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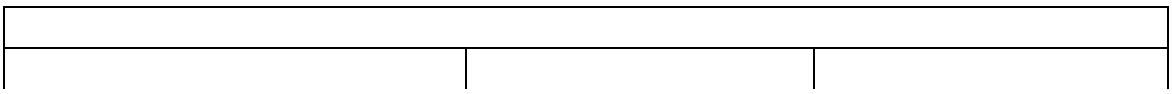

*The Journal of Economic Education:*

*International Handbook on Teaching and Learning Economics*

1. Title: Graphing Demand
   How do we plot a demand schedule to make a demand curve on a graph? The math behind the economics: Plotting on a Cartesian plane: http://youtu.be/lW1JkJEs610

2. Title: Interpreting Supply and Demand
   How do we interpret supply and demand graphs? The math behind the economics: reading graphs: http://youtu.be/oHlQ51BquA

3. Title: Shifting Supply and Demand Curves
   What happens when supply and demand curves shift? The math behind the economics: shifting curves: http://youtu.be/vq5qWdsDSRA

   Title: Demand Equations
   How do we find the equation of a straight line demand curve? The math behind the economics: finding the equation of a line: http://youtu.be/0qY4CsHbEsg

5. Title: Finding Equilibrium Algebraically
   How do we find equilibrium? The math behind the economics: solving simultaneous equations: http://youtu.be/GZt_nBknhik

6. Title: Price Elasticity of Demand
   How do we compute price elasticity of demand? The math behind the economics: finding percentage changes: http://youtu.be/GOwuZe_cbv0

7. Title: Average Cost
   How do we compute average total cost? The math behind the economics: finding averages: http://youtu.be/TJXZIsoGxVQ

8. Title: Marginal Cost
   How do we compute marginal cost? The math behind the economics: finding incremental changes): http://youtu.be/9qBS9fD7Vyw

14. Title: The Equation of Exchange
    How do we interpret the relationship between the variables in the equation of exchange? The math behind the economics: solving equations for different variables http://youtu.be/w0dAGaC4dOg

15. Title: Reserve Ratio
    What is a reserve ratio? The math behind the economics: ratios http://youtu.be/vdy9Qr2gsH8

16. Title: Aggregate Supply Curves
    How do we interpret horizontal and vertical aggregate supply curves? The math behind the economics:

# Effects of Math Intervention on Learning Principles of Economics

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# Why address mathematics weaknesse in principles of economics

- Principles of economics classes often expect that students have mast msf ebssic7Tx9( e)-1

# Mathematics for Economics Project:

- Helps students learn the math necessary for learning micro and macro principles
- 16 short videos:
  - explain math used in principles of economics
  - apply the math to economics
- Each video accompanied by 10 questions:
  - students can practice the math
  - students can apply the math to economics

# Outline of Presentation

- Literature Review
- Math for Econ Project content
-

# Literature Review

- Many studies use math as a control variable in economic education production function studies
- Several studies focus specifically on mathematics and learning economics
- Overall, results are mixed with respect to:
  - different dependent variables
  - effects of different measures of math background

# Literature Review (cont'd)

- Cohn et al (1998): no effect of math

# Literature Review (cont'd)

- Number and type of math courses taken may not be good proxy for math knowledge and skills.
- Schuhmann et al (2005): develop pre and post test to measure math proficiency.
  - students do not do well on pre-class quiz and thus may not understand math used in the course.
  - quantitative literacy is a significant determinant of economic literacy.

# Current study adds to the literature:

- Developed tests to capture pre and post class math and economics knowledge
  - control groups took the tests and did not have access to the videos and self-check assignments.
  - experimental groups took the tests and did have access to the videos and self-check assignments.
- We look at effects of specific systematic intervention addressing math topics necessary for understnd 3.g principles of economics

# Math/Econ Project Topics:

1. Graphing Demand (Plotting on a Cartesian plane)
2. Interpreting Supply and Demand (reading graphs)
3. Shifting Supply and Demand Curves (shifting curves)
4. Demand Functions (equation of a straight line)
5. Finding Equilibrium Algebraically (solving simultaneous equations)
6. Price Elasticity of Demand (finding percentage changes)
7. Average Cost (finding averages)
8. Marginal Cost (finding incremental changes)

# Math/Econ Project (cont'd)

9. Marginal and Average Cost (relationship between marginals and averages)
10. Profit and Graphs (tangents and area of rectangles)
11. Consumer Surplus (area of a right triangle)
12. Consumption function (mathematical functions)
13. Economic Growth Rates (finding rates of change)
14. Equation of exchange (solving equations for diff 5P6bo veariles)

# Research Design and Methodology

- Controlled experiment:
  - Fall 2014: one micro and one macro principles class asked to take pre and post test and questionnaires. Had no access to math/econ projects.
  - Spring 2015: one micro and one macro principles clas asked to take pre and post test and questionnaires. Given extra credit for watching videos and responding to self-check questions.
- Classes taught by same instructors and met same time of day.

