TEACHING COST ACCOUNTING: ALTERNATIVE METHODS FOR CALCULATING EQUIVALENT UNITS

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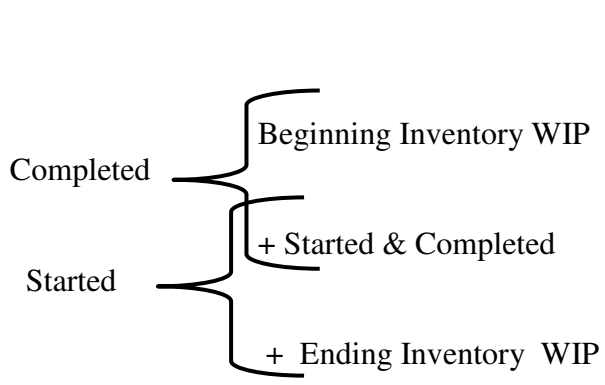
INTRODUCTION

A graduate level managerial/cost accounting course is a required course in most MBA and Masters of Accountancy programs. The course usually focuses on a variety of topics, including job order and process costing. In process costing, students are equally likely to have encountered one of two techniques for calculating equivalent units of production in their prior exposure to process costing, whether it was only in principles of accounting classes (for most MBA students) or principles plus an additional course in cost accounting (for Masters of Accountancy students). Students with prior exposure to one method of calculating equivalent units who are then presented the other method (with no mention of the alternative technique) can feel that the way they are currently seeing presented is perhaps inaccurate since it differs from the way they were originally taught. Alignment of the similarities and differences between the two techniques can be important in not only learning the material, but also in serving future clients who may use either technique. Accordingly, both methods are presented and discussed in the following sections.

OVERVIEW OF CALCULATING EQUIVALENT UNITS OF PRODUCTION

Students first need to be reminded that the term "equivalent units of production" means the equivalent number of whole units produced during a certain time period. For example, if one-half of the work was done on 100 units, that would be equivalent to 50 whole units produced. Next, students need to be cautioned that there are three potholes on the road to successfully calculating equivalent units of production. The first pothole to avoid is the confusion in correctly classifying physical units (both partially and fully completed units) into the following five categories: Beginning Inventory Work-In-Process (BIWIP), Ending Inventory Work-In-Process (EIWIP), units started (S), units started and completed (S&C), and units completed (C). It should also be noted that other names can be used to label the physical units. For example, units started and completed could also be called units started and finished. Units completed can also be called units completed and transferred, units finished, or units finished and transferred. These relationships can be shown as follows:



There are various equations that are often used to show these relationships, such as:

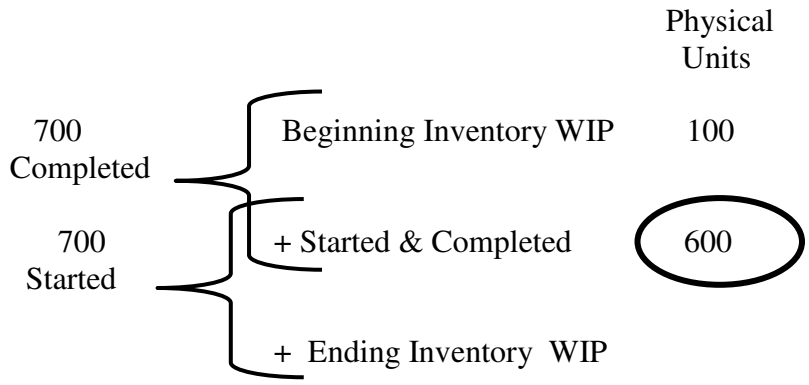
Beginning Inventory WIP + Started = Ending Inventory WIP + Completed

Started and Completed = Started - Ending Inventory
Or
Started and Completed = Completed - Beginning Inventory

An example can often highlight the trickiness of avoiding this pothole:

Suppose Z Company had a beginning inventory of 100 units. During May, 700 units were started and 700 units were completed. Therefore, the number of units both started and completed during May were:
A. 1,400 B. 700 C. 800 D. 600 E. None of the above

By plugging in the numbers, it can be seen that the answer is D. 600 units.



What this means then, (and this is the tricky part) is that the number of units started plus the number of units completed does not equal the number of units both started and completed. This always causes students to do a double take – so it is important to then insert the numbers – the number of units started (700) plus the number of units completed (700) for a total of 1400 units does not equal the number of units both started and completed (600). This does get the students' attention and does alert them to be careful to avoid pothole number one – because if a mistake is made here at the beginning, all the other numbers, no matter how meticulously calculated, will be wrong.

