

Cost Accounting: Linking Necessary Concepts

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ABSTRACT

Cost accounting textbooks are designed to introduce a concept in each chapter. Many students approach these chapters as standalone concepts and have a difficult time understanding the big picture of cost accounting and how all the concepts work together inside a real business. One of the AICPA's Core Competencies is linking data and transferring knowledge from one situation to another. While the focus is linking concepts from multiple business decisions, students have to start by doing this within one course. In this paper I present information on the retention of basic cost accounting concepts over the course of one semester and the ability of students to put the information together. The paper includes examples of problems that can help students see the linkages and an end of semester project that requires the use of multiple basic cost accounting concepts.

Keywords: cost accounting, linking concepts

INTRODUCTION

Traditional cost accounting textbooks present concepts in packets of material called chapters with very little interaction between the chapters. Concepts are taught in isolation with very little guidance on how the concepts should actually be linked to make correct business decisions. Further, suggested test questions only test the concept in isolation. An exam may cover multiple chapters, but a student learns to use the concepts in isolation. This does not prepare the student for a real life business situation. In this paper, I look at the ability of students to put multiple cost accounting concepts together to answer a comprehensive accounting problem. I then further suggest an end of semester review project that not only allows for review of multiple concepts; it makes the students think about how the concepts are related.

There has been criticism of accounting education in general because of the focus on mechanical procedural approaches and emphasis on narrow packets of information (American Accounting Association [AAA] 1986, Accounting Education Change Commission, 1992) and a through a joint study with the AAA, the Institute of Management Accountants and the American Institute of Certified Public Accountants it was concluded that current accounting education was not designed to adapt to changes in the business environment (Albrecht and Sack 2000). More recently, members of the Institute of Management Accountants and members of the Management Accounting Section of the American Accounting Association teamed up to address competency issues in accounting education and made suggestions on competency integration (Brewer, et al. (2014) Lawson et al. (2014), Lawson et al. (2015)). Traditional approaches to accounting education limit the ability of the student to move to the higher levels of learning and decision making that is necessary in the current business environment.

Duff and McKinstry (2007) reviewed students' approaches to learning. In their paper they discussed a "deep" and a "surface" approach to learning. "Surface" approach to learning is more associated with memorizing/reproduction and applying while "deep" is more associated with understanding, relating ideas/concepts, and looking for meaning within the material. Using traditional textbooks and testing procedures does not encourage (and possibly discourages) the "deep" approach to learning. While studying a particular chapter a student is not encouraged to relate the new material to previous concepts and testing procedures encourage memorizing a specific procedural approach that they can use to earn the desired grade.

In the next section I will be focusing on an undergraduate cost accounting course. Arguments can be made that it is necessary to move completely away from traditional textbooks and traditional examinations, but that may be too much of a paradigm shift in accounting education at the start. I will argue that some less extreme changes can be made now so that students, at a minimum, develop the skills to apply what they learn to multiple situations and to be able to combine multiple concepts that exist within just one subject.

THE PROBLEM

A typical cost accounting text book will cover cost-volume-profit analysis, job costing, process costing, activity based costing, budgeting, cost behavior, variances, and other concepts under various headings. The normal layout

tries to build upon complexity not necessarily a typical business process. Despite how the textbook is organized or how the instructor covers the textbook, the student should be able to see the larger picture and put two concepts together. This is not always the case.

To understand how cost accounting students are able to apply concepts learned during the course of the semester to a new situation, I developed a comprehensive exam question (Exhibit 1) that brought in multiple concepts together into one problem. The problem was tested in three sections of an undergraduate cost accounting course over three semesters. The mean score for the whole problem was 71% (n=215) and that goes down to 68.9% when the two basic questions on prime and conversion cost are removed.

Exhibit 1 – Comprehensive Problem

Mikey & Jack’s Adventures (MJA) Inc. has one production department. At MJA, all materials are added at the beginning of the process. Labor and overhead are added evenly throughout the process. The following information pertains to work in process for April				
	Physical units	Materials	Direct Labor	Overhead
Beginning work-in-process inventory	1,900 units (40% complete)	\$50,650	\$26,199	\$21,833
Units completed	16,000 units			
Ending work-in-process inventory	1500 units (60% complete)			
Added during April:				
Direct Materials	\$219,200 (8,000 pounds @ \$27.40 per pound)			
Direct Labor	7,250 hours @ \$12 per hour			
Overhead is applied using a predetermined rate of \$10 per direct labor hour				
Additional Information:				
<ul style="list-style-type: none"> • There was not any beginning Finished Goods inventory for April. • MJA sold 15,000 units @ \$40 each • MJA expected to sell 14,000 units @ \$45 each • For actual production MJA expected to use 7,400 hours of DL @ \$11.90 per hour • For actual production MJA expected to use 9,500 pounds of raw materials @ a cost of \$23.50 per pound • MJA had variable Selling & Administrative expense of \$5 per unit • MJA had fixed Selling & Administrative expense of \$27,000 				
Required:				
<ol style="list-style-type: none"> 1. What is the amount of the total prime cost added during April? 2. What is the amount of the total conversion cost added during April? 3. Determine the number of units started in April. 4. Compute the equivalent units using the weighted-average method. 5. Compute the cost per equivalent unit using the weighted-average method. 6. Compute the costs of goods transferred out to finished goods and the ending work-in-process inventory using the weighted-average method. 7. Compute the cost of goods sold (total and per unit) 8. Create a contribution margin income statement for MJA (treat the COGS per unit as variable cost) 9. Calculate the Direct materials usage and price variance (indicate favorable or unfavorable) 10. Calculate the Direct Labor usage and price variance (indicate favorable or unfavorable) 				

