the test items and determine what level of Bloom's Hierarchy of Learning each question would test. The testing instrument was seen as reliable because items receiving less than 67% consensus were thrown out prior to administering the testing instrument. The result of the topic experts ultimately provided two test variables: *KnowledgeRetention* (measure of lower-level thinking skills - first level on Bloom's Taxonomy) and *HigherOrderThinking* (measure of higher order thinking skills – second and third levels on Bloom's Taxonomy as these would be seen as higher order thinking in an introductory managerial accounting course).

*H1a: An experiential learning simulation has a positive effect on KnowledgeRetention*

Results from a *within groups* analysis (i.e., analyzing the difference between the pre-test and post-test scores for the *KnowledgeRetention* factor within groups) showed a significantly positive change in knowledge retention skills (Table 2) of students within the control group ( $p < .001$ ) and within experimental group ( $p < .01$ ). When comparing the post-test data *between groups* regarding the *KnowledgeRetention* factor, the experimental group ( $M=4.22$ ,  $SD=0.11$ ) performed significantly better than did the control group ( $M=3.82$ ,  $SD=0.11$ ),  $t(142)=2.60$ ,  $p=0.005$ .

*H2a: An experiential learning simulation has a positive effect on HigherOrderThinking*

Results from a *within groups* analysis of the data (i.e., analyzing the difference between the pre-test and post-test scores for the *HigherOrderThinking* factor within groups) showed that higher order thinking skills (Table 3) of students in the control group did not significantly change between the pre- and post-test results ( $p > .05$ ). However, there was a significantly positive change within the experimental group between the pre- and post-test results of the *HigherOrderThinking* factor ( $p < .001$ ). When comparing the post-test data *between groups* regarding the *HigherOrderThinking* factor, the experimental group ( $M=2.25$ ,  $SD=0.09$ ) performed significantly better than did the control group ( $M=1.93$ ,  $SD=0.09$ ),  $t(142)=2.52$ ,  $p=0.006$ .

Additional analysis was performed on the data testing the ability of students to correctly answer the specific process costing questions on the module exam<sup>4</sup>, between groups, and on the final exam<sup>5</sup>, between groups. With regard to the module exam, the analysis showed the experimental group ( $M=0.88$ ,  $SD=0.09$ ) significantly outperformed the control group ( $M=0.83$ ,  $SD=0.15$ ),  $t(121.63)=2.27$ ,  $p=0.03$ . This result shows the intervention significantly helped improve short-term retention of the material under study and potentially aided in successful study of the material.

<sup>2</sup> The pre-test was administered to the experimental and control groups prior to the intervention in the experimental group. The post-test (identical to the pre-test) was administered approximately two months later to both the control and experimental groups.

<sup>3</sup> The multiple-choice questions were either correct or incorrect; the problem was graded with the opportunity to receive partial credit.

<sup>4</sup> The Module Exam included activity-based costing and process costing topics which included questions that would be deemed knowledge retention and higher-order thinking (there was no distinction made for these types of questions on the results reported) and was administered approximately two weeks after the intervention was administered to the experimental group.

<sup>5</sup> The Final Exam was administered at the end of the semester approximately two months following the intervention and included questions that would be deemed knowledge retention and higher-order thinking (there was no distinction made for these types of questions on the results reported).

With regards to the between groups analysis on the process costing questions from the final exam, the experimental group ( $M=84.44$ ,  $SD=25.39$ ) significantly outperformed the control group ( $M=36.67$ ,  $SD=41.21$ ),  $t(61.93)=5.74$ ,  $p=0.0001$ . This result shows the intervention was successful in improving long-term retention of the material under study.

Although both groups showed a significant positive effect on the *KnowledgeRetention* factor, the experimental group significantly outperformed the control group on the module exam process costing questions. This may be due to students not having been exposed to questions on the module exam versus the questions on the post-test which were identical to the pre-test questions. These results show that students in the experimental group were better able to apply learned knowledge to different situations than the control group; therefore, we fail to reject H1a. All data analysis shows that the experimental group outperformed the control group on higher-order thinking skills; therefore, we fail to reject H2a.

#### 2.4.2 Qualitative Results

Student comments were collected from the experimental group during the administering of the “activities” mentioned above following from Kolb’s Experiential Learning Model. This anecdotal evidence shows students appeared to be thinking during the process and actively relating what they were doing to the concept of process costing:

*Reflective Observation.* Recurring themes from the reflections of students, following the experiential learning simulation activity included:

- How materials are used and accounted for
- How to account for partially completed units
- Active learning process helped with understanding the process and to form better memories of this material
- Activity helped when performing the calculations
- Materials versus conversion costs and accounting for them

*Abstract Conceptualization.* Comments from students on summarizing the activity they participated were very consistent and, for the most part, students were very effective in describing the activity (i.e., simulation) in which they had taken part. Students were asked what they thought made the process effective. Process effectiveness themes, from the final activity in the abstract conceptualization stage of Kolb’s Experiential Learning Model, in the experimental group included:

- Each department was able to focus on specific tasks, making each department more efficient
- Departments were close together (on one row) and transferring completed goods from one department to the next was more efficient

Students were also asked what they thought would have improved the process. Process improvement themes from the final activity in the abstract conceptualization stage of Kolb’s Experiential Learning Model, in the experimental group included (*these comments show that students were thinking more deeply about the process*):

- Production of more items
- Better quality supplies/materials
- Having partially completed units prior to the activity so that departments 2 and 3 had something to do while department one was working on new items
- Communication between departments

#### 2.5 Concluding Comments

This manuscript presents a way to potentially enhance student learning of the process costing material in an introductory managerial accounting course. The simulation encourages learning from a manufacturing perspective where students can actively experience what they have been learning and reading about. Students are asked to play the part of direct labor in the manufacturing of a product they are not previously familiar with and, in additional and more traditional activities, calculate equivalent units and assigning costs to those units using a 5-step process.

