

Just in Time Teaching in Intermediate Microeconomics

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## Core Idea

Just in Time Teaching (JiTT) is a strategy that alters the mix of planned activities **just before** the start of class to reflect the state of student understanding (**formative assessment**) at the point they have completed their own preparation for class.

Instructor-student and student-student face time are scarce resources. We should not waste class time by going over material students already have mastered. Active learning assignments are enhanced by grouping students based on their pre-class mastery of the material. In some cases, one wants a mix of mastery levels in a group; learning by all is enhanced when students who “get it” assist those struggling with a concept. In others, one wants to tailor tasks for different groups depending on mastery level. In short, the ideal is to match the organization and content of each class meeting “just in time” to meet the needs of students.

The chief obstacle to implementing JITT methods is the cost of assessing mastery during the short window between the time students have completed preparation for class and the actual class meeting. Web-based publishers’ supplements, such as Aplia and WileyPlus, have become increasingly capable of providing the nuanced feedback needed to implement effective JiTT strategies. This poster illustrates the way I used Aplia this past fall to lower the cost of customizing in-class and lab-in-lieu-of-office-hours activities for Intermediate Microeconomics.

Before the start of the semester, I developed a syllabus of readings, collected material for possible use in each class, and identified the Aplia problem sets I planned to use. Immediately following each class, I post the next problem set (possibly tweaked to reflect that day’s classroom experience). The morning of my next class or lab, I review the results in Aplia, group students for in-class activities and organize my class notes. I lecture on material students were unable to master from the reading and monitor and respond to difficulties students encounter in active learning group work.

## **Background**

Bryn Mawr is a selective liberal arts college for women just outside of Philadelphia with a close cooperative relationship with Haverford and Swarthmore Colleges.

1350 undergraduates

15-25 senior economics majors

Most students take Intermediate Microeconomics as sophomores having completed a one semester introductory economics course and at least one field course. Calc I is a prerequisite, but the course uses multivariable calculus. I used

Besanko and Braeutigam, Microeconomics, 3<sup>rd</sup> ed.

but drew extensively on

Nicholson and Snyder, Microeconomic Theory: Basic Principles and Extensions, 11<sup>th</sup> ed.

27 twice-weekly 80 minute class sessions (10am Tuesdays and Thursdays)

13 weekly 50 minute lab sessions in lieu of problem sets (Wednesday afternoons)

29 students in the class; split into 3 lab sections

I used JiTT for 20 of 27 class meetings and 12 of the 13 lab sessions.

## **Applying JiTT for a typical class**

Class 6 (Thursday): Consumer Choice

Post Aplia assignment shortly after the conclusion of the preceding class (Tuesday).

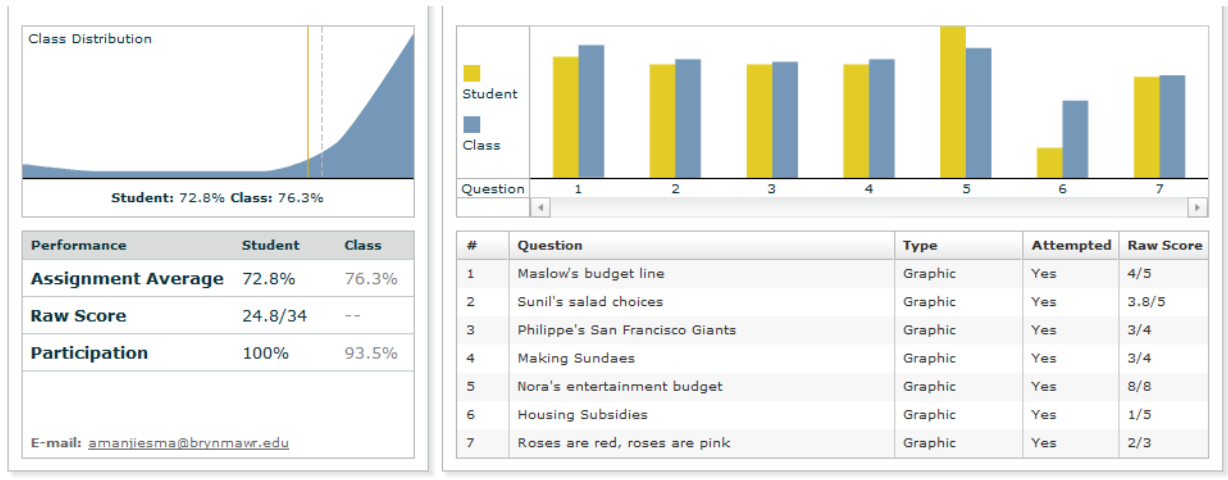
I had the Aplia problem sets organized for the semester. Posting them before each class in turn allowed me to tweak the assignments based on my experience of the preceding class and kept students on pace with the material I wanted to cover.

