Chapter 4

Lecture Notes

Chapter theme: Managers need to assign costs to products to facilitate external financial reporting and internal decision making. This chapter illustrates an **absorption costing approach** to calculating product costs known as **process costing**.

 1

1. Comparison of job-order and process costing
	1. Similarities between job-order and process costing
		1. Both systems assign material, labor, and overhead costs to products and they provide a mechanism for computing unit product costs.

2

* + 1. Both systems use the same manufacturing accounts, including Raw Materials, Work in Process, Manufacturing Overhead, and Finished Goods.
		2. The flow of costs through the manufacturing accounts is basically the same in both systems.
	1. Differences between job-order and process costing
		1. Process costing is used when a single product is produced on a continuing basis or for a long period of time. Job-order costing is used when many different jobs having different production requirements are worked on each period.

3

* + 1. Process costing systems accumulate costs by department and assign them uniformly to all units processed during the period. Job-order costing systems accumulate costs by individual jobs.

 3

* + 1. Process costing systems compute unit costs by department. Job-order costing systems compute unit costs by job on the job cost sheet.

*Quick Check − process vs. job-order costing*

 4-5

1. Cost flows in process costing
	1. Processing departments − An organizational unit where materials, labor, or overhead costs are added to the product.
		1. The activity performed in a processing department is performed uniformly on all units passing through it. Furthermore, the output of a processing department must be homogeneous.

 6

* + 1. Products in a process costing environment typically flow in a sequence from one department to another.

*Learning Objective 1: Record the flow of materials, labor, and overhead through a process costing system.*

 7

* 1. The flow of materials, labor, and overhead costs
		1. The flow of costs through the manufacturing accounts is basically the same for process and job-order costing.

 8

* + - 1. Direct materials, direct labor, and manufacturing overhead are added to Work in Process. When work in process is completed, the costs are transferred to Finished Goods. When finished goods are sold, the costs are transferred to Cost of Goods Sold.

 8

* + 1. Nonetheless, there is a key fundamental difference between process and job-order costing systems.
			1. Job-order costing systems trace and apply manufacturing costs to jobs.

 9

* + - * 1. One Work in Process account is often used to accumulate costs for all jobs. The individual job cost sheets serve as a subsidiary ledger.
			1. Process costing systems trace and apply manufacturing costs to departments.
				1. A separate Work in Process account is maintained for each processing department.

 10

* + - * 1. Material, labor, and overhead costs transferred from one department’s Work in Process account to another department’s Work in Process account are called transferred-in costs.
		1. T-account and journal entry views of process cost flows (For purposes of this example, assume there are two processing departments—A and B).

 11

*Helpful Hint: Explain that the journal entries for job-order and process costing are similar, with the exception of the specific Work in Process account for each department under process costing.*

* + - 1. The flow of raw material costs.
				1. In T-account form:

Direct material costs are debited to the appropriate departmental Work in Process account depending upon where the materials were added to the production process. The Raw Materials account is credited for the corresponding amounts.

 12

* + - * 1. In journal entry form:

Debit the respective departmental Work in Process accounts. Credit Raw Materials.

 13

* + - 1. The flow of labor costs.
				1. In T-account form:

Direct labor costs are debited to the appropriate departmental Work in Process account depending upon where the labor was added to the production process. Salaries and Wages Payable is credited for the corresponding amounts.

 14

* + - * 1. In journal entry form:

Debit the respective departmental Work in Process accounts. Credit Salaries and Wages Payable.

 15

* + - 1. The flow of manufacturing overhead costs.
				1. In T-account form:

Manufacturing overhead costs are debited to the respective departmental Work in Process accounts. Manufacturing Overhead is credited by the corresponding amounts.

 16

Predetermined overhead rates are usually used to apply overhead to the departments.

* + - * 1. In journal entry form:

Debit the appropriate departmental Work in Process accounts. Credit Manufacturing Overhead.