The simulation is not meant to take the place of traditional methods but is intended to enhance and build on the more traditional classroom methods of learning (e.g., lectures/lecture videos, homework, quizzes, etc.) by actively engaging the student in a very abstract concept and making it become real. An advantage of this type of activity is small group work which is encouraged in both the accounting education literature and calls from accounting regulating bodies (The Pathways Commission, 2015). By working in these small groups, students are provided immediate feedback from their fellow students and can, in return, provide their own feedback and understanding for confirmation or correction.

The results of the assessment data that was collected, both quantitative and qualitative, suggest that students benefit from this type of simulation activity and students believe that it does enhance/improve their learning/understanding of the process costing material. In summary, this manuscript provides a unique and successful way of presenting the process costing material to introductory managerial accounting students.

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### Appendix

**Pre-/Post-Test** (followed by matrix of each questions location on the first three levels of Bloom's Taxonomy according to topic experts and a Q-Sort).

1) Clarksen Company uses a process costing system. The company requisitioned \$93,000 of material for Department A and \$67,000 of material for Department D. The entry to record the use of the direct materials by these two departments is:

- |    |                            |           |           |
|----|----------------------------|-----------|-----------|
| A) | Raw Materials              | \$160,000 |           |
|    | Accounts Payable           |           | \$160,000 |
| B) | Work in Process – Dept. A  | \$93,000  |           |
|    | Work in Process – Dept. D  | \$67,000  |           |
|    | Raw Materials              |           | \$160,000 |
| C) | Factory Overhead           | \$160,000 |           |
|    | Raw Materials              |           | \$160,000 |
| D) | Raw Materials – Dept. A    | \$93,000  |           |
|    | Raw Materials – Dept. D    | \$67,000  |           |
|    | Work in Process            |           | \$160,000 |
| E) | Work in Process – Dept. A  | \$93,000  |           |
|    | Work in Process – Dept. D. | \$67,000  |           |
|    | Accounts Payable           |           | \$160,000 |

2) Which of the following is the best explanation for why it is necessary to calculate equivalent units of production in a process costing environment?

- A) In most manufacturing environments, it is not possible to conduct a physical count of units
- B) Companies often use a combination of a process costing and job order costing systems.
- C) In most process costing systems, direct materials are added at the beginning of the process while conversion costs are added at the end of the manufacturing process.
- D) All of the work to make a unit 100% complete and ready to move to the next stage of production or to finished goods inventory may not have been completed in a single time period.
- E) In most cases, there is no difference between physical units and equivalent units of production

3) The combined costs of direct labor and factory overhead per equivalent unit used by many businesses with process operations is called:

- A) Physical cost per equivalent unit
- B) Overhead cost per equivalent unit
- C) Combined cost per equivalent unit
- D) Conversion cost per equivalent unit
- E) Finished cost per equivalent unit

4) A company uses a process costing system. Its Weaving Department completed and transferred out 120,000 units during the current period. The ending inventory in the Weaving Department consists of 40,000 units (20% complete with respect to direct materials and 60% complete with respect to conversion costs). Determine the equivalent units of production for the Weaving Department for direct materials and conversion costs assuming the weighted average method.

- A) 120,000;120,000
- B) 120,000;160,000
- C) 128,000;120,000
- D) 128,000;144,000
- E) 128,000;184,000

5) A system of accounting in which costs are accumulated and then measured per unit at the end of a period by combining costs per equivalent unit from various departments is a:

- A) General cost accounting system
- B) Process costing system
- C) Job order cost accounting system
- D) Manufacturing cost accounting system
- E) Work in Process accounting system

6) An organizational unit of a factory that has the responsibility for partially manufacturing or producing a product is called a:

- A) Production department
- B) Service department
- C) Primary department
- D) Responsibility department
- E) Control department

7) During a period, Department B finished and transferred 50,000 units to Department C. Also, in Department B during the period, 10,000 units were started but brought only to a stage of being 60% completed. The number of equivalent units produced by Department B during the period was:

- A) 44,000 units
- B) 50,000 units
- C) 54,000 units
- D) 56,000 units
- E) 60,000 units

8) Metaline Corp. had the following information available for the year. The number of units transferred to finished goods during the year is:

Beginning Work in Process (40% complete; \$1,100)	200 units
Ending Inventory of Work in Process (80% complete)	400 units
Total units started during the year	3,200 units

- A) 3,200 units
- B) 3,000 units
- C) 3,400 units
- D) 3,160 units
- E) 3,500 units

9) A company that applies process costing is most frequently characterized by:

- A) Low standardization and high production volume
- B) Custom orders and mass production
- C) Repetitive production and unique products
- D) Repetitive production and low production volume
- E) Similar products and high production volume

10) Manufacturers that utilize process costing operations produce large quantities of:

- A) Identical products
- B) Different products
- C) Disgruntled employees
- D) Smog
- E) Financial loss

**Problem:**

Below you will find information regarding the production of the 4c<sup>2</sup> using Tinker Toys. In department one, two round pieces are attached to each end of a stick piece. In department two, the product is completed by adding four more stick pieces and two round pieces to form a square. The final product will have four round pieces and five stick pieces.