The second pothole to avoid is to be sure to accurately calculate equivalent units for materials added at different points in the production process. The information in process costing problems usually states the percentage of completion for beginning inventory WIP and for ending inventory WIP. For example, suppose beginning inventory WIP is 40 percent complete and ending inventory WIP is 30 percent complete. Students need to be reminded that these percentages apply only to items added evenly – usually direct labor and factory overhead – also known as conversion costs of production. If materials happen to be added evenly, the percentages would then apply to materials, too. However, materials are usually added in a different pattern – and thus the pothole to watch for and avoid. In textbook problems, materials are almost always added at the beginning, with sometimes a second type of materials added at the end. Students need to become comfortable with the fact that materials added at the beginning of production will be 100 percent complete, no matter how complete the production process is. In this

example with beginning inventory WIP being 40 percent complete – if materials are added at the beginning, 100 percent of the materials have been added even though production is only 40 percent complete. A good example to use is the lighting in the classroom. If all the lights are turned on when someone enters the room (at the beginning of production), then even if someone is only 40 percent of the way around the room, 100 percent of the light is present. Alternately, if materials are added at the end of the process (such as being put in a big red box), then even if production is 40 percent complete, zero big red boxes have been added.

The third pothole relates to beginning inventory WIP. As in the example above, if beginning inventory is 40 percent complete, it must be remembered that the 40 percent that is complete (for items added evenly) is from work done in the last time period. The work done this time period to complete the production is not the 40 percent – but the other 60 percent. With materials added at the beginning, 100 percent would have been completed during the last time period, so zero would need to be added to complete production this time period. If added at the end, zero materials would have been added last time period and 100 percent would need to be added this time period to complete production.

TWO ALTERNATIVES FOR CALCULATING EQUIVALENT UNITS OF PRODUCTION

There are two alternatives that are generally used to calculate equivalent units of production. One of the procedures incorporates the analysis used in the section above for properly aligning units in beginning inventory WIP, ending inventory WIP, units started, units completed, and units started and completed. The second procedure does not use this exact alignment. However, the second procedure does arrange the data in a way that avoids the dangers of pothole number three mentioned above. The two methods will give the same answers for equivalent units, and will be illustrated through the use of the following example:

The Ocean Tide Company operates under a process costing system and has one department where no spoilage, waste, or shrinkage is assumed to occur. The following information is available for May:

Work-In-Process Items	Units	Percent Complete	Materials	Labor & Overhead
Beg. Inventory	5,000	40%	$20,500	$ 6,460
Current Costs			$51,000	$28,800
End. Inventory	8,000	30%		

Additional Information:

1. 9,000 units were started and completed during May.
2. Materials are added at the beginning of the process.
3. Conversion costs are added evenly.

Calculation of the equivalent units of production can be done by using one of the two following alternative frameworks:

ALTERNATIVE 1 FOR CALCULATING EQUIVALENT UNITS

	Physical Units	Materials	Labor & Overhead
Completed — Beginning Inventory WIP			
+ Started & Completed			
Started — + Ending Inventory WIP			
Equivalent Units			

ALTERNATIVE 2 FOR CALCULATING EQUIVALENT UNITS

	Physical Units	Materials	Labor & Overhead
Completed + Ending Inventory			
Subtotal - Beginning Inventory			
Equivalent Units			

Started

Substituting in the data for Ocean Tide Company yields the following results:

ALTERNATIVE 1 FOR CALCULATING EQUIVALENT UNITS

		Physical Units	Materials	Labor & Overhead
14,000 Completed	Beginning Inventory WIP	5,000	-0- (2)	3,000 (3)
17,000 Started	+ Started & Completed	+ 9,000 (1)	+ 9,000	+ 9,000
	+ Ending Inventory WIP	+ 8,000	+ 8,000 (4)	+ 2,400 (5)
	Equivalent Units		17,000	14,400

(1) Units Completed = BIWIP + Started & Completed
14,000 = 5,000 + Started & Completed
9,000 = Started & Completed

(2) BIWIP was 40% complete and contained 100% of materials; therefore, -0- was added this month to complete.

(3) BIWIP contained 40% of conversion costs; therefore, 60% was added this month to complete: 60% of 5,000 = 3,000.

(4) EIWIP was 30% complete and contained 100% of materials:
100% of 8,000 = 8,000.

(5) EIWIP contained 30% of conversion costs, all added this month:
30% of 8,000 = 2,400.