 17

* + - 1. The flow of manufacturing costs for partially completed units transferred from Department A to Department B:
				1. In T-account form:

The cost of direct materials, direct labor, and manufacturing overhead assigned to partially completed units from Department A is debited to Department B and credited to Department A.

 18

The transferred-in costs from Department A are added to the manufacturing costs incurred in Department B.

* + - * 1. In journal entry form:

Debit Work in Process − Department B and credit Work in Process − Department A.

 19

* + - 1. The flow of manufacturing costs from the final processing department to finished goods.
				1. In T-account form:

Debit Finished Goods and credit Work in Process − Department B for the amount of the cost of goods manufactured.

 20

* + - * 1. In journal entry form:

Debit Finished Goods and credit Work in Process − Department B.

 21

* + - 1. The flow of manufacturing costs from Finished Goods to Cost of Goods Sold.
				1. In T-account form:
1. Debit Cost of Goods Sold and credit Finished Goods.

 22

* + - * 1. In journal entry form:

Debit Cost of Goods Sold and credit Finished Goods.

 23

1. Equivalent units of production
	1. Equivalent units − are defined as the product of the number of partially completed units and the percentage completion of those units.

 24

* + 1. Equivalent units need to be calculated because a department usually has some partially completed units in its beginning and ending inventories. These partially completed units complicate the determination of a department’s output for a given period and the unit cost that should be assigned to that output.

 24

*Helpful Hint: Explain that equivalent units simply restate the ending work in process inventory as if it were comprised of a smaller number of fully completed units.*

* + 1. Equivalent units − the basic idea.
			1. Two half completed products are equivalent to one complete product.

 25

* + - 1. 10,000 units 70% completed are equivalent to 7,000 complete units.

26-27

*Quick Check − calculating equivalent units*

* + 1. Equivalent units can be calculated two ways.
			1. The FIFO method is covered in the appendix.

 28

* + - 1. The weighted-average method is included within the main portion of the chapter and it is covered next.
	1. The weighted-average method of calculating equivalent units

*Learning Objective 2: Compute the equivalent units of production using the weighted-average method.*

 29

* + 1. Characteristics of the weighted-average method:
			1. This method makes no distinction between work done in the prior and current periods. It blends together units and costs from the prior and current periods.

 30

* + - 1. The equivalent units of production for a department are the number of units transferred to the next department (or finished goods) plus the equivalent units in the department’s ending work in process inventory.
		1. Treatment of direct labor
			1. Direct labor costs are often small in comparison to the other product costs in process cost systems.

 31

* + - 1. Therefore, direct labor and manufacturing overhead are often combined into one classification of product cost called conversion costs. The forthcoming example combines these costs.

 32

* + 1. An example of the weighted-average method
			1. Assume that Smith Company’s Assembly Department reported activity for June as shown on this slide.

 33

* + - 1. The first step in calculating the equivalent units is to identify the units completed and transferred out of the department in June (5,400 units for materials and conversion).

 34

* + - 1. The second step is to identify the equivalent units of production in ending work in process with respect to materials for the month (540 units) and adding this to the 5,400 units from step one.

 35

* + - 1. The third step is to identify the equivalent units of production in ending work in process with respect to conversion for the month (270 units) and adding this to the 5,400 units from step one.

 36

*Helpful Hint: Explain that there will most likely be differences in the equivalent unit calculations between materials and conversion costs, as materials are usually added at the beginning of production, while conversion costs are added during the period.*

* + - 1. The equivalent units of production equals the units completed and transferred out (5,400 units) plus the equivalent units remaining in work in process (540 units for materials and 270 units for conversion).

 37

* + - 1. A different visual depiction of the equivalent units calculation for materials is shown on this slide.

 38

* + - 1. A different visual depiction of the equivalent units calculation for conversion is shown on this slide.