**Department 1**

Information about units:

Beginning WIP	2 units
Started in production during period	4 units
Completed and transferred to dept. 2	3 units
Ending WIP (DM added halfway through the process, 30% complete as to Conversion)	3 units

Information about costs:

Beginning WIP (\$.80 DM; \$2.50 Conversion costs)
DM used (\$1.60)
Conversion Costs incurred (\$6.50 = \$2.50 DL + \$4 OH)

**Department 2**

Information about units:

Beginning WIP	3 units
Transferred in from Dept. 1	3 units
Completed/Transferred out to Fin. Goods	4 units
Ending WIP (DM added at the end of the process; 60% complete as to conversion)	2 units

Information about costs:

Beginning WIP (transferred in costs, \$7.20; DM, \$1.50; Conversion costs \$4.15)	\$ 12.85
Transferred in from Dept. 1 this period	\$ 8.83
DM cost added this period	\$ 2.10
Conversion cost added this period (DL, \$3; OH, \$4.25)	\$ 7.25

**Additional information:**

- Round all amounts to two decimal places
- Make a list of potential items that could make up OH costs

**Process Steps for each department:**

- 1) Summarize flow of units (use the spreadsheets attached)
- 2) Compute output in terms of Equivalent units
- 3) Summarize the Costs to account for
- 4) Summarize the cost per equivalent unit
- 5) Assign total costs to units completed and to units in Ending WIP
- 6) Journalize all transactions occurring in each department
- 7) Summarize results in a WIP t-account for each department
- 8) Describe what could make up OH costs in this production process

DEPARTMENT 1

Step 1: Summarize the Flow of Physical Units

Step 2: Compute Output in Terms of Equivalent Units

4c <sup>2</sup>	Step 1:	Step 2: Equivalent Units	
	Flow of Physical Units	Direct Materials	Conversion Costs
Units to account for:			
Beg. WIP			
Plus: Started in prod.			
Total units to account for			
Units accounted for:			
Completed and transferred out			
Plus: Ending WIP			
Total physical units accounted for			
Total Equivalent Units			

Step 3: Summarize Total Costs to Account for

Step 4: Compute the Cost per Equivalent Unit

4c <sup>2</sup>	Direct Materials	Conversion Costs	Total
Beginning WIP			
Plus: Costs added during period			
Total costs to account for			
Divided by: Total Equivalent units			
Cost per Equivalent Unit			

Step 5: Assign Total Costs to Units Completed and to Units in Ending WIP

4c <sup>2</sup>	Direct Materials	Conversion Costs	Total
Completed and Transferred Out:			
EU completed and transferred out			
Multiplied by: cost per EU			
Cost assigned to units completed and transferred out			
Ending WIP			
EU in ending WIP			
Multiplied by: Cost per EU			
Cost assigned to units in ending WIP			
Total costs accounted for			

DEPARTMENT 2

Step 1: Summarize the Flow of Physical Units

Step 2: Compute Output in Terms of Equivalent Units

4c <sup>2</sup>	Step 1:	Step 2: Equivalent Units		
	Flow of Physical Units	Transferred-In	Direct Materials	Conversion Costs
Units to account for:				
Beg. WIP				
Plus: Transferred In				
Total units to account for				
Units accounted for:				
Completed and transferred out				
Plus: Ending WIP				
Total physical units accounted for				
Total Equivalent Units				

Step 3: Summarize Total Costs to Account for

Step 4: Compute the Cost per Equivalent Unit

4c <sup>2</sup>	Transferred-In	Direct Materials	Conversion Costs	Total
Beginning WIP				
Plus: Costs added during period				
Total costs to account for				
Divided by: Total Equivalent units				
Cost per Equivalent Unit				

Step 5: Assign Total Costs to Units Completed and to Units in Ending WIP

4c <sup>2</sup>	Transferred-In	Direct Materials	Conversion Costs	Total
Completed and Transferred Out:				
EU completed and transferred out				
Multiplied by: cost per EU				
Cost assigned to units completed and transferred out				
Ending WIP				
EU in ending WIP				
Multiplied by: Cost per EU				
Cost assigned to units in ending WIP				
Total costs accounted for				

**Journal Entries & T-Accounts****Dept. 1**

Transfer Materials to WIP - Dept. 1

Transfer Labor to WIP - Dept. 1

Transfer Overhead to WIP - Dept. 1

Transfer completed good in Dept. 1 to Dept. 2

**Dept. 2**

Transfer Materials to WIP - Dept. 2

Transfer Labor to WIP - Dept. 2

Transfer Overhead to WIP - Dept. 2

Transfer completed good from Dept. 2 to Finished Goods

Department 1		WIP
Beg.		
DM		Trans. to Dept. 2
DL		
OH		
End.		

Department 2		WIP
Beg.		
Trans. In		Trans. To F.G.
DM		
DL		
OH		
End.		

**Results of the Q-Sort (*topic experts*):** The above 11 questions (10 multiple choice and one problem) were the result of 16 total questions. Some questions were eliminated prior to a random selection of 10 multiple choice questions using a number randomizer within Microsoft Excel (i.e. “=RANDBETWEEN(1,16) – results highlighted below). The consensus for each question, by the topic experts, is listed below for each question; if a selection is omitted, then that question was eliminated prior to random selection of the ten viable multiple-choice questions. Question 16 was automatically included as it was the only short-answer question.