ALTERNATIVE 2 FOR CALCULATING EQUIVALENT UNITS

	Physical Units	Materials	Labor & Overhead
Completed	14,000 (1)	14,000	14,000
+ Ending Inventory	+ 8,000	+ 8,000 (100%)	+ 2,400 (30%)
Subtotal	22,000	22,000 (2)	16,400 (2)
- Beginning Inventory	- 5,000	- 5,000 (100%)	- 2,000 (40%)
Equivalent Units	17,000	17,000 (3)	14,400 (3)

Started

(1) Completed - BI = Started and Completed
14,000 - 5,000 = 9,000
OR Completed = BI + Started and Completed
14,000 = 5,000 + 9,000

(2) Weighted-Average Denominators

(3) FIFO Denominators

Again, both alternatives give the same right answers. Alternative 1 focuses just on the exact numbers produced for this time period. Alternative 2 focuses on the total number completed this time period and then subtracts out the numbers from last time period to arrive at the numbers relevant just for this time period. Is one procedure better than the other? Probably not. One positive feature of Alternative 2 is that, as mentioned above, it does avoid pothole number three since the percentage given of 40 percent can be used (subtracted in alternative 2) instead of having to remember that the 40 percent (for items added evenly) is from work done in the prior time period and that the other 60 percent must be used for completing the work this time period (added in alternative 1). A second positive feature of alternative 2 is that the weighted-average denominators needed for calculating per-unit costs are isolated while calculating equivalent units. On the other hand, a negative feature of Alternative 2 is that units both started and completed are not isolated in the calculation of equivalent units, but are needed later when

completing the problem when calculating the value of units transferred out under the FIFO alternative. The important point here, though, is not to determine the better method, but to be sure to present both methods to graduate level managerial/cost accounting students since the textbook will likely have only one of the two methods and some of the students will probably have had the other method in a prior accounting course. Exposure to both methods will allow students with prior exposure to only the method that is not shown in the textbook the opportunity to see why the way presented in the textbook is not inaccurate, even though it differs from the way they were originally taught. Additionally, even if all students in a class had prior exposure only to the method shown in their current textbook, seeing both methods will alert students to possibilities they may encounter later on when they are in the workforce working with clients.

COMPLETION OF THE PROBLEM

While the main focus of the paper is on the two alternatives for calculating equivalent units of production, completion of the problem does allow the plusses and minuses of each method as they relate to the rest of the problem to emerge. Accordingly, the remaining steps to completing the problem are as follows:
Using the FIFO method, prepare schedules for Per-Unit Costs, the Cost of Units Transferred Out (including the journal entry), and the value of Ending Inventory Work-In-Process. Next, repeat the calculations using the Weighted-Average method.

FIFO CALCULATIONS

Step 1 FIFO Per-Unit Costs:

Materials: $51,000 / 17,000 units = $3.00

Conversion Costs: $28,800 / 14,400 units = $2.00

Step 2 Transferred to Finished Goods:

5,000 Units Beginning Inventory :	100% Materials	$ 20,500
	40% Conversion Costs …..	6,460
To Complete: Materials		-0-
Conv. Costs (60%) (5,000) ($2.00)……..		6,000
9,000 Units Started and Completed =		
9,000 ($3.00 + $2.00)		45,000
		$77,960

Journal Entry

Finished Goods		77,960	
	Work-In-Process		77,960

Step 3 Ending Inventory WIP:

Materials:	8,000 units x 100% complete x $3.00 =	$24,000
Conv. Costs:	8,000 units x 30% complete x $2.00 =	4,800
		$28,800

WEIGHTED-AVERAGE CALCULATIONS

Step 1 Weighted-Average Per-Unit Costs:

Materials: [$51,000 + $20,500] / 22,000 units = $3.25

Conversion Costs: [$28,800 + $6,460] / 16,400 units = $2.15

Step 2 Transferred to Finished Goods:

5,000 Units Beginning Inventory
9,000 Units Started and Completed
14,000 Units Completed ($3.25 + $2.15) $75,600

Journal Entry

Finished Goods	75,600	
Work-In-Process		75,600

Step 3 Ending Inventory WIP:

Materials:	8,000 units	x 100% complete	x $3.25 =	$26,000
Conv. Costs:	8,000 units	x 30% complete	x $2.15 =	5,160
				$31,160

SUMMARY AND CONCLUSIONS

This paper presented two alternative procedures for calculating equivalent units of production. The primary focus of the paper is to ensure that a student with prior exposure to one of the procedures does not feel perplexed if he or she encounters only the other procedure in the textbook. Exposure to both methods at the graduate managerial/cost accounting level allows students to assess the plusses and minuses of each alternative for themselves and then allows them to choose the better method from their individual perspectives.