# Research Design and Methodology
## Data collection instruments:

- Background questions: age, sex, year in college, race/ethnicity, language, major, expected grade, self

# Videos and Self-Check Questions

- Video and self-check environment for students and instructors
  - Course materials pushed to course shell by AT sta
  -

# Videos and Self-Check Questions

- Standard elements in each set of videos
  - Introduce economics question
  - Present the “math behind the economics”
  - Revisit original economics question
  - Give examples of other areas of economics where the same mathematics is used

# Videos and Self-Check Questions

- Link to Google Site or Bb shell to view assessments as the student would

# Making materials available to all

- Link togooglesite
  - Tools for creating self-check questions with feedback not easy to use

# A mathematicians point of view

- Math class vs econ class
  - Should math classes incorporate specific economics applications or leave that to the experts?
  - Should econ classes spend time teaching mathematics?
  - Is there language, notation, conventions that mathematics classes should use differently/more carefully?
  - How can we help students “translate”?

# Preliminary Results

# Macro students in the experimental group may have*scored higher on the posttest.

(Micro students in experimental group: no difference)

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Students in the experimental group may have had somewhat higher post-course opinions about the usefulness of videos.

| | | Microeconomics | | Macroeconomics | |
|---|---|---|---|---|---|
| | | Control | Treatment | Control | Treatment |
| Pretest responses (1=not at all useful, 5=extremely useful) | | | | | |
| Videos | Mean | 3.60 | 3.65 | 3.76 | 4.04 |
| | St dev | 1.06 | 0.95 | 1.15 | 0.98 |
| Internet | Mean | 3.73 | 3.60 | 3.59 | 3.96 |
| | St dev | 1.16 | 1.01 | | |
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# Students showed no clear trends in their post-course excitement or anxiety regarding economics or mathematics

| | | Microeconomics | | Macroeconomics | |
|---|---|---|---|---|---|
| | | Control | Treatment | Control | Treatment |
| Pretest responses (1=strongly disagree, 5=strongly agree) | | | | | |
| Econ: excited | Mean | 3.9 | 3.9 | 3.5 | 3.7 |
| Econ: anxious | Mean | 2.9 | 3.0 | 3.3 | 2.8 |
| Math: enjoy | Mean | 4.1 | 3.4 | 3.1 | 2.9 |
| Math: anxious | Mean | 2.5 | 2.8 | 3.1 | 2.9 |
| Math: easily apply | Mean | 3.8 | 3.2 | 3.4 | 3.3 |
| Mean | | | | | |
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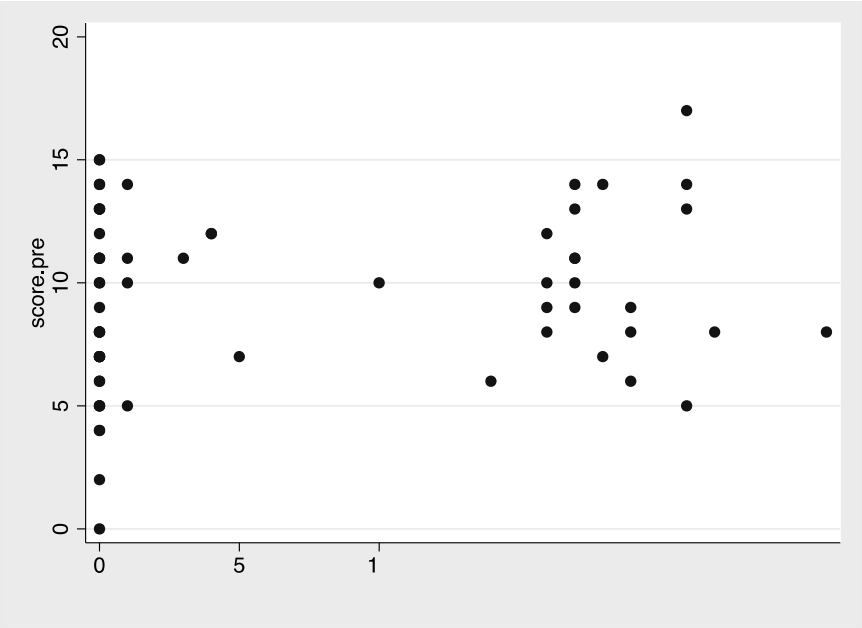
Pre- and post-test scores (of 20) as a function of average self-

# Pre- and post-test scores (of 20) as a function of # of self-checks performed

Pre-test scores




Post-test scores

# Change in score (post minus pre).

…as a function of average self-check

# Further topics to investigate

- Test performance (pre-test, post-test, self-check tests) as a function of the number of times students watched the videos
- Pre- to post-test improvements in:
  - the math portion (10 questions)
  - the economics portion (10 questions)
- With larger sample, could perform regressions controlling for:
  - pre-
    controos

# Questions?