While the student is presented multiple pieces of information and has to be able to pick out the appropriate pieces of information for each question, most of the problem is still similar to chapter based work. There are two questions that require the student to integrate a concept from one chapter to another concept initially covered in a different chapter. On question seven students are asked to combine process costing with cost of goods sold. Traditionally, process costing textbook chapters focus on transferred-out cost to the next process. They even usually have a discussion on finishing the last process and transferring the cost to finished goods, but most stop there and do not

take the concept all the way to the sale of such goods (e.g. Horngren, et al 2015, Kinney and Raiborn 2012). Students in cost accounting are usually presented cost of goods sold in the chapter that covers the cost of goods manufactured and sold statements, often at the beginning of the semester. In this simple problem with no beginning inventory, all the student has to do is take the cost flows one step further. The problem requires the student to realize that once the product reaches finished goods that manufacturing cost have ended. Students have to successfully calculate cost per unit to transfer the cost to finished goods. Then to answer problem seven all they have to do is take that cost per unit and multiply it by the number of units sold. Simple enough, but the mean score on problem seven was only 47.7%.

Question Eight does take a detour from reality and states that there were no fixed cost in the manufacturing process. This is in order to keep things simple when creating a contribution margin income statement; cost of goods sold can be viewed as a variable cost. To create the contribution margin income statement the student only has to take the cost of goods sold amount from question seven, and the information given as to the selling and administration cost. To keep grading fair, the answer (right or wrong) the student gives for question seven was carried through to question eight. This basic concept using multiple pieces resulted in a mean score of 68.8%.

The scores on this comprehensive problem indicate that students are either forgetting material as the semester proceeds or are unable to combine multiple concepts and complete a comprehensive problem. Table 1 presents the mean scores for the various parts of the problem

Table 1 - Mean Question Scores

Question #	Mean Score (n=215)
1	86.0%
2	83.7%
3	76.7%
4	73.3%
5	67.4%
6	70.2%
7	47.7%
8	68.8%
9	68.8%
10	70.1%

SUGGESTION FOR HELP

To overcome the problems of forgetting material or the inability to fit multiple concepts together I suggest that a comprehensive style case be used at the end of the semester. Many of the currently available cases are either too complex for the first course of undergraduate cost accounting or only one or two concepts are covered in the case. One quick way to develop a comprehensive style problem is to combine two or three problems from multiple chapters that can be related and combine them into one problem. Exhibit 2 is an example of a problem used in an online class. This problem combines cost estimation (High-low method) and break-even analysis. I have also included some feedback from students on this problem that illustrates how they were not thinking about how multiple concepts fit together.

Exhibit 2 – Sample Multi-concept problem

	Units Produced	Total Cost
Year 1	50,000	425,000
Year 2	60,000	480,000

- 1) Calculate variable cost and fixed cost using the high-low method:
- 2) How many units must be sold to break even at the sales price of \$10?
- 3) Create a contribution margin statement for 55,000 units \$10 sales price

Answers

- 1) Variable rate \$5.50, fixed cost \$150,000
- 2) 33,333.33 → 33,334
- 3) CM = \$247,500, income = \$97,500

Another approach is to create a comprehensive review problem that covers multiple concepts from the perspective of a small company. An example of such a problem is illustrated in Exhibit 3. This problem takes the student through direct cost, overhead, cost estimation, cost-volume-profit relationships, budgeting, process costing, variances, and a special order decision. The problems could be completed in groups, as a take-home project or simply reviewed in class.