 39

*Helpful Hint: The treatment of beginning inventory under the weighted-average method often puzzles students, since work done in the prior periods is included in the equivalent units. Explain that this is called the weighted-average method precisely because it averages together beginning inventory and work performed in the current period. Costs and units are treated consistently. Both the equivalent units and the costs that go into the unit cost calculations under the weighted-average method include amounts already in beginning inventory.*

1. Compute and apply costs

*Learning Objective 3: Compute the cost per equivalent unit using the weighted-average method.*

 40

* 1. Computing the cost per equivalent unit—weighted average method
		1. Assume the following additional facts with respect to Smith Company’s Assembly Department.

 41

* + 1. The formula for computing the cost per equivalent units is as shown.

 42

* + - 1. The numerators for Smith Company ($124,740 for materials and $85,050 for conversion) are computed as shown.

 43

* + - 1. The cost per equivalent unit for materials ($21.00) and conversion ($15.00) is computed as shown.

 44

* + - * 1. The equivalent units of production (5,940 for materials and 5,670 for conversion) were computed on a prior slide.
	1. Applying Costs—Weighted Average Method

*Learning Objective 4: Assign costs to units using the weighted-average method.*

 45

* + 1. Computing the cost of ending work in process inventory.
			1. The first step is to record the equivalent units of production in ending work in process inventory (540 units for materials and 270 units for conversion).

 46

* + - 1. The second step is to record the cost per equivalent unit ($21.00 for materials and $15.00 for conversion).

 47

* + - 1. The third step is to compute the cost of ending work in process inventory ($11,340 for materials, $4,050 for conversion, and $15,390 in total).

 48

* + 1. Computing the cost of units transferred out.
			1. The first step is to record the units transferred out to the next department (5,400 units for materials and conversion).

 49

* + - 1. The second step is to record the cost per equivalent unit ($21.00 for materials and $15.00 for conversion).

 50

* + - 1. The third step is to compute the cost of units transferred out ($113,400 for materials, $81,000 for conversion and $194,400 in total).

 51

*Learning Objective 5: Prepare a cost reconciliation report.*

 52

* + 1. Reconciling costs
			1. Computing the costs to be accounted for:

 53

* + - * 1. The first step is to record the cost of beginning work in process as shown on slide 43 ($10,039).
				2. The second step is to record the costs added to production during the period as shown on slide 43 ($199,751).
				3. The third step is to sum these two costs ($209,790).
			1. Computing the costs accounted for:
				1. The first step is to record the previously computed cost of ending working process inventory ($15,390).
				2. The second step is to record the previously computed cost of units transferred out ($194,400).

 54

* + - * 1. The third step is to sum these two costs ($209,790).
			1. Notice the two totals agree indicating that all costs have been accounted for.
1. Operation costing
	1. Operation costing is a hybrid of job-order and process costing because it possesses attributes of both approaches.
		1. Operation costing is commonly used when batches of many different products pass through the same processing departments.

 55

* + - 1. For example, similar to job-order costing, a shoe manufacturer may charge each batch of shoes for its own specific material costs (e.g., shoes made with expensive leather would be charged accordingly, as would shoes made with inexpensive synthetic materials).
			2. Similar to process costing, the shoe manufacturer may accumulate the labor and overhead costs by department and assign the same conversion cost per unit to each shoe regardless of the shoe style.

 55

1. Appendix 4A: FIFO method (slide 56: title slide)
	1. FIFO vs. weighted-average method
		1. The FIFO method (generally considered more accurate than the weighted-average method) differs from the weighted-average method in two ways:

 57

* + - 1. The computation of equivalent units.
			2. The way in which the costs of beginning inventory are treated.
	1. Equivalent units − FIFO method

*Learning Objective 6: Compute the equivalent units of production using the FIFO method.*

 58

* + 1. Let’s revisit the Smith Company example that was used to illustrate the weighted-average method.
			1. Assume the following activity, as shown on the slide, is reported in the Assembly Department for the month of June.

 59

* + - 1. The first step is to determine the equivalent units needed to complete beginning work in process inventory (180 units for materials and 240 units for conversion).