- Questions 1 and 5 were eliminated due to lack of consensus between the topic experts
- 4 out of 6 experts agreed with the results (67%) in all categories listed
- All experts (100%) agreed that students should be able to answer questions 4, 6, 7, 8, 9, 10, 13, 14, and 15 at the end of an introductory managerial accounting course
- 5 out of 6 experts (83%) agreed that students should be able to answer questions 2, 3, 11, 12, and 16 at the end of an introductory managerial accounting course.
- All the experts possess terminal degrees in accounting, and all are accounting faculty that have taught introductory managerial accounting on the college level

Original Item #	New Item #	Blooms Category
2	1	Application
3	2	Comprehension
4	3	Knowledge
6		Application
7	4	Application
8	5	Knowledge
9	6	Knowledge
10		knowledge
11	7	Application
12	8	Application
13	9	Comprehension
14		Knowledge
15	10	Knowledge
16	Problem	Application

**Concrete Experience** (*Demonstration of Equivalent Unit Calculation - optional*) - **SOLUTION****Department 1:**

## Information about units:

Beginning WIP	0 units
Started in production during period	1 unit
Completed and transferred to dept. 2	1 unit
Ending WIP (DM added at beginning of process, 60% complete as to Conversion)	0 units

## Information about costs:

Beginning WIP	\$ 0.00
DM used	\$ 2.00
Conversion Costs incurred (\$4.50 = \$2.50 DL + \$2 OH)	

**Department 2 Information:**

## Information about units:

Beginning WIP	1 unit
Transferred in from Dept. 1	1 unit
Completed/Transferred out to Dept. 3	1 unit
Ending WIP (DM added at beginning of the process; 70% complete as to conversion)	1 unit

## Information about costs:

Beginning WIP (transferred-in, \$5.20; DM, \$2.85; Conversion costs, \$3.15)	\$ 11.20
Transferred in from Dept. 1 this period	\$ 6.50
DM cost added this period	\$ 4.10
Conversion cost added this period (DL, \$3.50; OH, \$6.75)	\$ 10.25

**Department 3 Information:**

## Information about units:

Beginning WIP	2 units
Transferred in from Dept. 2	1 unit
Completed/Transferred out to FG	1 unit
Ending WIP (DM added at end of the process; 90% complete as to conversion)	2 units

## Information about costs:

Beginning WIP (transferred-in, \$7.20; DM, \$2.55; Conversion costs, \$5.85)	\$ 15.60
Transferred in from Dept. 2 this period	\$ 17.21
DM cost added this period	\$ 3.20
Conversion cost added this period (DL, \$2.50; OH, \$3.75)	\$ 6.25

**DEPARTMENT 1 Spreadsheet**

Step 1: Summarize the Flow of Physical Units

Step 2: Compute Output in Terms of Equivalent Units

	Step 1:	Step 2: Equivalent Units	
	Flow of Physical Units	Direct Materials	Conversion Costs
Units to account for:			
Beg. WIP	0		
Plus: Started in prod.	1		
Total units to account for	1		
Units accounted for:			
Completed and transferred out	1	1	1
Plus: Ending WIP	0	0	0
Total physical units accounted for	1		
Total Equivalent Units		1	1

Step 3: Summarize Total Costs to Account for

Step 4: Compute the Cost per Equivalent Unit

	Direct Materials	Conversion Costs	Total
Beginning WIP	0	0	
Plus: Costs added during period	\$2	\$4.50	
Total costs to account for	\$2	\$4.50	\$6.50
Divided by: Total Equivalent units	1	1	
Cost per Equivalent Unit	\$2	\$4.50	

## Step 5: Assign Total Costs to Units Completed and to Units in Ending WIP

	Direct Materials	Conversion Costs	Total
Completed and Transferred Out:			
EU completed and transferred out	1	1	
Multiplied by: cost per EU	\$2	\$4.50	
Cost assigned to units completed and transferred out	\$2	\$4.50	\$6.50
Ending WIP			
EU in ending WIP	0	0	
Multiplied by: Cost per EU	\$2	\$4.50	
Cost assigned to units in ending WIP	0	0	0
Total costs accounted for			\$6.50

**DEPARTMENT 2 Spreadsheet**

Step 1: Summarize the Flow of Physical Units

Step 2: Compute Output in Terms of Equivalent Units

	Step 1:	Step 2: Equivalent Units		
	Flow of Physical Units	Transferred-In	Direct Materials	Conversion Costs
Units to account for:				
Beg. WIP	1			
Plus: Transferred In	1			
Total units to account for	2			
Units accounted for:				
Completed and transferred out	1	1	1	1
Plus: Ending WIP	1	1	1	0.7
Total physical units accounted for	2			
Total Equivalent Units		2	2	1.7

Step 3: Summarize Total Costs to Account for

Step 4: Compute the Cost per Equivalent Unit

	Transferred-In	Direct Materials	Conversion Costs	Total
Beginning WIP	\$5.20	\$2.85	\$3.15	\$11.20
Plus: Costs added during period	\$6.50	\$4.10	\$10.25	\$20.85
Total costs to account for	\$11.70	\$6.95	\$13.40	\$32.05
Divided by: Total Equivalent units	2	2	1.7	
Cost per Equivalent Unit	\$5.85	\$3.48	\$7.88	

## Step 5: Assign Total Costs to Units Completed and to Units in Ending WIP

	Transferred-In	Direct Materials	Conversion Costs	Total
Completed and Transferred Out:				
EU completed and transferred out	1	1	1	
Multiplied by: cost per EU	\$5.85	\$3.48	\$7.88	
Cost assigned to units completed and transferred out	\$5.85	\$3.48	\$7.88	\$17.21
Ending WIP:				
EU in ending WIP	1	1	0.7	
Multiplied by: Cost per EU	\$5.85	\$3.48	\$7.88	
Cost assigned to units in ending WIP	\$5.85	\$3.48	\$5.52	\$14.84
Total costs accounted for				\$32.05