Exhibit 3 – Review Project

Given information:

1. Your company produces a basic potato chip. There are three main processes used in the chips. The first process washes and peels the potatoes. The second process slices and fries the potatoes. The third process seasons and packages the chips. The potato chips are sold in 12 oz bags (1 bag is a unit)
2. Information on the direct materials is listed in Table 1 below. Consider this information the standard.
3. Direct labor information given in Table 2 below. Consider this information the standard.
4. Annual overhead information is given in Table 3 below. Overhead is allocated based direct labor hours. Estimated annual direct labor hours are 12,500. Calculate a predetermined OH rate (round to two decimal places if needed). Use this rate when you need to apply OH.
5. Table 4 below gives you the information for the last two months on the overhead cost. Use this information to determine the fixed and variable portions of the cost. (You will need this information to complete Table 5). Machine hours have been determined as the best cost driver for separating mixed cost into their fixed and variable portions. It takes approximately 12 minutes of total machine time for each bag of chips (or 1/5 a machine hour per bag of chips).
6. Table 5 below is where you will list all your production cost, separated into their fixed and variable components.
7. Cost-Volume-Profit (CVP) Relationships
 - a. Selling Price: You sell a bag of chips for \$4.00
 - b. Breakeven point: Calculate the breakeven point. Be sure to include the fixed component of mixed cost in your fixed costs and the variable component in the variable cost. Show your breakeven in Sales units and in Sales Dollars
 - c. Profit Planning: Determine the number of units you must sell to make an annual pre-tax profit using 3 assumptions concerning your net income (profit), both in sales units and sales dollars.
 - i. Aggressive Profit (\$100,000)
 - ii. Conservative Profit (\$25,000)
 - iii. Average Profit (\$60,450)
8. Budgeting:
 - a. Create a sales budget using the information for earning an average profit for the year. You will break the budget down into the four quarters for the year. (Sales tend to be consistent each quarter, you can only sale a whole unit so round-up if necessary)
 - b. Create a production budget for each quarter of the year (keep it in quarters; you do not need to break it down by month). You desire to keep 10% of next quarter's sales in ending inventory. Sales for Qtr 1 the following year are expected to be 30,000 bags of chips. There is not any beginning finished goods inventory for quarter one.

9. Running quarter one -- Weighted-average process costing. Table 6 below presents the information for the packaging department. Complete the questions under Table 6 below.
10. Actuals are in for quarter one. You sold 25% more units than you budgeted for, but price per unit was only \$3.80.
 - a. Calculate revenue
 - b. Compute the cost of goods sold (total and per unit) before adjusting for actual OH cost
11. Actual potato usage for quarter one was 68,000 pounds at a price of \$0.45 per pound. Actual equivalent units of production (bags of chips) completed through the first process (where the potatoes are added) was 29,520. Calculate the direct materials variances for the potatoes (price, usage, and total) and indicate if these variances are favorable or unfavorable.
12. Actual direct labor hours for the quarter were 4,830 at an average rate of \$8.10 per hour. For actual production you expected to use 4,200 direct labor hours. Calculate the direct labor variances (rate, efficiency and total) and indicate if these variances are favorable or unfavorable.
13. For next quarter you have been asked to supply a special order of you potato chips. The non-profit organization requesting this order would like a special bag that will cost \$0.20 instead of the normal \$0.10 per bag. The request is for 10,000 bags of chips. Based on your projections you have the capacity for this order. What is the minimum price per unit and total price you would be willing to accept on this order? (You cannot afford to take this offer at a loss, but you are fine with accepting it at cost).
14. Determine over- or under-applied overhead and close to cost of goods sold. Actual OH cost are given in Table 7 (look at #12 for actual DL hours used to apply OH). Determine the new cost of goods sold amount.

Table 1: Direct Materials

Material	Quantity per unit	Cost	Total per unit
Potatoes	2 lbs	\$0.48	\$0.96
Seasoning	0.1 ounces	\$0.50	\$0.05
Packaging	1 bag	\$0.10	\$0.10
	1/12 box	\$0.48	\$0.04
TOTAL			\$1.15

Table 2: Direct Labor

Job Description	Hours per bag of chips	Rate	Total cost
Potato Washer & Peeler	.05	\$8.00	\$0.40
Slicer & Fryer	.04	\$8.00	\$0.32
Packager	.05	\$8.00	\$0.40
Total	0.14		\$1.12

Table 3: YEARLY OVERHEAD COSTS

Cost Description	Total Cost
Indirect Materials	\$6,000
Indirect Labor	60,010
Machine Maintenance	4,040
Electricity	3,440
Depreciation	4,680
Quality Testing	10,160
TOTAL	\$88,330

Table 4 – Actual Overhead cost for the last two months

	Month 1	Month 2
Indirect Material	\$500	\$500
Indirect Labor	\$5000.83	\$5000.83
Machine Maintenance	\$250	\$290
Electricity	\$200	\$240
Depreciation	\$390	\$390
Quality Testing	\$630	\$730
Machine Hours*	1000	1200

*12 minutes of machine time per bag of chips (1/5 hour = 1 unit)

Table 5: Variable and Fixed Costs

COSTS Description	VARIABLE Cost per unit	FIXED Cost per Year
TOTAL		

If a cost is mixed, put the fixed amount in the fixed column and the variable amount in the variable column.

