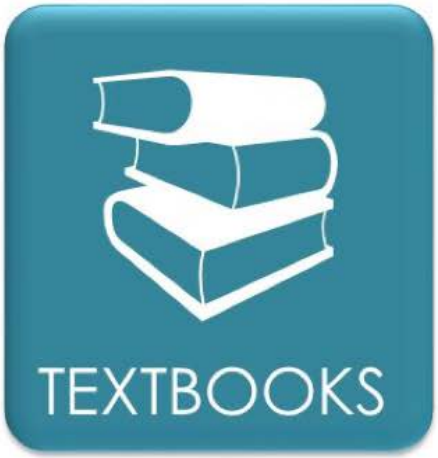
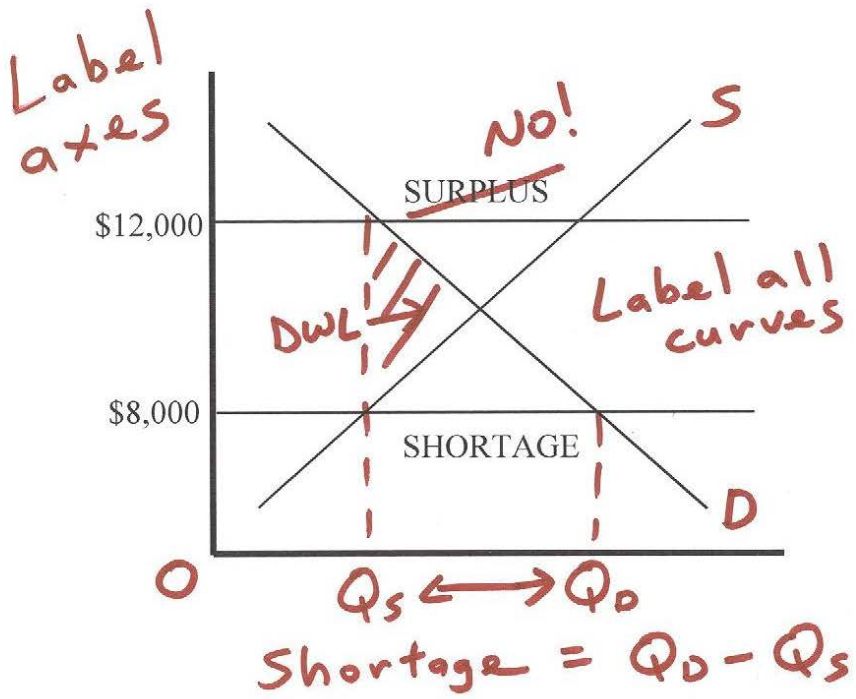
MAKING FORMATIVE ASSESSMENTS REALLY FORMATIVE

EVALUATING THE EFFICACY OF NARRATED FEEDBACK

BY: ERIC CHIANG AND JOSE VAZQUEZ



1. (10 points) Suppose the equilibrium price for on-campus housing is $10,000 a year. The university places a price ceiling of $8,000 to make housing more affordable. Assuming no change in the supply, draw a supply and demand graph to show the effects of the price ceiling, and describe any inefficiencies that may result. If the price ceiling is raised to $12,000, does this change the analysis?



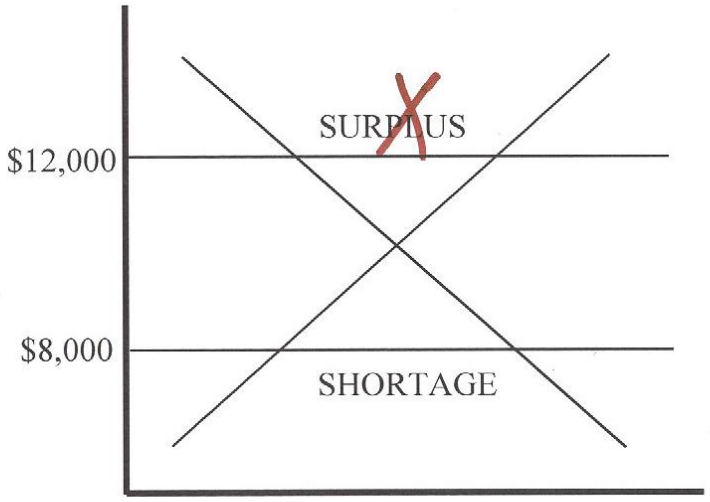
Incomplete analysis

The price ceiling of $8,000 creates a shortage in the market. Deadweight loss is created. Show on graph

A $12,000 price ceiling causes a surplus because it appears above the equilibrium, and deadweight loss is again created. NO effect on market (non-binding)

Score = 6/10

1. (10 points) Suppose the equilibrium price for on-campus housing is $10,000 a year. The university places a price ceiling of $8,000 to make housing more affordable. Assuming no change in the supply, draw a supply and demand graph to show the effects of the price ceiling, and describe any inefficiencies that may result. If the price ceiling is raised to $12,000, does this change the analysis?



6/10

The price ceiling of $8,000 creates a shortage in the market. Deadweight loss is created.

A $12,000 price ceiling causes a surplus because it appears above the equilibrium, and deadweight loss is again created. X

Assignment

#	Stats	ID	Title	Topic	Description

Question 1 Incorrect

After the price ceiling is in place, how many bushels of corn are bought/sold?

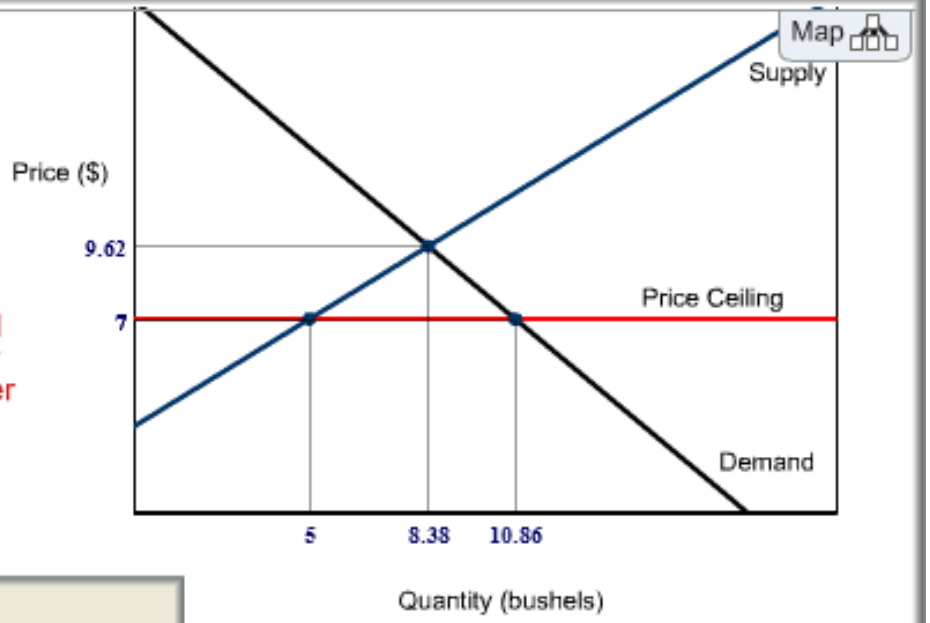
Number: 3 bushels

Incorrect.
For an exchange to occur, a willing buyer and seller are needed. At a price of $7, how many units exist where there are both a willing buyer and seller?

The market is not in equilibrium after the price ceiling is imposed. Rather, there is a _____ of _____ bushels.

- surplus
- shortage

Number: 5 bushels



Suppose the equilibrium price in a market is $10. The government sets a maximum price of $7. This is an example of a(n):

- equilibrium price.
- price ceiling.
- ~~price floor.~~
- fair price.

Nope. The correct answer is not

Report this question

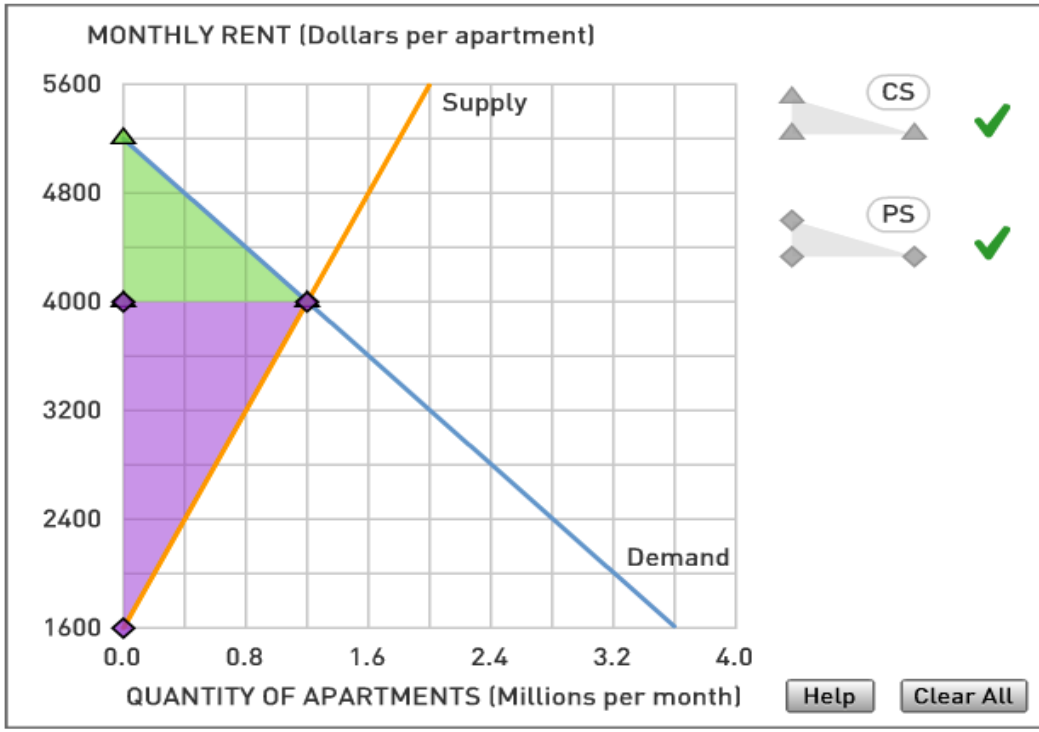
price floor.