Problem set due “before you retire Wednesday night, or no later than 3am Thursday”

Access Aplia results before coming to school in the morning.

Besanko and Braeutigam is a Wiley text. Hence, I’m still using a relatively early Aplia implementation, not updated since Cengage acquired the company.

A student's Aplia results:



I export the student results to Excel (see next page), pair up students (in part based on their experience with problem 4), and devise a seating chart for class. For classroom activities, I tend to pair a student who “got” the key concept with one who struggled with aspects of the problem.

The Aplia 4 question

#### Question 4: Making Sundaes

✓ 4. Making Sundaes

Nina spends her entire income ( $I$ ) of \$120 making sundaes that require ice cream ( $C$ ) and strawberries ( $S$ ). Nina's utility is given by  $U(C, S) = C^2 \times S$ . Her marginal utility of ice cream and strawberries is  $MU_C = 2 \times C \times S$  and  $MU_S = C^2$ , respectively. A quart of ice cream costs \$8, and a pound of strawberries costs \$5.

Info a. Nina's budget line is  ✓

Info b. At an internal optimum consumption basket, the tangency condition requires that the slope of the budget line equal the slope of the indifference curve. On a graph with strawberries on the vertical axis and ice cream on the horizontal axis, the negative of the slope of Nina's budget line is equal to  ✓ and the negative of the slope of the indifference curve is equal to  ✓

Info c. Nina's optimal consumption basket is  ✓

✓

						34	5	5	4	4	8	5	3
Last	First	Row	Table	Pair	Old	Wrd	1	2	3	4	5	6	7
		A	2	1	1	1							1
		A	2	1	7	10		1.2		1		5	3
		A	3	2	9	3			3				
		A	3	2	11	19		1.2	4	1	6	5	2
		A	4	3	2	4.5	1	2.5	1				
		A	4	3	14	9.2	1	1.2	1	1		4	1
		A	5	4	12	1				1			
		A	5	4	13	27	5	5	3	2	6	4	2
		A	6	5	7	4			1	1		1	1
		A	6	5	5	8.2	1	1.2	1	1		4	
		D	5	6	8	7.2		1.2	3	1		1	1
		D	5	6	5	12		1.2	2	1	3	4	1
		B	2	7	2	7.2		1.2		2	1	2	1
		B	2	7	11	7.2		1.2	1	1	1	3	
		B	3	8	10	1						1	
		B	3	8	12	8	1			1	1	3	2
		B	4	9	8	6			4		1	1	
		B	4	9	10	9	1			1	2	3	2
		B	5	10	3	4	2					1	1
		B	5	10	6	8.5	1	2.5		1		3	1
		B	6	11	4	3						3	
		B	6	11	9	22	4	3.7	1	2	5	3	3
		C	5	12	4	5						3	2
		C	5	12	13	6.2		1.2		1		3	1
		C	6	13	3	6.2		1.2	1			3	1
		C	6	13	14	7.2		1.2		2	1	2	1
		C	3	14	6	8	1				2	5	
		C	3	14	1	8.5		2.5		2	1	2	1
		C	3	14	14	10		1.2	1	2	3	2	1

It is easy to see not only how the class did on a particular question, but to identify common errors on individual elements of each question.

The Example in Class:

2) Nina spends her entire income (I) of \$120 making sundaes that require ice cream (X) and strawberries (Y). Her utility is given by  $U(X,Y) = X^2Y$ . A quart of ice cream costs \$8 and a pound of strawberries costs \$5.

a) Confirm that Nina's marginal utilities are  $U_X = 2XY$  and  $U_Y = X^2$ .

b) Confirm that the price ratio along Nina's budget line is  $P_X/P_Y = 1.6$  and that the marginal rate of substitution of ice cream for strawberries is  $MRS_{X,Y} = 2Y/X$ .

c) Confirm that if Nina wishes to maximize her satisfaction given her budget constraint, she should choose 10 quarts of ice cream and 8 pounds of strawberries.

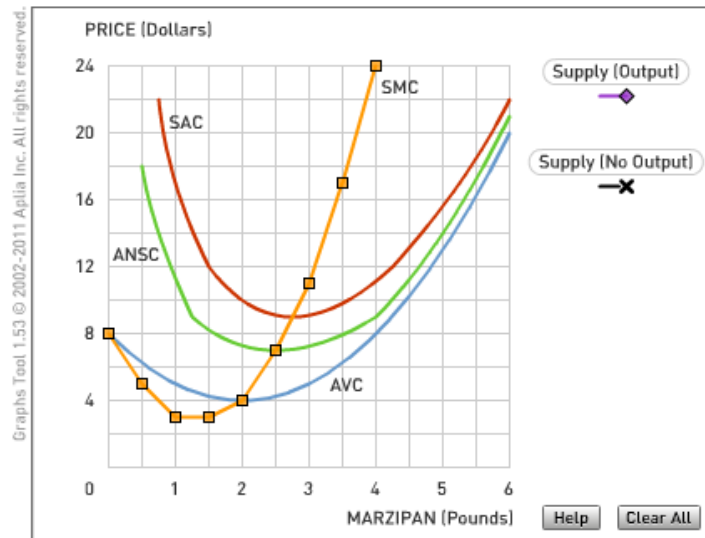
## Applying JiTT for a typical lab

### Lab 9: Competitive Supply

The Aplia Problem:

#### 3. Al Mond marzipan

Al Mond is a perfectly competitive firm that produces marzipan. The graph below shows Al Mond's short-run marginal cost (orange curve labeled *SMC*), short-run average cost (red curve labeled *SAC*), average nonsunk cost (green curve labeled *ANSC*), and average variable cost (blue curve labeled *AVC*).



a. Al Mond's short-run shut-down price is

b. On the graph above, plot Al Mond's short-run supply curve. Use the black point (X symbol) to plot the portion of the supply curve that corresponds to prices at which Al Mond produces no output. Use the purple point (diamond symbol) to plot the portion of the supply curve at which Al Mond produces positive output. Line segments will automatically connect the points.

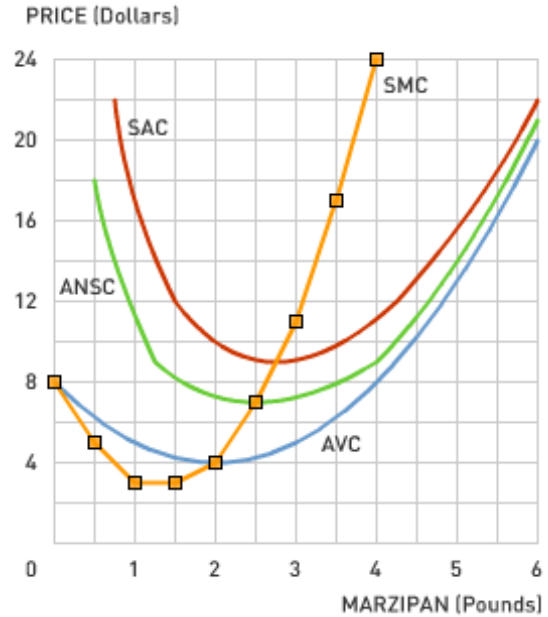
c. Al Mond will earn zero economic profits when the market price is

In contrast to my approach in class, I generally organized homogeneous groups during the weekly lab and gave each a different mix of problems to tackle depending on their success with the Web-based assignment. Groups with students who struggled over Aplia Problem 3 would tackle this question during lab:

1) Aplia 3: The graph at right shows the cost curves for the firm in the marzipan industry.

a) Confirm that at a price of \$11, the firm will produce 3 pounds and earn profits of a little under \$6.

b) Why is the short-run shut-down point at \$7 and not \$4 or \$9?



### Participation Rates

97.1% for 20 pre-class Aplia assignments

93.9% for 12 pre-lab Aplia assignments

93.6% for 27 class meetings

93.4% for 13 labs

### Reflections

Positives:

- I am convinced (and studies in university settings suggest) that students learn more with JiTT.
- Nicely fits Student preference for working late at night and my preference for working early in the morning.

Negatives:

Using early implementation of Aplia involves a bit more mechanical processing than I would like.



Next steps:

- Shift to WileyPlus, for more nuanced formative assessment
- Use JiTT/group work as basis for discussion, not just mastery of tools (a la Simkins and Maier 2004).
- Substitute Web-based videos for mini-lectures

### **Learn More**

JiTT was first applied in physics education (Novak, G. M., et al. 1999; Simkins & Maier 2008) and has been applied successfully in at least 10 other disciplines:

<http://serc.carleton.edu/sp/library/justintime/examples.html>

Scott Simkins and Mark Maier have promoted its use in economics (Simkins and Maier 2004 and SERC 2010). See in particular

<http://serc.carleton.edu/sp/library/justintime/index.html>

It works by raising the quantity and quality of three inputs that have been demonstrated to enhance student learning (Astin 1993): Instructor-student interactions, student-student interactions, and time on task. It is an example of blended learning (Nagel 2011) in that it combines classroom instruction with Web-based content delivery and assessment involving a degree of student control over time, place, path, and/or pace.

While there are some open-source initiatives that offer diagnostic modules of the sort needed to implement JiTT, such as Carnegie Mellon's Open Learning Initiative

<http://oli.web.cmu.edu/openlearning/>

and course management systems such as Blackboard and Moodle allow instructors to create their own formative assessment instruments, implementation costs are lowest when one relies on the modules publishers increasingly are providing as textbook supplements, e.g.,

<http://www.aplia.com/>

<http://www.myeconlab.com/>

<http://connect.mcgraw-hill.com>

<https://www.wileyplus.com>

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