Process Costing – Packaging Department

Direct materials are added 70% at the beginning of the process and the remaining 30% are added when the chips are 50% complete with the packaging process. Direct labor and overhead are added evenly throughout the process.

Table 6– Unit and cost information

	Physical Units	Cost			
		Transferred -in	Direct Materials	Direct Labor	Overhead
Beg WIP	1,000 (40% complete)	\$2,450	\$110.40	\$165	\$141.44
Transferred In	30,000	\$73,500			
End WIP	2,200 (30% complete)				

Added during Qtr 1:

Direct Materials -- \$4,835.02

Direct Labor – 1,580 hrs @ \$8.10 per hour

Overhead – OH is applied based on predetermined OH rate and actual DL hours

1. Determine the number of units completed during quarter 1.
2. Compute the equivalent units using the weighted average method
3. Compute the cost per equivalent unit using the weighted average method
4. Compute the cost of goods transferred to finished goods inventory
5. Compute the ending balance in WIP, Packaging

Table 7 – Actual OH cost for Quarter 1

Description	Cost
Indirect Materials	\$1,750
Indirect Labor	\$15,000
Machine Maintenance	\$1,416.20
Electricity	\$1,235.75
Depreciation	\$1,050
Quality Testing	\$4,615

1. Amount of applied OH:
2. Amount of actual OH:
3. Under or Over- Applied Amount:
4. New COGS amount:

Answers

4. Calculate a predetermined OH rate: 7.07 (rounded)
5. Fixed: Indirect Materials, Indirect Labor, Depreciation. Variable: Electricity (\$.04 per unit). Mixed: Machine Maintenance (\$.04 per unit & \$600 per year), Quality Testing (\$.10 per unit, \$1560 per year)
6. Variable cost per unit: \$2.45. Annual Fixed cost \$72,850.
7. Cost-Volume-Profit (CVP) Relationships
 - d. Breakeven point: 47,000 units \$188,00 sales dollars
 - e. Profit Planning:
 - iv. Aggressive Profit: 111,517 units \$446,064.52 sales dollars
 - v. Conservative Profit: 63,130 units \$252,516.13 sales dollars
 - vi. Average Profit: 86,000 units \$344,000 sales dollars
8. Budgeting:
 - c. Sales Budget: Each Quarter 21,500 units X 4 = \$86,000
 - d. Production Budget:

	Qtr 1	Qtr 2	Qtr 3	Qtr 4
Sales	21,500	21,500	21,500	21,500
Des End Inventory	2,150	2,150	2,150	3000
Needs	23,650	23,650	23,650	24,500
Beg. Inventory	0	2,150	2,150	2,150
Production	23,650	21,500	21,500	22,350

9. Process costing
 - a. Units completed: 28,800
 - b. Equivalent units: TI 31,000, DM 30,340, Conv 29,460
 - c. Cost per Eq Unit: T1 \$2.45, DM \$0.163, Conv \$0.824
 - d. Finished Goods Inv: \$98,985.60
 - e. Ending WIP: \$6,184.86
10. Actuals are in for quarter one.
 - c. Calculate revenue \$104,006.25
 - d. COGS \$92,369.38
11. DM Variances
 - a. Price \$2,040 Fav
 - b. Usage \$4300.80 Unfav
 - c. Overall \$2260.80 Unfav
12. DL Variances
 - a. Rate \$483 Unfav
 - b. Efficiency \$240 Unfav
 - c. Overall \$723 Unfav
13. Cost per unit \$2.55. Minimum to accept the order \$25,500
14. Overhead
 - a. Applied OH: \$34,148
 - b. Actual OH: \$25,067
 - c. Overapplied OH \$9081
 - d. COGS: \$83,288.23

CONCLUSION

Before future accountants can achieve the AICPA Core Competency of “the ability to link data, knowledge, and insight together from various disciplines to provide information for decision-making” (AICPA, 2008; AICPA, 2012) they need to be able to simply link data and knowledge from one discipline. Undergraduate students struggle with this as illustrated in a basic comprehensive cost accounting problem. One reason for this could be traditional teaching methods and textbooks encourage “surface” learning. Until the accounting education community is ready to change the use of textbooks and testing methods in undergraduate accounting courses something has to be done to encourage the use of “deep” learning.

I suggest the use of a comprehensive problem or case to at least end the semester reviewing what was covered and a method of presenting the concepts in a big picture. It would be better to incorporate such cases and problems throughout the semester after multiple related chapters have been covered. The ultimate learning environment would consistently link concepts possibly in a more Internet type manner focusing on decision making rather than rote memorization of mechanical procedures.

The next step will be to analyze the results of using the comprehensive review problem; does the problem lead to better ability in linking concepts. From there a better environment for “deep” learning can be created.

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