→ *A price floor is a minimum price for a good.*

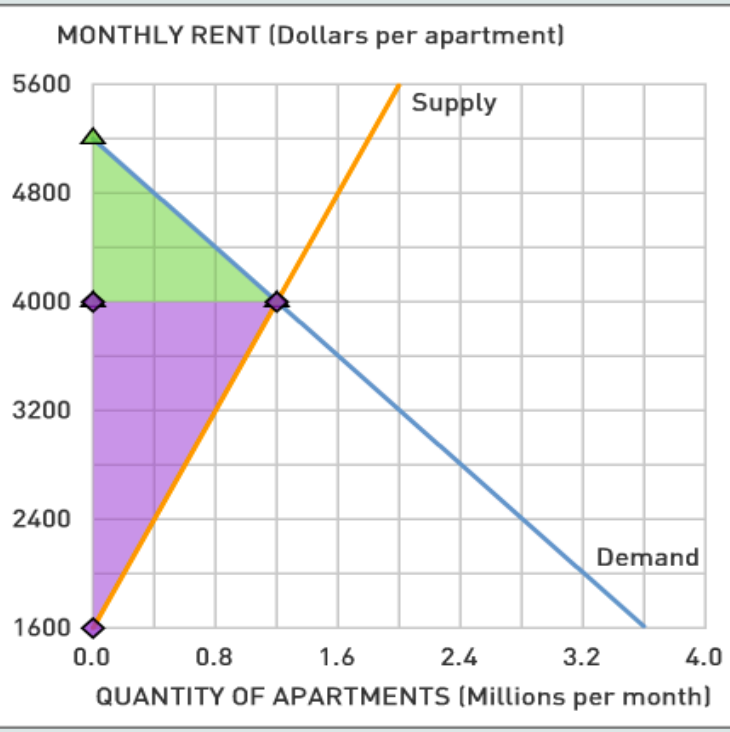
*Try again, **check the e-book**, GET A HINT, or click SHOW ME to see the answer and try another question.*

Get a Hint

Show Me



Answer



Explanation: Close

In the market for apartments, the equilibrium rent is $4,000 per month and the equilibrium quantity is 1.2 million apartments. Consumer surplus is the difference between a buyer's willingness to pay and the price the buyer actually pays, while producer surplus is the difference between the price a seller receives and the seller's cost (or willingness to sell). Therefore, consumer surplus is the triangular area below the demand curve and above the market rent of $4,000, and producer surplus is the triangular area above the supply curve and below the market rent. Mousing over the shaded area, you will find that the consumer surplus is $720 million per month and the producer surplus is $1,440 million per month at equilibrium.


FAU
EXECUTIVE EDUCATION
College of Business
Florida Atlantic University

Online Quiz: Chapter 4

The equilibrium rent in the market for 1-bedroom apartments in your neighborhood is $800. If the government imposes a price ceiling of $400 in this market:

- O More apartments will be available for rent
- O Fewer people will rent apartments
- O More people will rent apartments
- O The same number of apartments will be rented

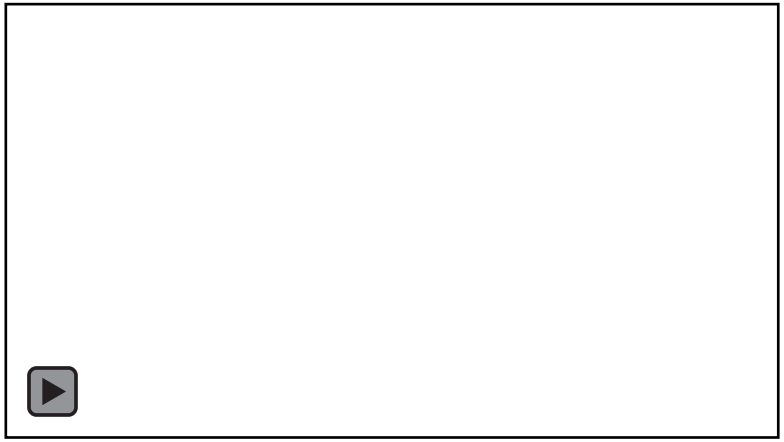
SUBMIT

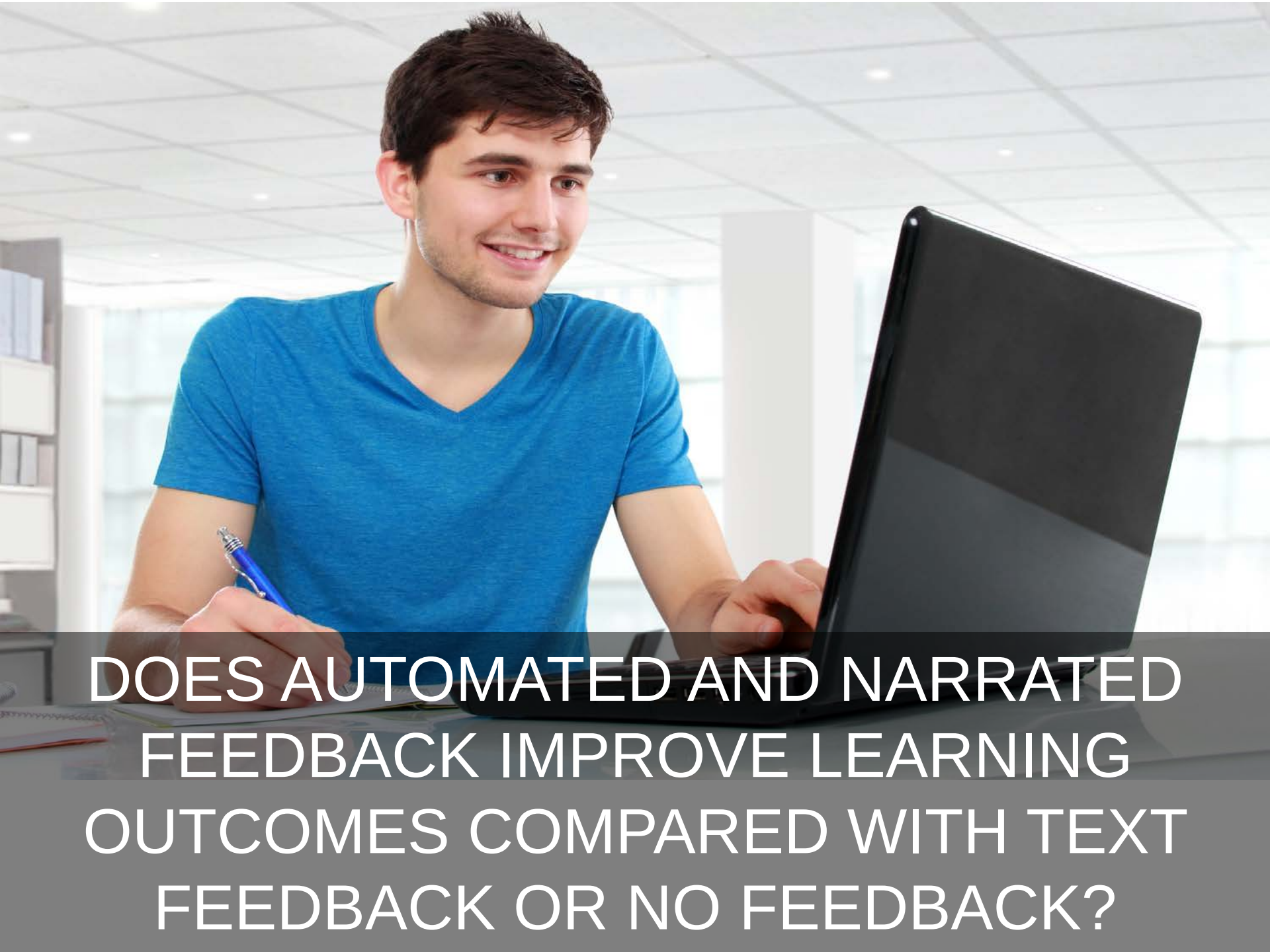
Online Quiz: Chapter 4

The equilibrium rent in the market for 1-bedroom apartments in your neighborhood is $800. If the government imposes a price ceiling of $400 in this market:

Your answer: The same number of apartments will be rented

INCORRECT: The correct answer is: “Fewer people will rent apartments”





DOES AUTOMATED AND NARRATED FEEDBACK IMPROVE LEARNING OUTCOMES COMPARED WITH TEXT FEEDBACK OR NO FEEDBACK?

ECONOMICS EDUCATION RESEARCH

NICOL AND MACFARLANE-DICK (2006)

Studies in Higher Education
Vol. 31, No. 2, April 2006, pp. 199–218

Formative assessment a… regulated learning: a m… principles of good feed…

David J. Nicol[a]* and Debra Macfa…
[a]University of Strathclyde, UK; [b]University of …

The research on formative assessment and feedb… can help students take control of their own learni… mulation is used to identify seven principles of g… A key argument is that students are already s… feedback, and that higher education should b… feedback principle is presented, and some ex… briefly described. This shift in focus, whereby… reactive role in generating and using feedb… teachers organise assessments and support …

Introduction

This article positions the research… model of self-regulated learning… specifically intended to generate … learning (Sadler, 1998). A cent… assessment and feedback shou… learners. The construct of self-… regulate aspects of their thinki… & Zusho, 2002). In practice… and regulation of a number … orientation towards, learnin… ment of resources; the effe… produced.

*Corresponding author: C… Strathclyde, 50 George Stre…

CHASE AND HOUMANFAR (2009)

J Behav Educ (2009) 18:245–265
DOI 10.1007/s10864-009-9089-2

ORIGINAL PAPER

The Differential Effects of Elaborate Feedback and Basic Feedback on Student Performance in a Modified, Personalized System of Instruction Course