**DEPARTMENT 3 Spreadsheet**

Step 1: Summarize the Flow of Physical Units

Step 2: Compute Output in Terms of Equivalent Units

	Step 1:	Step 2: Equivalent Units		
	Flow of Physical Units	Transferred-In	Direct Materials	Conversion Costs
Units to account for:				
Beg. WIP	2			
Plus: Transferred In	1			
Total units to account for	3			
Units accounted for:				
Completed and transferred out	1	1	1	1
Plus: Ending WIP	2	2	0	1.8
Total physical units accounted for	3			
Total Equivalent Units		3	1	2.8

Step 3: Summarize Total Costs to Account for

Step 4: Compute the Cost per Equivalent Unit

	Transferred-In	Direct Materials	Conversion Costs	Total
Beginning WIP	\$7.20	\$2.55	\$5.85	\$15.60
Plus: Costs added during period	\$17.21	\$3.20	\$6.25	\$26.66
Total costs to account for	\$24.41	\$5.75	\$12.10	\$42.26
Divided by: Total Equivalent units	3	1	2.8	
Cost per Equivalent Unit	\$8.14	\$5.75	\$4.32	

## Step 5: Assign Total Costs to Units Completed and to Units in Ending WIP

	Transferred-In	Direct Materials	Conversion Costs	Total
Completed and Transferred Out:				
EU completed and transferred out	1	1	1	
Multiplied by: cost per EU	\$8.14	\$5.75	\$4.32	
Cost assigned to units completed and transferred out	\$8.14	\$5.75	\$4.32	\$18.21
Ending WIP:				
EU in ending WIP	2	0	1.8	
Multiplied by: Cost per EU	\$8.14	\$5.75	\$4.32	
Cost assigned to units in ending WIP	\$16.27	\$0	\$7.78	\$24.05
Total costs accounted for				\$42.26

**SOLUTIONS TO OBJECTIVE QUESTIONS***Abstract Conceptualization:*

## Activity 1: Terms and concepts recognition

From the list of terms/phrases below, determine which items would be considered a process costing term (*anything to do with process costing or the process costing process or affected by the process costing process*) and those that would not. If the term/phrase is not a process costing term/phrase, signify this by drawing a line through the term.

- |  |  |
|--|--|
| 1) Transferred in costs                    | 11) <del>Internal Controls</del>           |
| 2) Completed and transferred out           | 12) Conversion Costs                       |
| 3) <del>Master budget</del>                | 13) <del>Accrual Accounting</del>          |
| 4) <del>Break even point</del>             | 14) <del>Activity Based Costing</del>      |
| 5) <del>Statement of Cash Flows</del>      | 15) <del>Allocation Base</del>             |
| 6) <del>Bank reconciliation</del>          | 16) <del>Predetermined Overhead Rate</del> |
| 7) <del>Depreciation</del>                 | 17) <del>Current Ratio</del>               |
| 8) <del>Financial Statement Analysis</del> | 18) <del>Balance Sheet</del>               |
| 9) <del>Target operating income</del>      | 19) <del>Liquidity</del>                   |
| 10) <del>Make or Buy Decision</del>        | 20) <del>Cost of Goods Sold</del>          |

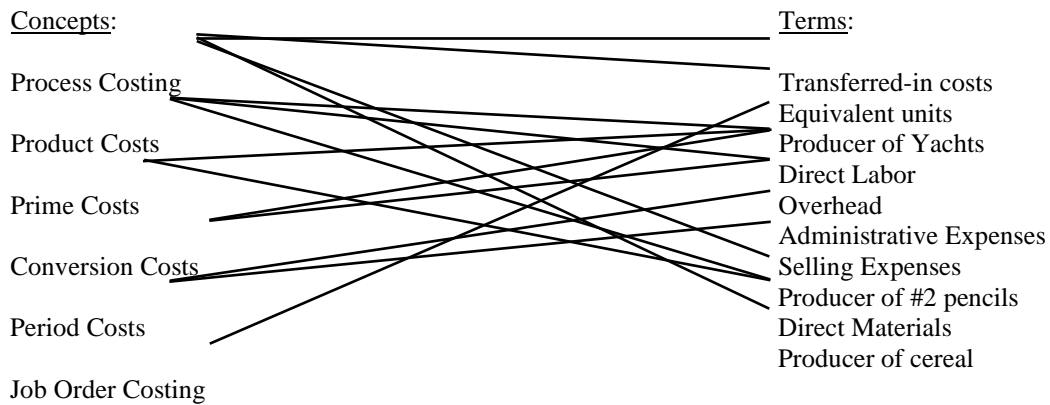
Activity 2: Fact verification

Decide whether the following statements are true or false and then designate how confident you are with your decision with the 3-point scale provided (1 - no idea of the answer; 2 - somewhat confident; 3 - very confident).