 60

* + - 1. The second step is to add the units started and completed during the period (5,100 units for materials and conversion).

 61

* + - 1. The third step is to add the equivalent units in ending work in process inventory (540 units for materials and 270 units for conversion).

 62

* + - * 1. This calculation results in 5,820 and 5,610 equivalent units of materials and conversion, respectively.
			1. A different visual depiction of the calculation of equivalent units with respect to materials is as follows.

 63

* + - 1. A different visual depiction of the calculation of equivalent units with respect to conversion is as follows.

 64

* 1. Comparing equivalent units of production under the weighted-average and FIFO methods
		1. The FIFO method removes the equivalent units that were already in beginning inventory from the equivalent units as defined using the weighted-average method. Thus, the FIFO method isolates the equivalent units due to work performed during the current period. This can be illustrated using the Smith Company example as follows:

65

* + - 1. The equivalent units of material produced per the weighted-average method (5,940 units) minus the equivalent units of material in beginning inventory (120 units) equals the equivalent units of production per the FIFO method (5,820 units).
			2. The equivalent units of conversion per the weighted-average method (5,670 units) minus the equivalent units of conversion in beginning inventory (60 units) equals the equivalent units of production per the FIFO method (5,610 units).

 65

*Helpful Hint: The only difference in the equivalent unit calculations between the weighted-average and FIFO methods is that the equivalent units in beginning inventory are included in the weighted-average method. Emphasize again that under the weighted-average method, the costs already in beginning inventory will be added to the costs incurred during the period to arrive at unit costs. To be consistent, equivalent units already in beginning inventory must be added to the equivalent units for work performed during the period.*

* 1. Cost per equivalent unit − FIFO method

*Learning Objective 7: Compute the cost per equivalent unit using the FIFO method.*

 66

* + 1. Recall the following facts with respect to Smith Company’s Assembly Department.

 67

* + 1. The formula for computing the cost per equivalent units is as shown.

 68

* + - 1. The cost per equivalent unit for materials ($20.3816) and conversion ($14.4617) is computed as shown.

 69

* 1. Applying Costs—FIFO Method

*Learning Objective 8: Assign costs to units using the FIFO method.*

 70

* + 1. Computing the cost of ending work in process inventory.
			1. The first step is to record the equivalent units of production in ending work in process inventory (540 units for materials and 270 units for conversion).

 71

* + - 1. The second step is to record the cost per equivalent unit ($20.3816 for materials and $14.4617 for conversion).

 72

* + - 1. The third step is to compute the cost of ending work in process inventory ($11,006 for materials, $3,905 for conversion, and $14,911 in total).

 73

* + 1. Computing the cost of units transferred out
			1. The first component of the computation is to record the cost in beginning work in process inventory ($6,119 for materials, $3,920 for conversion, and $10,039 in total)

 74

* + - 1. The second component of the computation is to compute the cost to complete the units in beginning work in process inventory.
				1. The first step is to record the equivalent units of production required to complete the units in beginning inventory (180 units for materials and 240 units for conversion).

 75

* + - * 1. The second step is to record the cost per equivalent unit ($20.3816 for materials and $14.4617 for conversion).

 75

* + - * 1. The third step is to compute the cost to complete the units in beginning work in process inventory ($3,669 for materials, $3,471 for conversion, and a total of $7,140).
			1. The third component of the computation is to compute the cost of units started and completed this period.
				1. The first step is to record the units started and completed this period (5,100 units for materials and conversion).
				2. The second step is to record the cost per equivalent unit ($20.3816 for materials and $14.4617 for conversion).

 76

* + - * 1. The third step is to compute the cost of units started and completed during this period ($103,946 for materials, $73,755 for conversion, and $177,701 in total).
			1. The final computation is to compute the total cost of units transferred out ($194,880).