Jared A. Chase · Ramona Houmanfar

Published online: 6 August 2009
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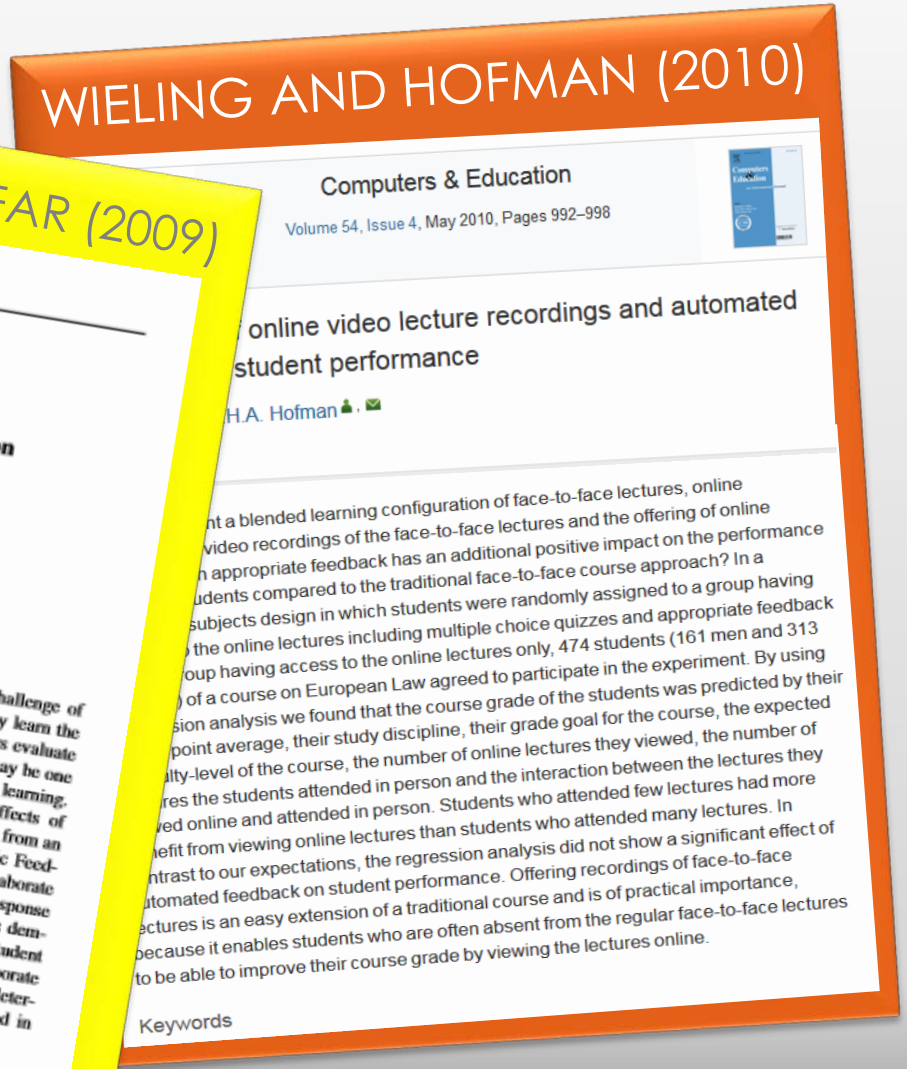
Abstract Educators in large-enrollment courses are faced with the challenge of effectively disseminating information to their students to ensure that they learn the content provided. A related issue involves the means by which instructors evaluate student performance. Offering effective forms of performance feedback may be one technique to provide students with additional information to facilitate learning. Accordingly, the purpose of this investigation was to determine the effects of elaborate feedback and basic feedback on student performance. Two groups from an introductory psychology course participated in the current study. The Basic Feedback Group ($N = 108$) received basic feedback on all quizzes. The Elaborate Feedback Group ($N = 102$) received elaborate feedback on all quizzes. Response accuracy and learning gain were evaluated between groups. Visual analyses demonstrated the relative effectiveness of elaborate feedback on subsequent student performance. Descriptive and inferential statistical analyses revealed that elaborate feedback was beneficial in general and particularly for questions that were determined to be difficult by item analyses. Results and implications are discussed in further detail.

Keywords Elaborate feedback · Basic feedback · Personalized system of instruction (PSI) · Large-enrollment course

WIELING AND HOFMAN (2010)



Computers & Education
Volume 54, Issue 4, May 2010, Pages 992–998

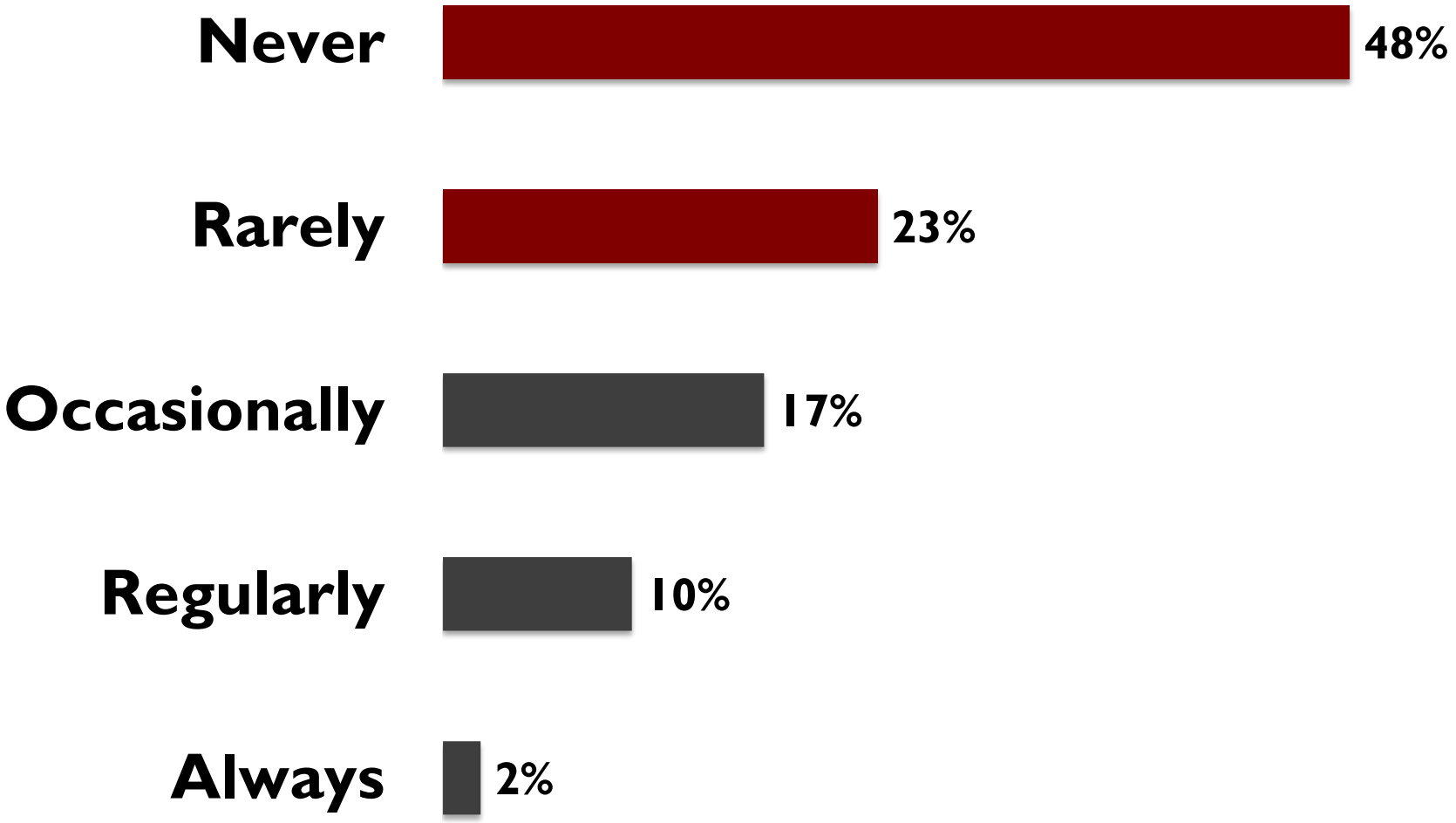
…online video lecture recordings and automated …student performance

…H.A. Hofman

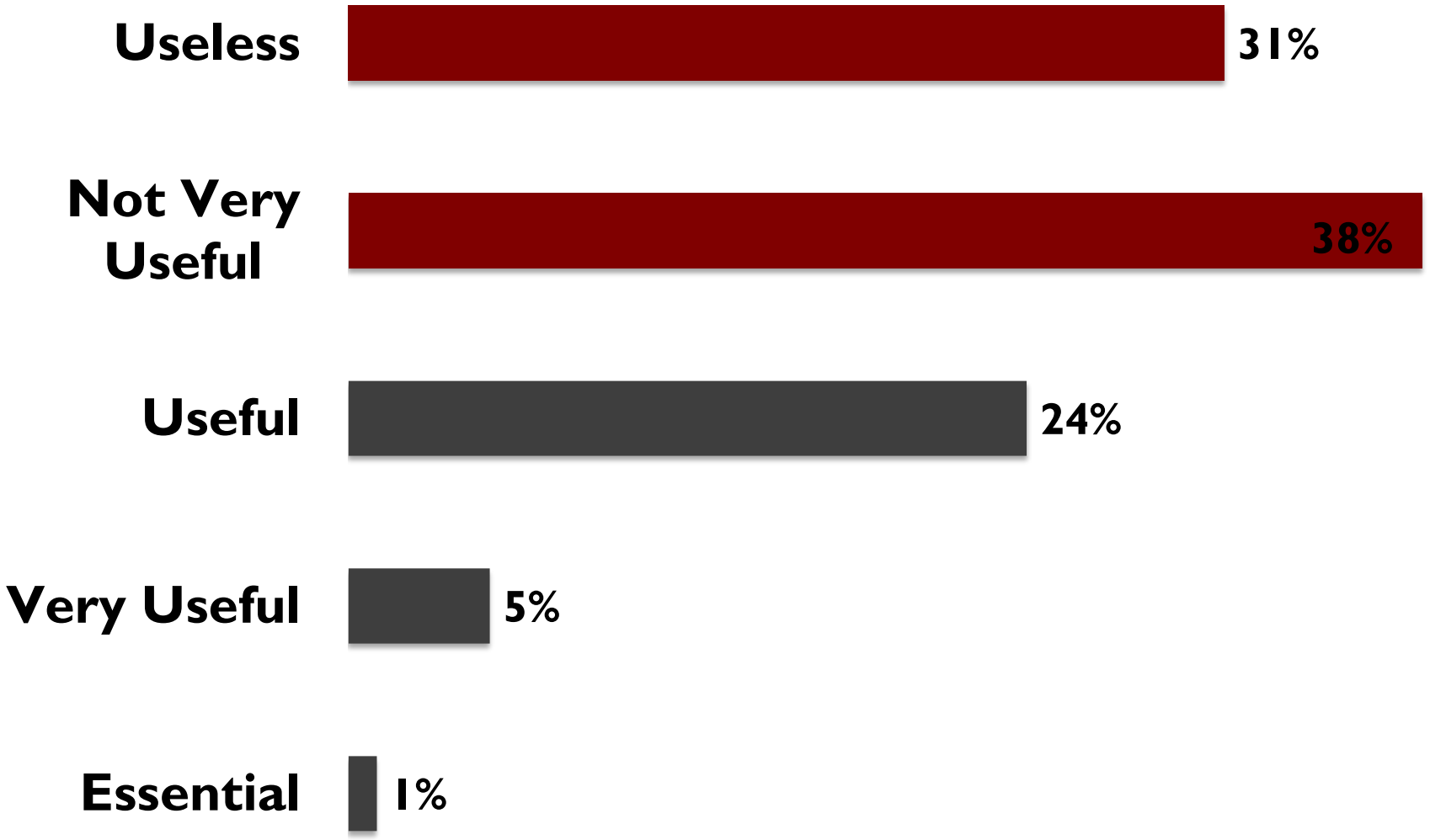
…nt a blended learning configuration of face-to-face lectures, online …video recordings of the face-to-face lectures and the offering of online …h appropriate feedback has an additional positive impact on the performance …udents compared to the traditional face-to-face course approach? In a …subjects design in which students were randomly assigned to a group having …the online lectures including multiple choice quizzes and appropriate feedback …oup having access to the online lectures only, 474 students (161 men and 313 …) of a course on European Law agreed to participate in the experiment. By using …sion analysis we found that the course grade of the students was predicted by their …point average, their study discipline, their grade goal for the course, the expected …lty-level of the course, the number of online lectures they viewed, the number of …res the students attended in person and the interaction between the lectures they …ved online and attended in person. Students who attended few lectures had more …efit from viewing online lectures than students who attended many lectures. In …ntrast to our expectations, the regression analysis did not show a significant effect of …utomated feedback on student performance. Offering recordings of face-to-face …ctures is an easy extension of a traditional course and is of practical importance, …because it enables students who are often absent from the regular face-to-face lectures …to be able to improve their course grade by viewing the lectures online.

