

LEARNING AND DOING

WHAT, HOW AND WHY

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The Importance of Doing

This talk is about creating opportunities for students to do things in the classroom.

Doing things is important to me. I define myself more by my activities and less by my opinions.

Retirement has been meaningful because I retired to doing something new (and not to stop doing what I used to do).

Introduction

Here's What I Am Doing Now



www.MichaelSalemi.com

Introduction

Learning about Learning From Learning About Turning

It's important to respect centrifugal force.

Expert turners can help novices learn to turn...but it's hard to learn to turn by reading and listening.

One learns to turn wood by turning wood.

Introduction

Learning and Doing

During this talk, you will have opportunities to engage in learning activities.

You will also have an opportunity to share information. I will collate, edit and share the contributions you make during this talk's activities.

Acknowledgement: Some ideas come from the Frank and Bernanke text. Others come from colleagues.

Introduction

Learning and Doing

1. What: Examples of student activities that promote learning of basic economic principles
2. How: Rules that enhance the learning potential of these and other student activities
3. Why: Reasons that support the use of student activities in the classroom.

Introduction

The Scarcity Principle

Choosing is refusing--when resources are scarce, choosing one option requires giving up alternative options.

The Opportunity Cost of the chosen option is the value one places on the next best option.

What

Student Activity One: Survey of Preconceptions

Students respond to a survey before and after a lecture on the scarcity principle. The instructor collects and reviews student responses and reacts to them in the next class session.

Learning Objective

Students use the scarcity principle correctly to decide whether statements are true or false.

Note: Debriefing is necessary to determine whether students used the scarcity principle correctly.

What

Scarcity-Principle Survey

True or False?	Percent "True"	
	Before	After
The best things in life are free.	52	24
The biggest college cost is tuition and fees.	37	10
Anything worth doing is worth doing well.	83	84
Life should be sustained at any cost.	28	13

What

Participant Exercise One

What incorrect preconceptions about economic matters do your students have?

1. Think about an incorrect and important preconception that you have encountered.
2. Discuss it with your neighbors.
3. Discuss how you might address the preconception in your teaching.
4. Report your findings by logging onto the following survey.

What

SURVEY MONKEY SURVEY

<https://www.surveymonkey.com/r/CTREE>

The Benefit-Cost Principle

To a decision maker, the relevant costs and benefits are marginal costs and marginal benefits where marginal means "incremental."

Most decisions involve choosing a little bit more or less of a good or activity. Few decisions are all or nothing decisions.

What

Student Activity Two: Peer Instruction

After a brief lecture on the benefit-cost principle:

1. Students silently respond to a multiple choice prompt.
2. Instructor privately views the response histogram.
3. Instructor checks whether the frequency of a correct response is between 30 and 85 percent.
4. If yes, students discuss the question with their neighbors and then re-answer it.
5. If no, instructor either re-teaches or moves on.

What

Benefit-Cost Principle Question

Which of the following scenarios describes a student action that is not rational from an economic point of view?

- A. After eating a slice of pizza, Jane buys and eats a second slice even though the marginal benefit of the second slice is lower than the marginal benefit of the first.
- B. Harry buys a replacement ticket to the baseball game when he realizes that he forgot his first ticket at home.
- C. Elizabeth decides to go to a party on Thursday even though she has an important quiz on Friday.
- D. None of the above.

What

Response Frequency First Polling

Which of the following scenarios describes a student action that is not rational from an economic point of view?	
A. After eating a slice of pizza, Jane buys and eats a second slice even though the marginal benefit of the second slice is lower than the marginal benefit of the first.	.14
B. Harry buys a replacement ticket to the baseball game when he realizes that he forgot his first ticket at home.	.05
C. Elizabeth decides to go to a party on Thursday even though she has an important quiz on Friday.	.14
D. None of the above	.67

What

Peer Instruction

Learning Objectives:

- Students recognize the correct response to the prompt.
- Students correctly use target concepts while discussing the question with their peers.
- Students revise their response to the question when appropriate.

What

The Incentive Principle

A person (or firm or group of people) is more likely to take an action if the benefits of the action rise.

A person is less likely to take an action if the costs of the action rise. That is, people, firms and groups respond to incentives.

What

Student Activity Three: Writing about a News Article

Students are provided an article (or asked to find one) that can be analyzed with the help of the incentive principle.

Students complete a writing exercise in which they use the incentive principle to analyze the article.

What

“Water Pricing in Two Thirsty Cities,” NYT, May 6, 2015

The article contrasts water rate increases in Fresno California and Santa Fe New Mexico.

Two years ago, Fresno officials voted to raise the uniform water rate ... to help pay for a new \$429 million project that would make use of river water and let the aquifer recover. But the increase was called off after a political uproar and threats of court action.

What

“Water Pricing in Two Thirsty Cities,” NYT, May 6, 2015

Santa Fe, in addition to raising the basic cost of water, decided to make the heaviest users of water pay more – much more – for the water they consumed.

Known as tiered pricing, the system wasn't new or unique to Santa Fe, but in no major city today are the tiers so steep, with water guzzlers paying three to four times more per gallon than more efficient consumers are charged.