 77

*Learning Objective 9: Prepare a cost reconciliation report using the FIFO method.*

 78

* + 1. Reconciling costs
			1. Computing the costs to be accounted for:

 79

* + - * 1. The first step is to record the cost of beginning work in process as shown earlier ($10,039).
				2. The second step is to record the costs added to production during the period as shown earlier ($199,751).
				3. The third step is to sum these two costs ($209,790).
			1. Computing the costs accounted for:
				1. The first step is to record the cost of ending work in process inventory ($14,911).
				2. The second step is to record the cost of units transferred out ($194,879).

 80

* + - * 1. The third step is to sum these two costs ($209,790).
			1. Notice the two totals agree indicating that all costs have been accounted for.
		1. A comparison of costing methods
			1. In most situations, the weighted-average and FIFO methods will produce very similar unit costs, particularly in a lean production environment.

 81

* + - 1. From a cost control standpoint, the FIFO method is superior to the weighted-average method because it does not mix costs of the current period with costs of the prior period.

*Helpful Hint: Remind students that the only difference between the FIFO and weighted-average approaches is the treatment of units in beginning inventory and the costs of beginning inventory. In essence, the weighted-average approach simply combines the units in beginning inventory and the costs of beginning inventory with all other units and all costs incurred during the period. The FIFO method segregates the beginning inventory. Providing that the number of units transferred out is at least as large as the number of units in beginning inventory, the costs already in beginning inventory are simply transferred out under the FIFO method.*

1. Appendix 4B: Service Department Allocations (slide 82 is the title slide)

#### Key definitions/concepts

* + 1. **Operating departments** carry out the central purpose of the organization. Examples of operating departments include:

 83

* + - 1. The Surgery Department at Mt. Sinai Hospital.
			2. The Geography Department at the University of Washington.
			3. The production departments at Mitsubishi.
		1. **Service departments** do not directly engage in operating activities. They provide services or assistance to the operating departments. Examples of service departments include:

 84

* + - 1. Cafeteria, Internal Auditing, Human Resources, and Accounting.
		1. The overhead costs of operating departments frequently include allocations of costs from service departments. To the extent service department costs are classified as production costs, they should be included in unit product costs and thus must be allocated to operating departments in a process costing system.

 85

* + 1. Three approaches are used to allocate service department costs to other departments—**the direct method, the step-down method, and the reciprocal method.**

 86

* + 1. Keep in mind that many service departments provide services to each other, as well as to operating departments. Services provided between service departments are known as **interdepartmental or reciprocal services**.

 87

#### Methods of allocation

*Learning Objective 10: Allocate service department costs to operating departments using the direct method.*

 88

* + 1. **Direct method: a definition**
			1. The direct method is the **simplest** of the three cost allocation methods because it **ignores** the services provided by a service department to other service departments. It allocates all costs **directly** to operating departments.

 89

* + 1. **Direct method: an example**
			1. Assume that a company has two service departments (**Cafeteria and Custodial**) and two operating departments (**Machining and Assembly**) with accompanying information as shown.

 90

* + - 1. **How much of the Cafeteria and Custodial costs should be allocated to each operating department?**

 91

* + - 1. The **Machining Department** would be allocated **$144,000** of the Cafeteria Department’s costs as shown. Notice:
				1. The allocation base is the **number of employees**.

 92

* + - * 1. Quantities of the allocation base attributed to the service departments are **ignored**.
			1. The **Assembly Department** would be allocated **$216,000** of the Cafeteria Department’s costs as shown. Notice:
				1. The sum of the costs assigned to Assembly (**$216,000**) and Machining (**$144,000**) is equal to the total costs assigned from the Cafeteria (**$360,000**).

 93

* + - 1. The **Machining Department** would be allocated **$30,000** of the Custodial Department’s costs as shown. Notice:

 94

* + - * 1. The allocation base is **square feet occupied**.
			1. The **Assembly Department** would be allocated **$60,000** of the Custodial Department’s costs as shown. Notice:

 95

* + - * 1. The sum of the costs assigned to Assembly (**$60,000**) and Machining (**$30,000**) is equal to the total costs assigned from the Custodial Department (**$90,000**).