Keywords

How often do you read the text before attending class?



How useful do you find the textbook to answer problems before class?



The Square Knot

1) Make an X with the two ends, with the right end on top. Tie an overhand knot, twisting the right end around the left end.

2) With the "new" right and left ends, put the left over the right. Tie another overhand knot.

3) Pull tightly on both all four "parts" emerging from the knot.

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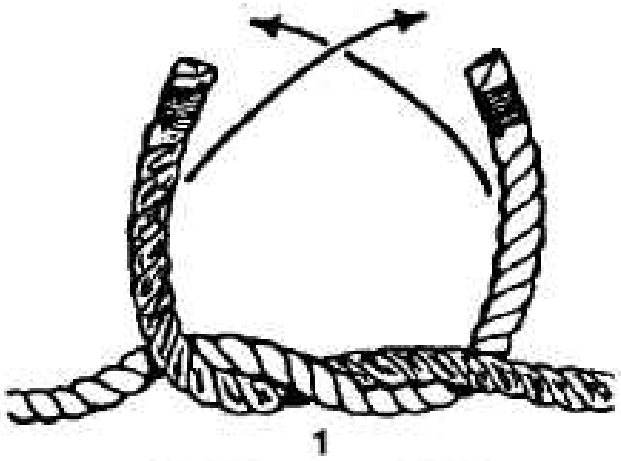

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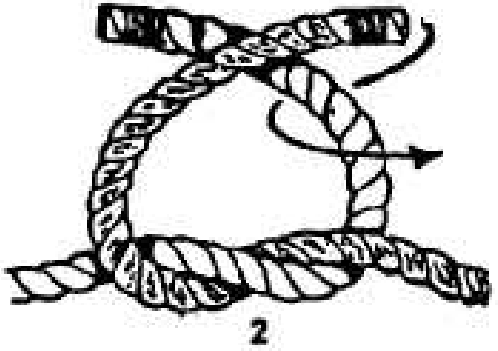
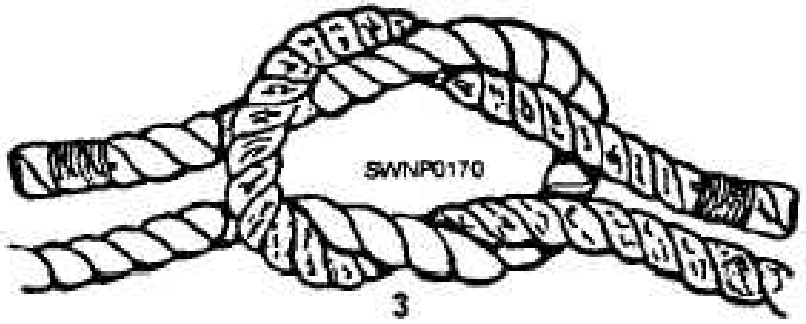
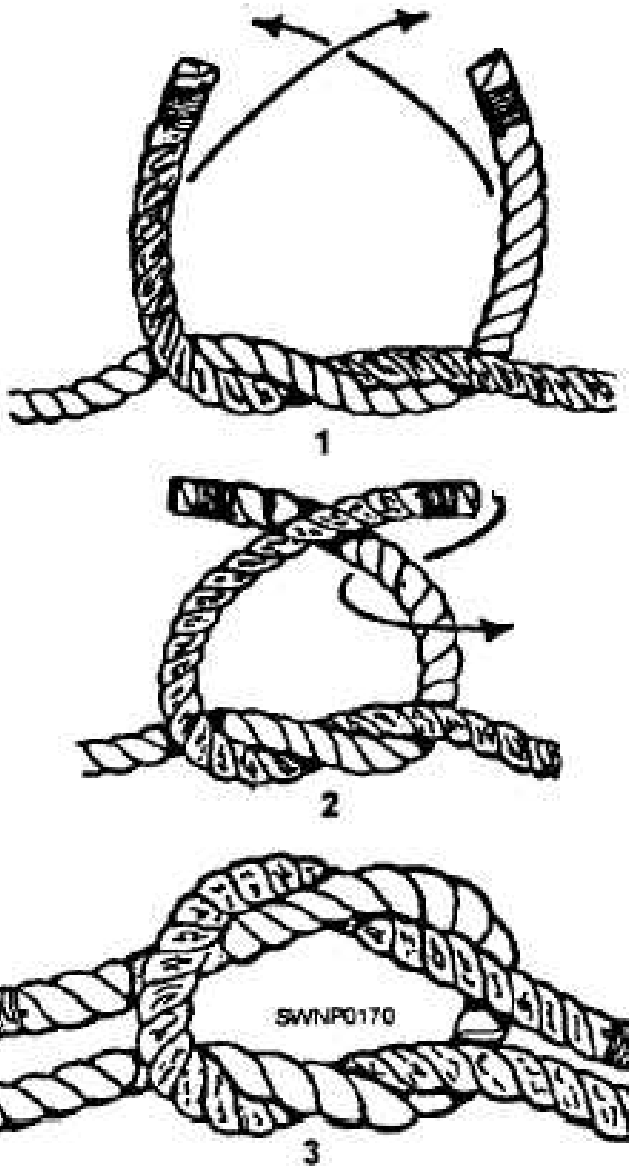


3) Pull tightly on both all four "parts" emerging from the knot.



The Square Knot



Which presentation is more effective?

A. Just text
B. Just pictures
C. Text and pictures
D. Video (narration and pictures)
E. There is no difference

Production and Costs

Firms incur costs when they buy inputs to produce the goods and services that they plan to sell. In this section, we examine the link between a firm's production process and its total cost. Once again, we consider Caroline's Cookie Factory.

In the analysis that follows, we make an important simplifying assumption: We assume that the size of Caroline's factory is fixed and that Caroline can vary the quantity of cookies produced only by changing the number of workers she employs. This assumption is realistic in the short run but not in the long run. That is, Caroline cannot build a larger factory overnight, but she can do so over the next year or two. This analysis, therefore, describes the production decisions that Caroline faces in the short run. We examine the relationship between costs and time horizon more fully later in the chapter.

The Production Function

Table 1 shows how the quantity of cookies produced per hour at Caroline's factory depends on the number of workers. As you can see in the first two columns, if there are no workers in the factory, Caroline produces no cookies. When there is 1 worker, she produces 50 cookies. When there are 2 workers, she produces 90 cookies and so on. Panel (a) of Figure 2 presents a graph of these two columns of numbers. The number of workers is on the horizontal axis, and the number of cookies produced is on the vertical axis. This relationship between the quantity of inputs (workers) and quantity of output (cookies) is called the **production function**.

production function
the relationship between quantity of inputs used to make a good and the quantity of output of that good

Table 1
A Production Function and Total Cost: Caroline's Cookie Factory

Number of Workers	Output (quantity of cookies produced per hour)	Marginal Product of Labor	Cost of Factory	Cost of Workers	Total Cost of Inputs (cost of factory + cost of workers)
0	0		$30	$0	$30
1	50	50	30	10	40
2	90	40	30	20	50
3	120	30	30	30	60
4	140	20	30	40	70
5	150	10	30	50	80
6	155	5	30	60	90

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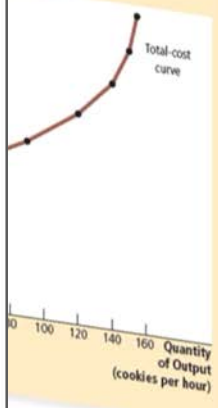
marginal product.

Total-cost curve



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production function
the relationship between quantity of inputs used to make a good and the quantity of output of that good

Table 1

A Production Function and Total Cost: Caroline's Cookie Factory

Number of Workers	Output (quantity of cookies produced per hour)	Marginal Product of Labor	Cost of Factory	Cost of Workers	Total Cost of Inputs (cost of factory + cost of workers)
0	0		$30	$0	$30
		50			
1	50		30	10	40
		40			
2	90		30	20	50
		30			
3	120		30	30	60
		20			
4	140		30	40	70
		10			
5	150		30	50	80
		5			
6	155		30	60	90

marginal product of 30 cookies, and the fourth worker has a marginal product of 20 cookies. This property is called **diminishing marginal product.** At first, when only a few workers are hired, they have easy access to Caroline's kitchen equipment. As the number of workers increases, additional workers have to share equipment and work in more crowded conditions. Eventually, the kitchen is so crowded that the workers start getting in each other's way. Hence, as more and more workers are hired, each additional worker contributes fewer additional cookies to total production.

diminishing marginal product the property whereby the marginal product of an input declines as the quantity of the input increases

Diminishing marginal product is also apparent in Figure 2. The production function's slope ("rise over run") tells us the change in Caroline's output of cookies ("rise") for each additional input of labor ("run"). That is, the slope of the production function measures the marginal product of a worker. As the number of workers increases, the marginal product declines, and the production function becomes flatter.

From the Production Function to the Total-Cost Curve

The last three columns of Table 1 show Caroline's cost of producing cookies. In this example, the cost of Caroline's factory is $30 per hour, and the cost of a worker is $10 per hour. If she hires 1 worker, her total cost is $40 per hour. If she hires 2 workers, her total cost is $50 per hour, and so on. With this information, the table now shows how the number of workers Caroline hires is related to the quantity of cookies she produces and to her total cost of production.

Our goal in the next several chapters is to study firms' production and pricing decisions. For this purpose, the most important relationship in Table 1 is between quantity produced (in the second column) and total costs (in the sixth column). Panel (b) of Figure 2 graphs these two columns of data with the quantity produced on the horizontal axis and total cost on the vertical axis. This graph is called the *total-cost curve*.

Now compare the total-cost curve in panel (b) with the production function in panel (a). These two curves are opposite sides of the same coin. The total-cost curve gets steeper as the amount produced rises, whereas the production function gets flatter as production rises. These changes in slope occur for the same reason. High production of cookies means that Caroline's kitchen is crowded with many workers. Because the kitchen is crowded, each additional worker adds less to production, reflecting diminishing marginal product. Therefore, the production function is relatively flat. But now turn this logic around: When the kitchen is crowded, producing an additional cookie requires a lot of additional labor and is thus very costly. Therefore, when the quantity produced is large, the total-cost curve is relatively steep.