		<u>How confident are you?</u>				
1)	Transferred-in costs never appear in the first department in a process costing system	<input checked="" type="radio"/> T	F	1	2	3
2)	Completed and transferred out items from every department are always transferred to finished goods.	T	<input checked="" type="radio"/> F	1	2	3
3)	DM may be added at any point during the process of each department.	<input checked="" type="radio"/> T	F	1	2	3
4)	Conversion costs are always added evenly throughout a production process	<input checked="" type="radio"/> T	F	1	2	3
5)	If materials are added at the beginning of the process, then none of the units are completed as to materials halfway through the process	T	<input checked="" type="radio"/> F	1	2	3

Activity 3: Concepts/Terms grouping

Below you will be provided with a few categories of concepts as well as terms. Your objective is to match the term(s) provided with the over-arching concept that encompasses these terms (*all terms and concepts will be used/matched at least once*). Draw a line connecting the term(s) with the matching concept.



## Activity 4: Cued recall

Using the terms provided, fill-in the blank with the appropriate term (terms may be used more than once or not at all).

Job	Process	Transferred-in	Direct Materials
Conversion Costs	Direct Labor	Overhead Costs	Equivalent units
Allocate	Tracing	Prime Costs	Cost driver

**TRANSFERRED-IN** costs are fully added in a prior department and all units are complete as to these costs in future departments.

**CONVERSION COSTS** are made up of direct labor costs plus overhead costs allocated to a job/product.

**PROCESS** costing is used when identical products are produced over and over.

Direct Labor costs plus Overhead costs allocated to a job convert **MATERIALS** into a finished good.

**JOB** costing is used when a company creates “made-to-order” products or small batches of products.

Direct Materials costs plus Direct Labor costs are called **PRIME COSTS** .

A predetermined overhead rate is calculated using a **COST DRIVER**; the rate is then used to **ALLOCATE** overhead costs to process.

*Active Experimentation:*

Process Steps for each department (use the spreadsheets provided to complete the following tasks):

- 1) Summarize flow of units
- 2) Compute output in terms of Equivalent units
- 3) Summarize the Costs to account for
- 4) Summarize the cost per equivalent unit
- 5) Assign total costs to units completed and to units in Ending WIP
- 6) Journalize all transactions occurring in each department (samples provided)
- 7) Summarize results in a WIP t-account for each department (samples provided)
- 8) Describe what could make up OH costs in this production process

Department 1 Information:

Information about units:

Beginning WIP	1 unit
Started in production during period	2 units
Completed and transferred to dept. 2	2 units
Ending WIP (DM added at beginning of process, 50% complete as to Conversion)	1 unit

Information about costs:

Beginning WIP (DM, \$1.25; Conversion costs, \$3.65)	\$ 4.90
DM used	\$ 3.00
Conversion Costs incurred (\$6.50 = \$2.50 DL + \$4 OH)	

Department 2 Information:

Information about units:

Beginning WIP	2 units
Transferred in from Dept. 1	2 units
Completed/Transferred out to Dept. 3	2 units
Ending WIP (DM added halfway through the process; 65% complete as to conversion)	2 units

Information about costs:

Beginning WIP (transferred-in, \$8.20; DM, \$2.75; Conversion costs, \$5.15)	\$ 16.10
Transferred in from Dept. 1 this period	\$ 10.95
DM cost added this period	\$ 4.10
Conversion cost added this period (DL, \$3.50; OH, \$6.75)	\$ 10.25

**Department 3 Information**

Information about units:

Beginning WIP	2 units
Transferred in from Dept. 2	2 units
Completed/Transferred out to Fin. Goods	1 unit
Ending WIP (DM added at the end of the process; 80% complete as to conversion)	3 units

Information about costs:

Beginning WIP (transferred-in, \$8.45; DM, \$3.10; Conversion costs, \$6.05)	\$ 17.60
Transferred in from Dept. 2 this period	\$ 23.48
DM cost added this period	\$ 3.70
Conversion cost added this period (DL, \$5; OH, \$3.25)	\$ 8.25

**DEPARTMENT 1 Spreadsheet**

Step 1: Summarize the Flow of Physical Units

Step 2: Compute Output in Terms of Equivalent Units

	Step 1:	Step 2: Equivalent Units	
	Flow of Physical Units	Direct Materials	Conversion Costs
Units to account for:			
Beg. WIP	1		
Plus: Started in prod.	2		
Total units to account for	3		
Units accounted for:			
Completed and transferred out	2	2	2
Plus: Ending WIP	1	1	0.5
Total physical units accounted for	3		
Total Equivalent Units		3	2.5

Step 3: Summarize Total Costs to Account for

Step 4: Compute the Cost per Equivalent Unit

	Direct Materials	Conversion Costs	Total
Beginning WIP	\$1.25	\$3.65	
Plus: Costs added during period	\$3	\$6.50	
Total costs to account for	\$4.25	\$10.15	\$14.40
Divided by: Total Equivalent units	3	2.5	
Cost per Equivalent Unit	\$1.42	\$4.06	

Step 5: Assign Total Costs to Units Completed and to Units in Ending WIP

	Direct Materials	Conversion Costs	Total
Completed and Transferred Out:			
EU completed and transferred out	2	2	
Multiplied by: cost per EU	\$1.42	\$4.06	
Cost assigned to units completed and transferred out	\$2.83	\$8.12	\$10.95
Ending WIP			
EU in ending WIP	1	0.5	
Multiplied by: Cost per EU	\$1.42	\$4.06	
Cost assigned to units in ending WIP	\$1.42	\$2.03	\$3.45
Total costs accounted for			\$14.40