What

“Water Pricing in Two Thirsty Cities,” NYT, May 6, 2015

In moving away from the idea that water should be cheap for everybody just because it is so essential to life, Santa Fe’s approach to water pricing offers lessons in how other parched cities can balance the societal costs of scarcer, more expensive water in a relatively equitable way.

Because of the huge gap between tiers, the biggest consumers effectively subsidize everyone else, shielding poorer residents from feeling the full brunt of rate increases.

What

Writing about Two Thirsty Cities

The instructor can provide a specific prompt like: “Use the incentive principle to discuss why tiered water rates lowered water usage in Santa Fe.”

The instructor can provide a more general prompt: “Use the concepts we have learned to discuss the impact and fairness of the policy described in the article.”

What

Participant Exercise Two

1. Think about what learning objective(s) students could meet by completing a writing assignment on the Thirsty-Cities article.
2. Exchange views on learning objectives with your neighbors.
3. Choose a learning objective and design a writing prompt that will lead students to meet it.
4. Discuss how students might receive feedback on their exercise without one-on-one instructor involvement.

What

How To Use Student Activities Three Suggestions

1. Write learning objectives and use them to guide creation of activities.
2. Incorporate writing in activities whenever possible even if students do not submit what they write.
3. Debrief every activity.

How

Learning Objectives

Because student activities use up scarce teaching resources, it makes sense to target them to the important course concepts.

Objectives should specify how students are to demonstrate that they have mastered target concepts.

A well-crafted learning objective helps one create an activity that is targeted at the right concepts and helps student develop the right level of mastery.

How

Writing

Most of what I know about writing as a learning activity, I learned from Bill Walstad.

Writing improves thinking. Unclear student writing is evidence that students do not fully understand what they are writing about.

There are substantial developmental benefits from writing even if students do not receive a grade or comments on what they wrote.

How

Debriefing

During in-class activities, students get caught up in their own responses to a prompt or in the production of their group's product. This is a good thing – a sense of ownership is a great motivator.

An important benefit of debriefing is that it requires students to step back from their own contributions to consider the contributions of others and what the class has learned.

Debriefing can be as simple as asking "What have we learned today?" or can be more highly structured.

How

Why Use Student Activities

The following three reasons provide a powerful rationale for employing student activities during class.

1. "It's not what you cover, it's what they learn,"
Phil Saunders
2. It is hard to maintain attention for long periods of time.
3. Research suggests that that correct use of student activities improves student learning.

Why

It's Not What You Cover...

- Instructors feel pressure to include more concepts in their courses than most students can master.
- Adding an additional concept precludes activities that help students gain deeper understanding of retained concepts.
- Gilleskie and Salemi (JEE, 2012) show that students who took a "literacy targeted" principles course performed as well in intermediate theory courses as those who took traditional many-topics principles courses.

Why

It's Hard to Maintain Attention

Bunce, D. M., Flens, E. A., & Neiles, K. Y. (2010). "How Long Can Students Pay Attention in Class? A Study of Student Attention Decline using Clickers," *Jour of Chemical Education*, 87, 1438-1443.

Students in three general chemistry courses were offered the chance to report attention lapses with their clickers.

35 Percent of 186 students agreed to participate.

Why

Attention Study Findings

1. Attention lapses were brief – one minute or less.
2. Spikes in lapses occurred at the 4.5-5.5, 7-9, 9-10 minute marks etc. The lapses occurred more frequently as a lecture progressed.
3. Compared to lecture segments, fewer attention lapses were reported during and after active-learning methods segments.

Why

What Learning Theory Says about Attention Lapses

During a lecture, students encounter new material which they store in their short term memories.

Students may not immediately perceive how lecture material is organized and thus may not be able to transfer it to their long term memories.

Participating in activities helps students organize lecture material and transfer it from short term to long term memory.

Why

Activities Increase Learning

Crouch and Mazur, *American Journal of Physics*, 2001 show that Peer Instruction increases learning.

After Implementation of Peer Instruction:

Greatly improved scores on two standardized physics exams and constructed-response problems.

Results are not dependent on instructor.
Results hold for algebra- and calculus-based courses.
Student reactions are generally positive.

Why

How People Learn

How People Learn: Brain, Mind, Experience and School, National Research Council, 1999

How People Learn is a meta-study of research on human learning which also explains the implication of its findings for effective teaching.

A 2005 follow-on study provides examples of how the findings of *How People Learn* can be applied to the K-12 curriculum.

Why

Application of How People Learn to the K-12 Science Curriculum

- Telling students what scientists discovered is not sufficient to support change in their preconceptions about scientific phenomena.
- Activities where students do science promote learning better than activities where students follow the steps in the “scientific method.”
- It is important to help students learn how to learn.

“Scientific Inquiry and How People Learn,” Bransford and Donovan

Why

Example: El-Ed Module on Light

Preconception: Light reflects only from shiny objects.

Activity: Students shine a flashlight on a variety of objects and use a square of white paper to capture reflected light.

Metacognition: Instructor prepares a table that guides students in collecting data from their experiments.

Why

Reflections

1. The student opinion survey is one strategy for dealing with student preconceptions.
2. Well designed activities (such as peer instruction and responding to writing prompts) enhance student attention and increase student mastery.
3. Debriefing activities helps students gain an understanding of what they have learned, how it fits into the course, and why it is important.

Thank You

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