QUICK QUIZ *If Farmer Jones plants no seeds on his farm, he gets no harvest. If he plants 1 bag of seeds, he gets 3 bushels of wheat. If he plants 2 bags, he gets 5 bushels. If he plants 3 bags, he gets 6 bushels. A bag of seeds costs $100, and seeds are his only cost. Use these data to graph the farmer's production function and total-cost curve. Explain their shapes.*

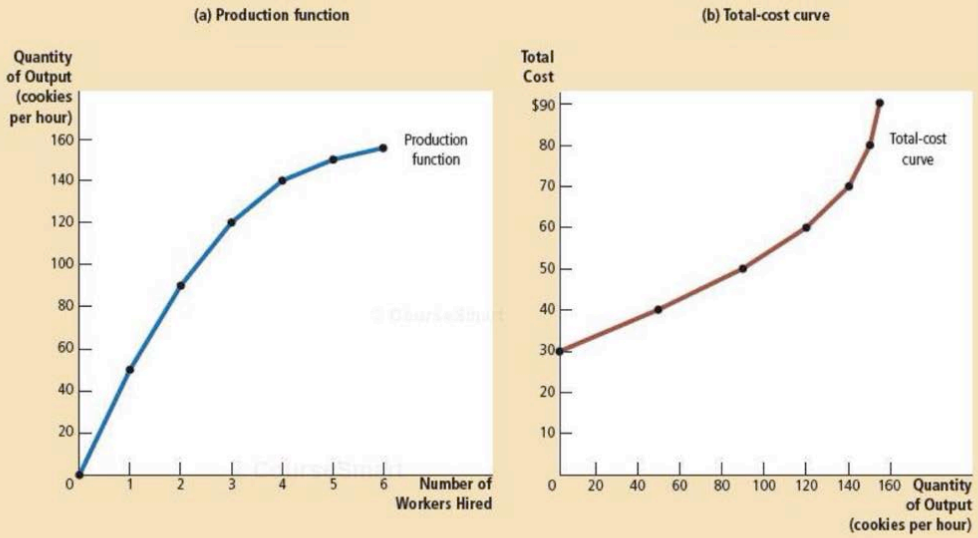
The Various Measures of Cost

Our analysis of Caroline's Cookie Factory demonstrated how a firm's total cost reflects its production function. From data on a firm's total cost, we can derive several related measures of cost, which will turn out to be useful when we analyze

Figure 2

Caroline's Production Function and Total-Cost Curve

The production function in panel (a) shows the relationship between the number of workers hired and the quantity of output produced. Here the number of workers hired (on the horizontal axis) is from the first column in Table 1, and the quantity of output produced (on the vertical axis) is from the second column. The production function gets flatter as the number of workers increases, which reflects diminishing marginal product. The total-cost curve in panel (b) shows the relationship between the quantity of output produced and total cost of production. Here the quantity of output produced (on the horizontal axis) is from the second column in Table 1, and the total cost (on the vertical axis) is from the sixth column. The total-cost curve gets steeper as the quantity of output increases because of diminishing marginal product.



marginal product
the increase in output that arises from an additional unit of input

One of the *Ten Principles of Economics* introduced in Chapter 1 is that rational people think at the margin. As we will see in future chapters, this idea is the key to understanding the decisions a firm makes about how many workers to hire and how much output to produce. To take a step toward understanding these decisions, the third column in the table gives the marginal product of a worker. The **marginal product** of any input in the production process is the increase in the quantity of output obtained from one additional unit of that input. When the number of workers goes from 1 to 2, cookie production increases from 50 to 90, so the marginal product of the second worker is 40 cookies. And when the number of workers goes from 2 to 3, cookie production increases from 90 to 120, so the marginal product of the third worker is 30 cookies. In the table, the marginal product is shown halfway between two rows because it represents the change in output as the number of workers increases from one level to another.

Notice that as the number of workers increases, the marginal product declines. The second worker has a marginal product of 40 cookies, the third worker has a

average total cost does not vary with the level of output, there are said to be **constant returns to scale.** In this example, Ford has economies of scale at low levels of output, constant returns to scale at intermediate levels of output, and diseconomies of scale at high levels of output.

constant returns to scale
the property whereby long-run average total cost stays the same as the quantity of output changes

What might cause economies or diseconomies of scale? Economies of scale often arise because higher production levels allow *specialization* among workers, which permits each worker to become better at a specific task. For instance, if Ford hires a large number of workers and produces a large number of cars, it can reduce costs with modern assembly-line production. Diseconomies of scale can arise because of *coordination problems* that are inherent in any large organization. The more cars Ford produces, the more stretched the management team becomes, and the less effective the managers become at keeping costs down.

This analysis shows why long-run average-total-cost curves are often U-shaped. At low levels of production, the firm benefits from increased size because it can take advantage of greater specialization. Coordination problems, meanwhile, are not yet acute. By contrast, at high levels of production, the benefits of specialization have already been realized, and coordination problems become more severe as the firm grows larger. Thus, long-run average total cost is falling at low levels of production because of increasing specialization and rising at high levels of production because of increasing coordination problems.

QUICK QUIZ *If Boeing produces 9 jets per month, its long-run total cost is $9.0 million per month. If it produces 10 jets per month, its long-run total cost is $9.5 million per month. Does Boeing exhibit economies or diseconomies of scale?*

FYI

Lessons from a Pin Factory

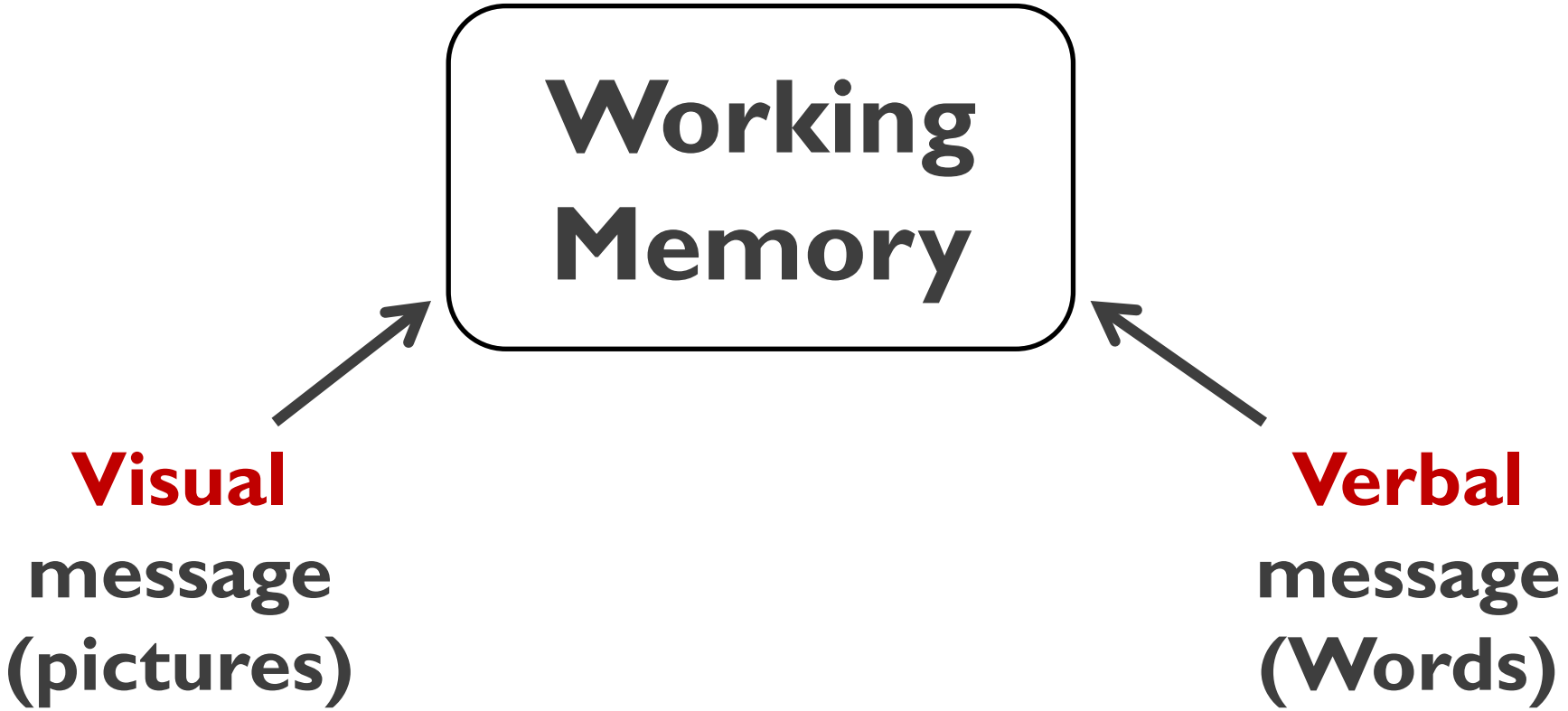
"Jack of all trades, master of none." This well-known adage helps explain why firms sometimes experience economies of scale. A person who tries to do everything usually ends up doing nothing very well. If a firm wants its workers to be as productive as they can be, it is often best to give each worker a limited task that he or she can master. But this is possible only if a firm employs many workers and produces a large quantity of output.

In his celebrated book *An Inquiry into the Nature and Causes of the Wealth of Nations*, Adam Smith described a visit he made to a pin factory. Smith was impressed by the specialization among the workers and the resulting economies of scale. He wrote,

> *One man draws out the wire, another straightens it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head; to make the head requires two or three distinct operations; to put it on is a peculiar business; to whiten it is another; it is even a trade by itself to put them into paper.*

Smith reported that because of this specialization, the pin factory produced thousands of pins per worker every day. He conjectured that if the workers had chosen to work separately, rather than as a team of specialists, "they certainly could not each of them make twenty, perhaps not one pin a day." In other words, because of specialization, a large pin factory could achieve higher output per worker and lower average cost per pin than a small pin factory.

The specialization that Smith observed in the pin factory is prevalent in the modern economy. If you want to build a house, for instance, you could try to do all the work yourself. But most people turn to a builder, who in turn hires carpenters, plumbers, electricians, painters, and many other types of workers. These workers specialize in particular jobs, and this allows them to become better at their jobs than if they were generalists. Indeed, the use of specialization to achieve economies of scale is one reason modern societies are as prosperous as they are.