 95

*Helpful Hint: What to include in the allocation base under the direct method often confuses students. For example, if Personnel Department costs are allocated on headcount, should the Personnel Department headcount and that of other service departments be included? While it doesn’t seem to make much sense economically, the service departments must be excluded to avoid allocating costs back to the service departments.*

*Learning Objective 11: Allocate service department costs to operating departments using the step-down method.*

 96

* + 1. **Step-down method: a definition**
			1. The step-down method provides for allocation of a service department’s costs **to other service departments**, as well as to operating departments. It is **sequential** and the sequence usually begins with the department that provides the **greatest amount of service to other service departments**.

 97

* + - * 1. Once a service department’s costs have been allocated to other departments, other service department costs **are not allocated back to it**.
			1. There are **three key points** to understand regarding the step-down method:
				1. In both the direct and step-down methods, any amount of the allocation base attributable to the service department **whose cost is being allocated** is always **ignored**.
				2. Any amount of the allocation base that is attributable to a service department **whose cost has already been allocated is ignored**.

 98

* + - * 1. Each service department assigns its **own costs** to operating departments plus **the costs that have been allocated to it** from other service departments.
		1. **Step-down method: an example**
			1. Assume the **same facts** that were used for the direct method example.

 99

* + - 1. **How much of the Cafeteria and Custodial costs should be allocated to each operating department?**

 100

* + - * 1. Assume that the Cafeteria costs are allocated **first** followed by the Custodial Department.
			1. The **Custodial Department** would be allocated **$60,000** of the Cafeteria Department’s costs as shown. Notice:

 101

* + - * 1. The allocation base is the **number of employees**, and the quantity of employees in the denominator is **60**.
			1. The **Machining Department** would be allocated **$120,000** of the Cafeteria Department’s costs as shown.

 102

* + - 1. The **Assembly Department** would be allocated **$180,000** of the Cafeteria Department’s costs as shown. Notice:

 103

* + - * 1. The sum of the assigned costs (**$60,000 + $120,000 + $180,000**) equals the total Cafeteria Department costs of **$360,000**.
			1. The **Custodial Department** will allocate **$150,000** in total costs. This amount includes the department’s own costs of **$90,000** plus the amount allocated from the Cafeteria Department of **$60,000**.

 104

* + - 1. The **Machining Department** would be allocated **$50,000** of the Custodial Department’s costs as shown. Notice:

 105

* + - * 1. The allocation base is **square feet occupied**.
			1. The **Assembly Department** would be allocated **$100,000** of the Custodial Department’s costs as shown. Notice:
				1. The sum of the costs assigned to Assembly (**$100,000**) and Machining (**$50,000**) is equal to the total costs assigned from the Custodial Department (**$150,000**).

 106

*Helpful Hint: What to include in the allocation base under the step-down method often confuses students. Never include in the allocation base the service department whose cost is being allocated; once a service department’s cost has been allocated, pretend the department does not exist anymore. In other words, at each step allocate a service department’s costs to the remaining service departments and to all of the operating departments.*

* + 1. **Reciprocal method: a definition**
			1. The reciprocal method gives **full recognition** to interdepartmental services. While the step-down method only allocates costs forward – never backwards – the reciprocal method allocates costs in **both directions**.

 107

* + - 1. Reciprocal allocation requires the use of **simultaneous linear equations** and is beyond the scope our book.

*Helpful Hint: Students may object to the inaccuracies of the step-down method. This gives an opportunity to explain the reciprocal method. Ask students what would happen if every service department’s costs were allocated to all of the service departments (including itself as appropriate). Someone should answer that some costs would still be left in the service departments when the allocations are finished. Ask what would happen if you started over and used the same procedure to allocate the service department costs that remain. Someone should answer that some costs would still be left in the service departments, but the costs would be less than before. In fact, if this process is repeated many times until no costs are left in the service departments, you have essentially performed a reciprocal allocation.*

Quick Check – direct and step-down methods

108-115