**DEPARTMENT 2 Spreadsheet**

Step 1: Summarize the Flow of Physical Units

Step 2: Compute Output in Terms of Equivalent Units

	Step 1:	Step 2: Equivalent Units		
	Flow of Physical Units	Transferred-In	Direct Materials	Conversion Costs
Units to account for:				
Beg. WIP	2			
Plus: Transferred In	2			
Total units to account for	4			
Units accounted for:				
Completed and transferred out	2	2	2	2
Plus: Ending WIP	2	2	1	1.3
Total physical units accounted for	4			
Total Equivalent Units		4	3	3.3

Step 3: Summarize Total Costs to Account for

Step 4: Compute the Cost per Equivalent Unit

	Transferred-In	Direct Materials	Conversion Costs	Total
Beginning WIP	\$8.20	\$2.75	\$5.15	\$16.10
Plus: Costs added during period	\$10.95	\$4.10	\$10.25	\$25.30
Total costs to account for	\$19.15	\$6.85	\$15.40	\$41.40
Divided by: Total Equivalent units	4	3	3.3	
Cost per Equivalent Unit	\$4.79	\$2.28	\$4.67	

## Step 5: Assign Total Costs to Units Completed and to Units in Ending WIP

	Transferred- In	Direct Materials	Conversion Costs	Total
Completed and Transferred Out:				
EU completed and transferred out	2	2	2	
Multiplied by: cost per EU	\$4.79	\$2.28	\$4.67	
Cost assigned to units completed and transferred out	\$9.58	\$4.57	\$9.33	\$23.48
Ending WIP:				
EU in ending WIP	2	1	1.3	
Multiplied by: Cost per EU	\$4.79	\$2.28	\$4.67	
Cost assigned to units in ending WIP	\$9.58	\$2.28	\$6.07	\$17.92*
Total costs accounted for				\$41.40

\* Rounding error

**DEPARTMENT 3 Spreadsheet**

Step 1: Summarize the Flow of Physical Units

Step 2: Compute Output in Terms of Equivalent Units

	Step 1:	Step 2: Equivalent Units		
	Flow of Physical Units	Transferred-In	Direct Materials	Conversion Costs
Units to account for:				
Beg. WIP	2			
Plus: Transferred In	2			
Total units to account for	4			
Units accounted for:				
Completed and transferred out	1	1	1	1
Plus: Ending WIP	3	3	0	2.4
Total physical units accounted for	4			
Total Equivalent Units		4	1	3.4

Step 3: Summarize Total Costs to Account for

Step 4: Compute the Cost per Equivalent Unit

	Transferred-In	Direct Materials	Conversion Costs	Total
Beginning WIP	\$8.45	\$3.10	\$6.05	\$17.60
Plus: Costs added during period	\$23.48	\$3.70	\$8.25	\$35.43
Total costs to account for	\$31.93	\$6.80	\$14.30	\$53.03
Divided by: Total Equivalent units	4	1	3.4	
Cost per Equivalent Unit	\$7.98	\$6.80	\$4.21	

## Step 5: Assign Total Costs to Units Completed and to Units in Ending WIP

	Transferred-In	Direct Materials	Conversion Costs	Total
Completed and Transferred Out:				
EU completed and transferred out	1	1	1	
Multiplied by: cost per EU	\$7.98	\$6.80	\$4.21	
Cost assigned to units completed and transferred out	\$7.98	\$6.80	\$4.21	\$18.99
Ending WIP:				
EU in ending WIP	3	0	2.4	
Multiplied by: Cost per EU	\$7.98	\$6.80	\$4.21	
Cost assigned to units in ending WIP	\$23.95	\$0	\$10.09	\$34.04
Total costs accounted for				\$53.03

## Journal Entries and T-accounts (in \$)

Dept. 1

WIP - Dept. 1	3.00	
Materials		3.00
WIP - Dept. 1	2.50	
Wages Payable		2.50
WIP - Dept. 1	4.00	
Overhead		4.00
WIP - Dept. 1	10.95	
WIP - Dept. 2		10.95

Dept. 2

WIP - Dept. 2	4.10	
Materials		4.10
WIP - Dept. 2	3.50	
Wages Payable		3.50
WIP - Dept. 2	6.75	
Overhead		6.75
WIP - Dept. 3	23.48	
WIP - Dept.		23.48

Dept. 3

WIP - Dept. 3	3.70	
Materials		3.70
WIP - Dept. 3	5.00	
Wages Payable		5.00
WIP - Dept. 3	3.25	
Overhead		3.25
Finished Goods	18.99	
WIP - Dept. 3		18.99

<u>Department 1</u>	<u>WIP</u>	
Beg.	4.90	
DM	3.00	Trans. to Dept. 2 10.95
DL	2.50	
<u>OH</u>	<u>4.00</u>	
End.	3.45	

<u>Department 2</u>	<u>WIP</u>	
Beg.	16.10	
Trans. In	10.95	Trans. to Dept. 3 23.48
DM	4.10	
DL	3.50	
<u>OH</u>	<u>6.75</u>	
End.	17.92	

<u>Department 3</u>	<u>WIP</u>	
Beg.	17.60	
Trans. In	23.48	Trans. To F.G. 18.99
DM	3.70	
DL	5.00	
<u>OH</u>	<u>3.25</u>	
End.	34.04	

**BLANK SPREADSHEETS USED TO CALCULATE EQUIVALENT UNITS**

**DEPARTMENT 1 Spreadsheet**

Step 1: Summarize the Flow of Physical Units

Step 2: Compute Output in Terms of Equivalent Units

	Step 1:	Step 2: Equivalent Units	
	Flow of Physical Units	Direct Materials	Conversion Costs
Units to account for:			
Beg. WIP			
Plus: Started in prod.			
Total units to account for			
Units accounted for:			
Completed and transferred out			
Plus: Ending WIP			
Total physical units accounted for			
Total Equivalent Units			