Working Memory
Visual
message
(pictures)
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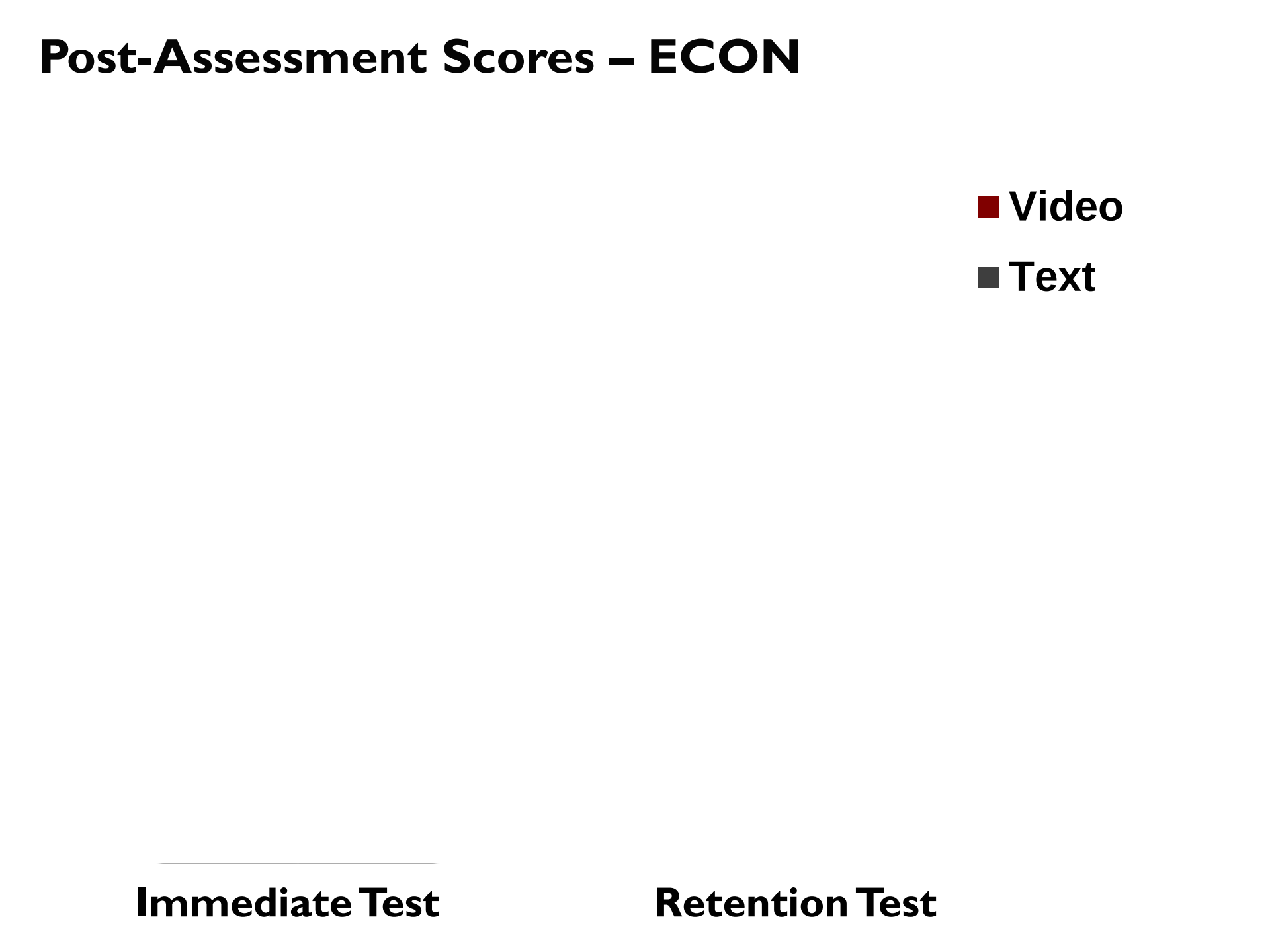
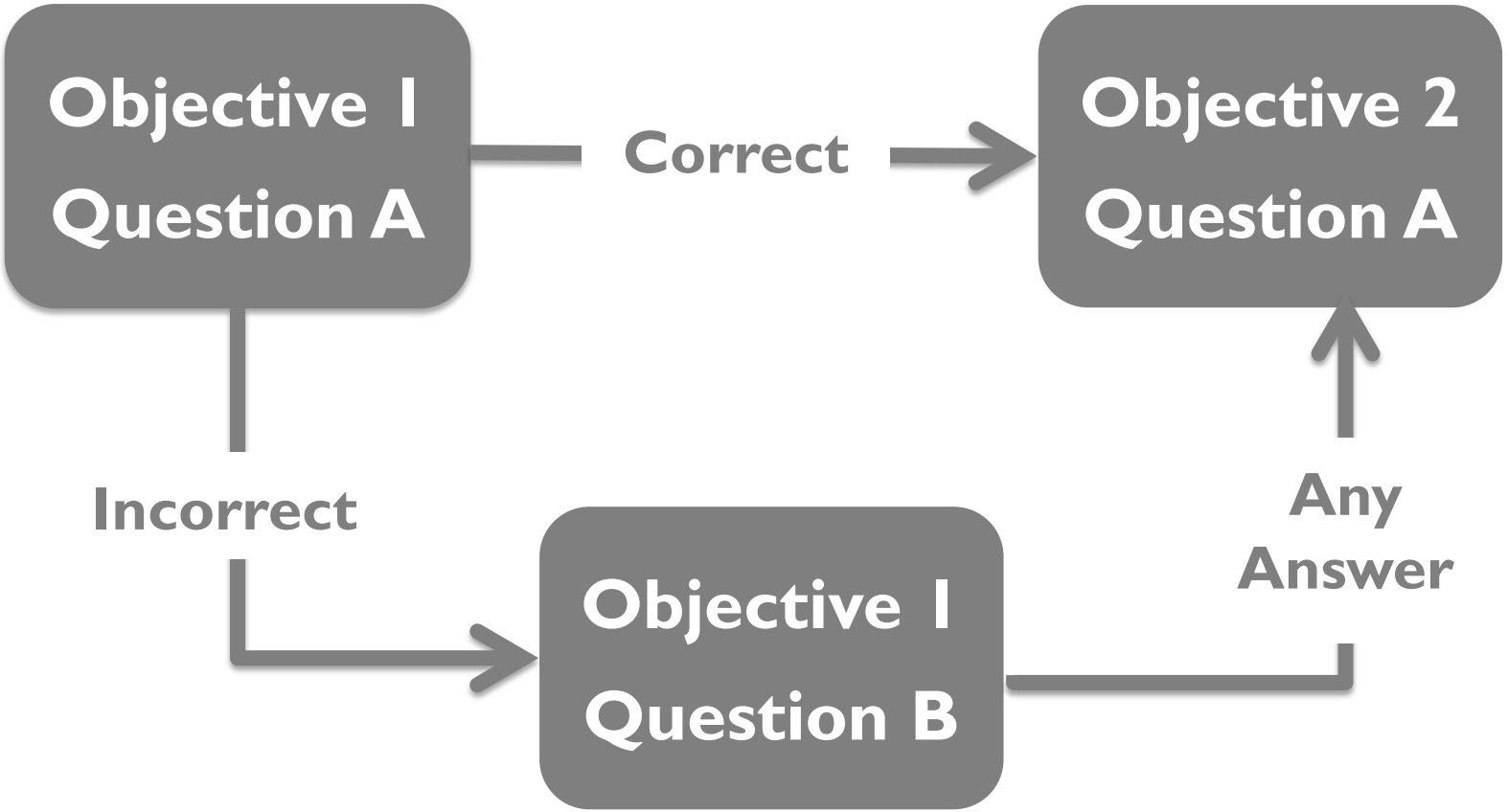
(Words)

Post-Assessment Scores – ECON




Objective 1
Question A
Correct
Objective 2
Question A
Incorrect
Objective 1
Question B
Any
Answer

Online Quiz: Chapter 4

The equilibrium rent in the market for 1-bedroom apartments in your neighborhood is $800. If the government imposes a price ceiling of $400 in this market:

- O More apartments will be available for rent
- O Fewer people will rent apartments
- O More people will rent apartments
- O The same number of apartments will be rented

SUBMIT

Online Quiz: Chapter 4

The equilibrium rent in the market for 1-bedroom apartments in your neighborhood is $800. If the government imposes a price ceiling of $400 in this market:

Your answer: The same number of apartments will be rented

INCORRECT: The correct answer is: "Fewer people will rent apartments"

CONTINUE

Online Quiz: Chapter 4

The equilibrium rent in the market for 1-bedroom apartments in your neighborhood is $800. If the government imposes a price ceiling of $400 in this market:

Your answer: The same number of apartments will be rented

INCORRECT: The correct answer is: "Fewer people will rent apartments"

Explanation: A price ceiling is a type of price control preventing sellers from increasing their price above that set price. In this situation, a price ceiling of $400 prevents any landlord from charging rent higher than $400. A reduction in price would increase quantity demanded.

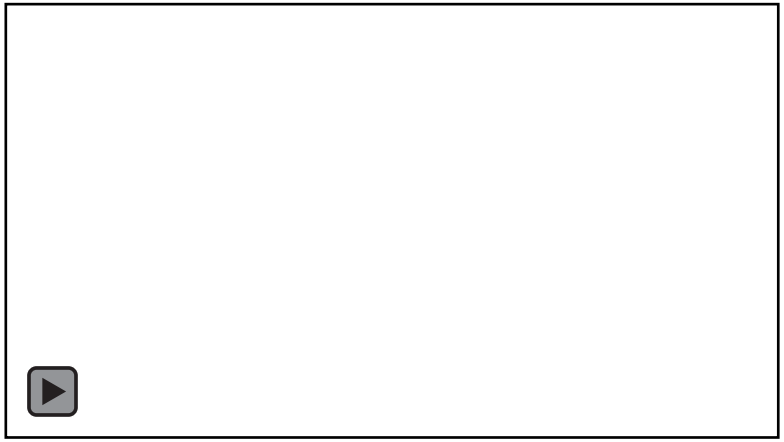
However, some landlords cannot cover their costs at the lower price, thereby reducing the quantity supplied. Although more apartments are desired at the lower price, fewer are actually supplied, resulting in a shortage. The result is that fewer people will rent apartments.

Online Quiz: Chapter 4

The equilibrium rent in the market for 1-bedroom apartments in your neighborhood is $800. If the government imposes a price ceiling of $400 in this market:

Your answer: The same number of apartments will be rented

INCORRECT: The correct answer is: “Fewer people will rent apartments”



Descriptive results

	No Feedback (n = 224)	Text (n = 232)	Video (n = 224)
ACT Composite	29.33 (.218)	29.09 (.234)	29.64 (.224)
Age	19.562 (.0776)	19.447 (.0771)	19.441 (.0733)
Econ Course Credit Earned	3.97 (.122)	4.08 (.128)	3.99 (.120)
Gender	.62 (.032)	.55 (.032)	.67 (.031)
Math Course Credit Earned	6.12 (.329)	5.89 (.356)	5.41 (.292)
Student Class	1.98 (.063)	2.00 (.062)	1.91 (.059)
Cumulative GPA	3.2258 (.03448)	3.2511 (.03571)	3.2466 (.03457)
Student Performance	.3625*** (.02206)	.3973*** (.02172)	.4643*** (.02301)

*** = p < 0.01; ** = p < 0.05

Descriptive results

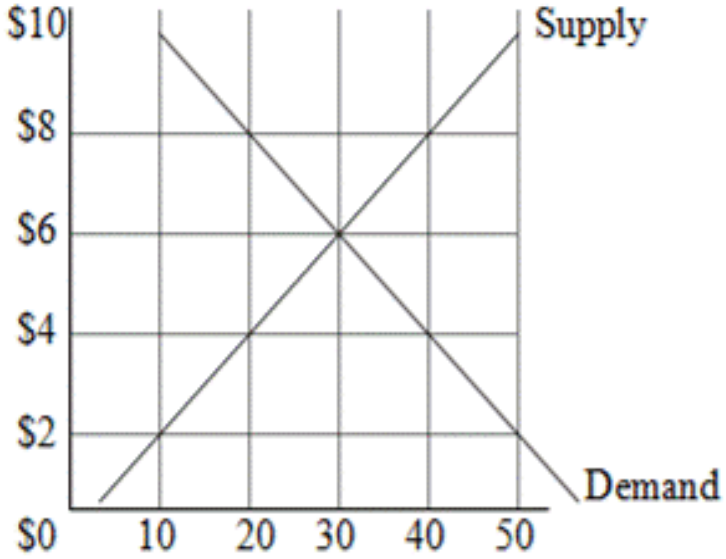
Q	%	No Feed	Text	Video
PC1	46%	1.04	1.12	1.00
PC2	37%	1.36	1.36	1.00
PC3	45%	2.07	1.26	1.00
PC4	27%	1.55	1.31	1.00
E1	25%	1.08	1.08	1.00
E2	84%	1.01	0.88	1.00
E3	45%	1.73	1.24	1.00
E4	46%	0.96	0.98	1.00

Descriptive results

Q	%	No Feed	Text	Video
PC1	46%	1.04	1.12	1.00
PC2	37%	1.36	1.36	1.00
PC3	45%	2.07	1.26	1.00
PC4	27%	1.55	1.31	1.00
E1	25%	1.08	1.08	1.00
E2	84%	1.01	0.88	1.00
E3	45%	1.73	1.24	1.00
E4	46%	0.96	0.98	1.00

Question PC2

In the following diagram showing the demand and supply for basketball tickets, which of the following policies would create a surplus of 20 units?



a) a price floor of $8
b) a price ceiling of $8
c) a price floor of $4
d) a price ceiling of $4

Question PC3

Which of the following would likely increase deadweight loss in the market for grapes?

a) lowering an effective price ceiling from $2 to $1.50 per pound
b) lowering an effective price floor from $3 to $2 per pound
c) raising an effective price ceiling from $3 to $4 per pound
d) none of the above would increase deadweight loss

Question E3

A luggage store estimates the price elasticity of its carry-on cases to be equal to 3. If the store discounts its carry-on cases by 10%, what would be the resulting effect on the quantity demanded?

a) An increase of 3%
b) A decrease of 3%
c) An increase of 30%
d) A decrease of 30%

Regression models

Overall Score =	$\beta_0 + \beta_1 video_i + \beta_2 text_i + \beta_3 demo_i + \beta_4 ability_i + \varepsilon_{ij}$
Tech Score =	$\beta_0 + \beta_1 video_i + \beta_2 text_i + \beta_3 demo_i + \beta_4 ability_i + \varepsilon_{ij}$

Regression results

VARIABLE	MODEL 1	MODEL 2
Text	0.034 (0.03)	0.416*** (0.08)
Video	0.089*** (0.03)	**1.05*** (0.08)**
Age	-0.014 (0.01)	-0.021 (0.03)
Male	0.036 (0.03)	0.083 (0.07)
GPA	0.063** (0.03)	0.165** (0.07)
ACT	0.009** (0.004)	0.033*** (0.01)

n = 752 *** p < 0.01 ** p < 0.05 * p < 0.1

KEY RESULTS

NARRATED VIDEO FEEDBACK

- BEST REPLICATES THE LIVE OFFICE HOURS SETTING
- LARGE MARGINAL IMPROVEMENT OVER TEXT FEEDBACK IN GRAPHICAL & TECHNICAL QUESTIONS

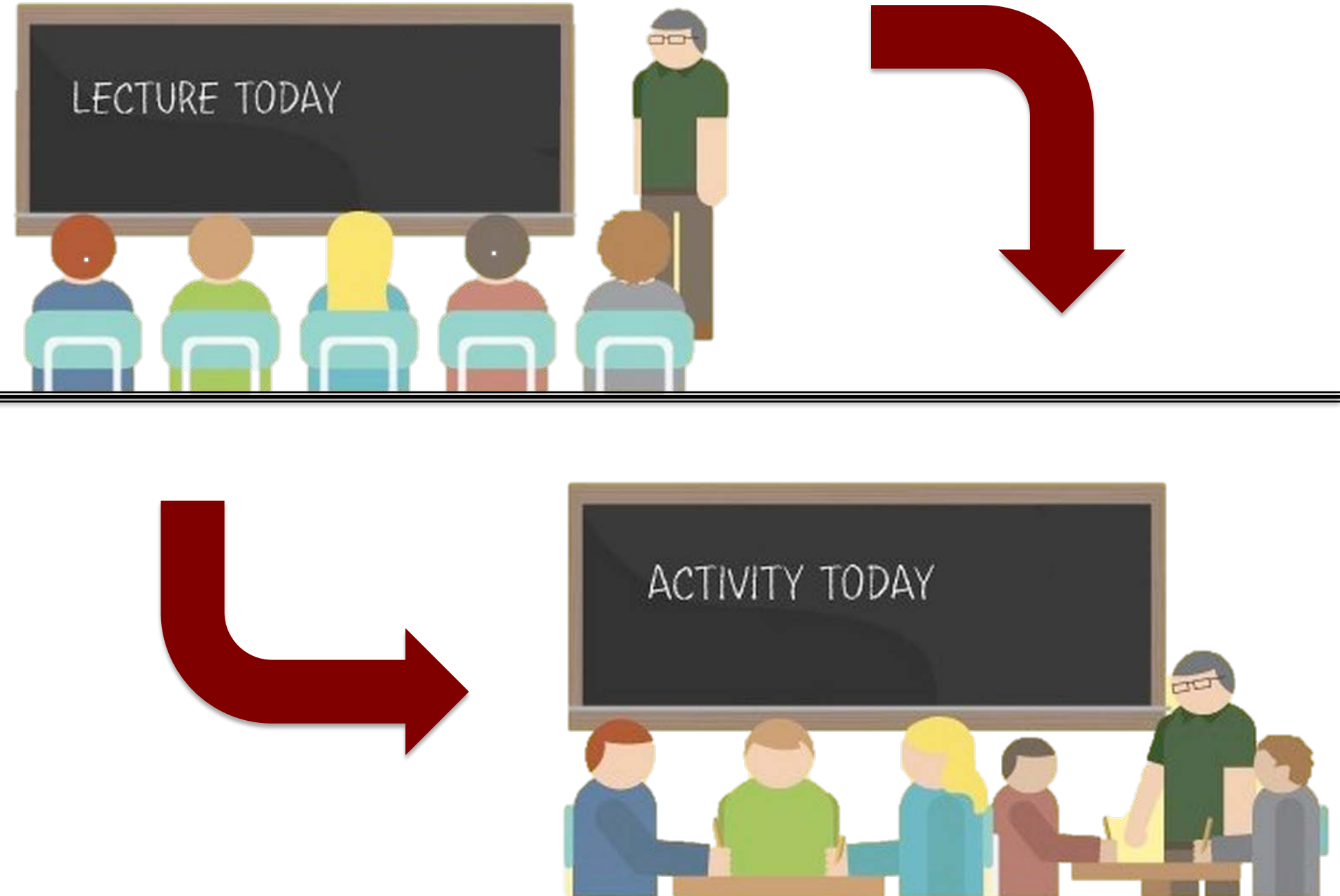
25% IMPROVEMENT OVER NO FEEDBACK

MYTH # 5

…means students

watch recorded

videos at home.