Step 3: Summarize Total Costs to Account for

Step 4: Compute the Cost per Equivalent Unit

	Direct Materials	Conversion Costs	Total
Beginning WIP			
Plus: Costs added during period			
Total costs to account for			
Divided by: Total Equivalent units			
Cost per Equivalent Unit			

## Step 5: Assign Total Costs to Units Completed and to Units in Ending WIP

	Direct Materials	Conversion Costs	Total
Completed and Transferred Out:			
EU completed and transferred out			
Multiplied by: cost per EU			
Cost assigned to units completed and transferred out			
Ending WIP			
EU in ending WIP			
Multiplied by: Cost per EU			
Cost assigned to units in ending WIP			
Total costs accounted for			

**DEPARTMENT 2 (or future) Spreadsheet**

Step 1: Summarize the Flow of Physical Units

Step 2: Compute Output in Terms of Equivalent Units

	Step 1:	Step 2: Equivalent Units		
	Flow of Physical Units	Transferred-In	Direct Materials	Conversion Costs
Units to account for:				
Beg. WIP				
Plus: Transferred In				
Total units to account for				
Units accounted for:				
Completed and transferred out				
Plus: Ending WIP				
Total physical units accounted for				
Total Equivalent Units				

Step 3: Summarize Total Costs to Account for

Step 4: Compute the Cost per Equivalent Unit

	Transferred-In	Direct Materials	Conversion Costs	Total
Beginning WIP				
Plus: Costs added during period				
Total costs to account for				
Divided by: Total Equivalent units				
Cost per Equivalent Unit				

Step 5: Assign Total Costs to Units Completed and to Units in Ending WIP

	Transferred-In	Direct Materials	Conversion Costs	Total
Completed and Transferred Out:				
EU completed and transferred out				
Multiplied by: cost per EU				
Cost assigned to units completed and transferred out				
Ending WIP:				
EU in ending WIP				
Multiplied by: Cost per EU				
Cost assigned to units in ending WIP				
Total costs accounted for				



Table 1: Descriptive Statistics - Variable, N, Percentage within each Group

Variable	Total		Control		Experimental	
	N	%	N	%	N	%
<b>Gender:</b>	144	100%	72	50%	72	50%
<i>Male</i>	76	53%	48	67%	28	39%
<i>Female</i>	68	47%	24	33%	44	61%
<b>Major:</b>						
<i>Accounting</i>	36	25%	8	11%	28	39%
<i>Other</i>	108	75%	64	89%	44	61%
<b>Letter Grade in Prior Accounting Course:</b>						
<i>A or B</i>	120	83%	60	83%	60	83%
<i>Less than B</i>	24	17%	12	17%	12	17%
<b>Class Standing:</b>						
<i>Junior or Senior</i>	92	64%	52	72%	40	56%
<i>other</i>	52	36%	20	28%	32	44%
<b>First Generation College Student:</b>						
<i>Yes</i>	45	31%	16	22%	28	39%
<i>No</i>	99	69%	56	78%	44	61%
<b>Took Accounting in High School:</b>						
<i>Yes</i>	48	33%	20	28%	28	39%
<i>No</i>	96	67%	52	72%	44	61%
<b>Overall GPA (2.67-4.0=1; Less than 2.67=0):</b>						
<i>2.67-4.0</i>	112	78%	33	46%	39	54%
<i>0-2.67</i>	32	22%	45	63%	27	38%
<b>Perception of Accounting:</b>						
<i>Positive</i>	84	58%	24	33%	36	50%
<i>Negative</i>	60	42%	48	67%	36	50%

Table 2: KnowledgeRetention - Pre-/post-test comparison within groups

	<b>Pre-test</b>	<b>Pre-test</b>	<b>Post-test</b>	<b>Post-test</b>	<b>Post less Pre Score</b>	<b>Post less Pre Score</b>		<b>Wilcoxon</b>
	<b>Mean (StDv)</b>	<b>Median</b>	<b>Mean (StDv)</b>	<b>Median</b>	<b>Gain Mean (StDv)</b>	<b>Median</b>	<b>t</b>	<b>Signed-Rank</b>
Control (N=72)	3.00 (1.26)	3.50	3.07 (0.88)	3.00	0.67 (1.21)	0.00	4.67***	678***
Experimental (N=72)	2.94 (0.98)	3.00	3.22 (0.79)	3.00	0.28 (0.94)	0.00	2.51**	298.00*

\*p &lt; .05; \*\*p &lt; .01; \*\*\*p &lt; .001

Table 3: HigherOrderThinking - Pre-/post-test comparison within groups

	<b>Pre-test</b>	<b>Pre-test</b>	<b>Post-test</b>	<b>Post-test</b>	<b>Post less Pre Score</b>	<b>Post less Pre Score</b>		<b>Wilcoxon</b>
	<b>Mean (StDv)</b>	<b>Median</b>	<b>Mean (StDv)</b>	<b>Median</b>	<b>Gain Mean (StDv)</b>	<b>Median</b>	<b>t</b>	<b>Signed-Rank</b>
Control (N=72)	1.81 (1.05)	2.21	1.93 (0.86)	2.00	0.13	-0.01	0.78	31.00
Experimental (N=72)	1.67 (0.86)	1.27	2.25 (0.64)	2.35	0.58	0.79	6.27***	889.00***

\*p &lt; .05; \*\*p &lt; .01; \*\*\*p &lt; .001