LECTURE TODAY
ACTIVITY TODAY

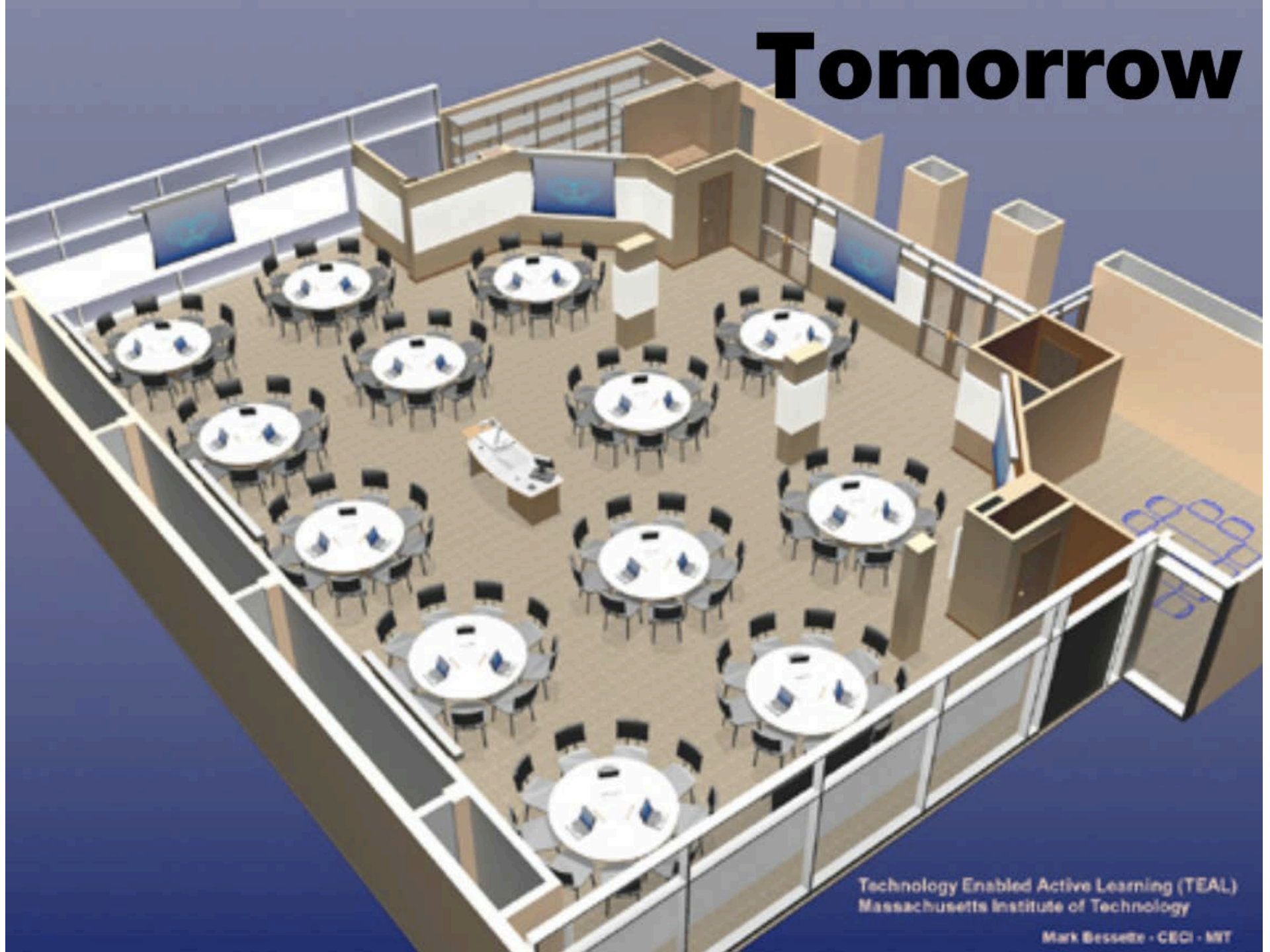

Re: More Photos From Our Trip
Dan Cohen
Not bad at all. Let's make a plan to check out Death Valley next month. It's supposed to be amazing!
Sent from my iPad
On Jan 27, 2011, at 9:35 AM, Dan Cohen wrote:
Here are a few of my pictures from our trip to Joshua Tree last week. Not bad for an amateur!
I think I've really improved since the last time we went hiking. My friend Jen came along as well. She's a real pro, you two should meet. I think you'd have a lot in common.
Jessica Ba
Erica Haim
Vivian Li
return
?123

Now


Then...
Copyright 2008, Ar
www.AmySt


Now
Copyright 2008,


Tomorrow


Tomorrow
Technology Enabled Active Learning (TEAL)
Massachusetts Institute of Technology
Mark Bessette - CECI - MIT

marginal product of 30 cookies, and the fourth worker has a marginal product of 20 cookies. This property is called **diminishing marginal product.** At first, when only a few workers are hired, they have easy access to Caroline's kitchen equipment. As the number of workers increases, additional workers have to share equipment and work in more crowded conditions. Eventually, the kitchen is so crowded that the workers start getting in each other's way. Hence, as more and more workers are hired, each additional worker contributes fewer additional cookies to total production.

diminishing marginal product the property whereby the marginal product of an input declines as the quantity of the input increases

Diminishing marginal product is also apparent in Figure 2. The production function's slope ("rise over run") tells us the change in Caroline's output of cookies ("rise") for each additional input of labor ("run"). That is, the slope of the production function measures the marginal product of a worker. As the number of workers increases, the marginal product declines, and the production function becomes flatter.

From the Production Function to the Total-Cost Curve

The last three columns of Table 1 show Caroline's cost of producing cookies. In this example, the cost of Caroline's factory is $30 per hour, and the cost of a worker is $10 per hour. If she hires 1 worker, her total cost is $40 per hour. If she hires 2 workers, her total cost is $50 per hour, and so on. With this information, the table now shows how the number of workers Caroline hires is related to the quantity of cookies she produces and to her total cost of production.

Our goal in the next several chapters is to study firms' production and pricing decisions. For this purpose, the most important relationship in Table 1 is between quantity produced (in the second column) and total costs (in the sixth column). Panel (b) of Figure 2 graphs these two columns of data with the quantity produced on the horizontal axis and total cost on the vertical axis. This graph is called the *total-cost curve*.

Now compare the total-cost curve in panel (b) with the production function in panel (a). These two curves are opposite sides of the same coin. The total-cost curve gets steeper as the amount produced rises, whereas the production function gets flatter as production rises. These changes in slope occur for the same reason. High production of cookies means that Caroline's kitchen is crowded with many workers. Because the kitchen is crowded, each additional worker adds less to production, reflecting diminishing marginal product. Therefore, the production function is relatively flat. But now turn this logic around: When the kitchen is crowded, producing an additional cookie requires a lot of additional labor and is thus very costly. Therefore, when the quantity produced is large, the total-cost curve is relatively steep.

QUICK QUIZ *If Farmer Jones plants no seeds on his farm, he gets no harvest. If he plants 1 bag of seeds, he gets 3 bushels of wheat. If he plants 2 bags, he gets 5 bushels. If he plants 3 bags, he gets 6 bushels. A bag of seeds costs $100, and seeds are his only cost. Use these data to graph the farmer's production function and total-cost curve. Explain their shapes.*

The Various Measures of Cost

Our analysis of Caroline's Cookie Factory demonstrated how a firm's total cost reflects its production function. From data on a firm's total cost, we can derive several related measures of cost, which will turn out to be useful when we analyze

Then

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Instructor Links

Instructor | Student Chiang, Eric

Unit 13: PreLecture / CheckPoint / Homework /

PreLecture: Budget Line

Deadline: 100% until Friday, May 29 at 11:59 PM

Slide 2 ... Budget Constraint

Prev Next

List of Slides

Edit Assignment
View Time on Assignment

- PreLecture Slide — Overview
- PreLecture Slide — The Budget Constraint
- Question — Question 1
- PreLecture Slide — Changes in the Budget Line
- PreLecture Slide — The Concept of Utility
- PreLecture Slide — Utility Maximization
- Question — Question 2

Now

The Square Knot

The Square Knot

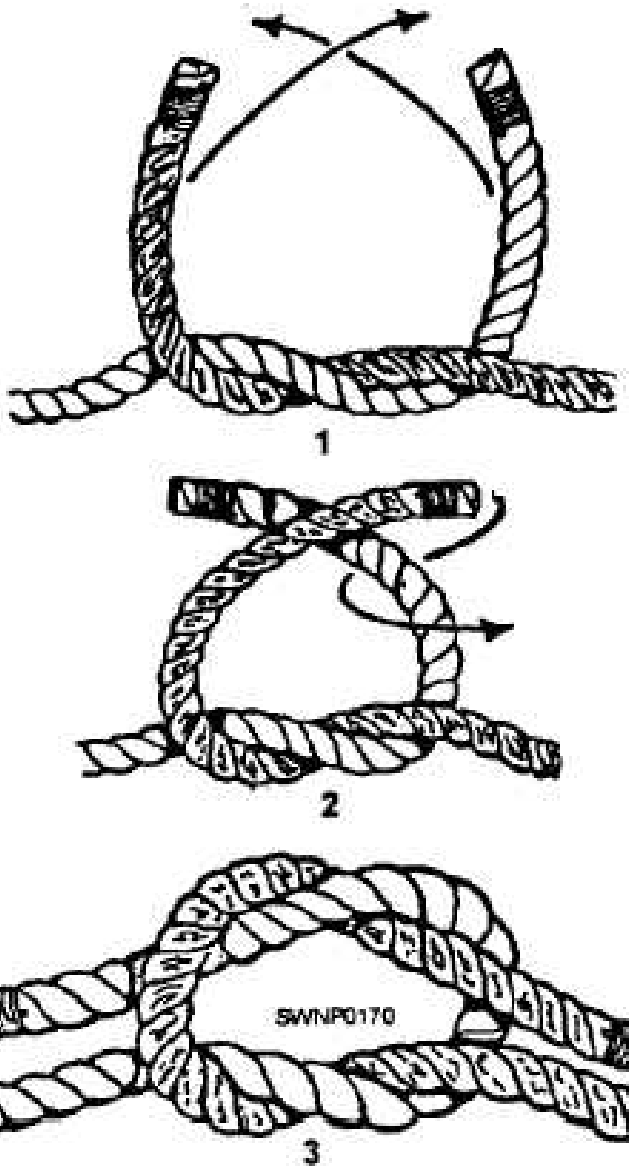
1) Make an X with the two ends, with the right end on top. Tie an overhand knot, twisting the right end around the left end.

2) With the "new" right and left ends, put the left over the right. Tie another overhand knot.

3) Pull tightly on both all four "parts" emerging from the knot.

The Square Knot

The Square Knot



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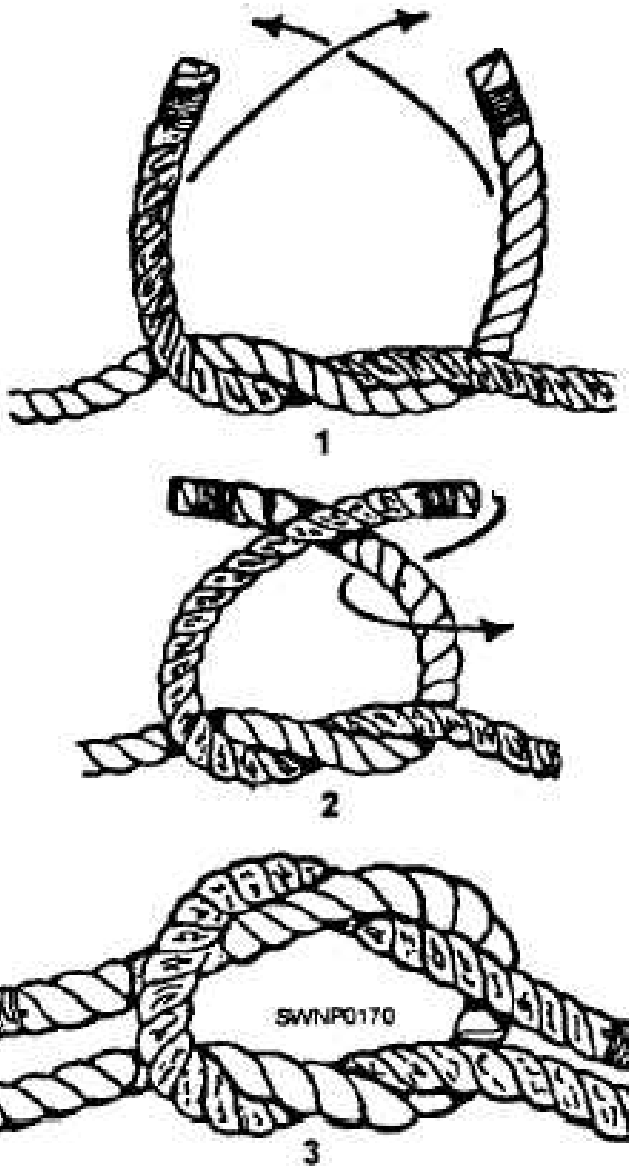

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