

14.48, Economics of Education
Prof. Frank Levy
Lecture 22

Rouse:

Results on technology in the classroom are NOT clear.

"The Computer and the Dynamo":

1990 paper by Paul David, an economic historian at Stanford

By the 1960s, mainframe computers were fairly widespread, and the 1st Apple personal computer was introduced around 1979.

However, productivity statistics from the 20th century do not show immediate benefits from personal computers:

1947-1965: 3.2% GDP/hr worked growth per year

1965-1973: 2.3%

1973-1996: 1.4%

1996-2005: 3.0%

Productivity didn't revive while computers spread throughout American business and industry. Solow said, "You can see computers everywhere, except in productivity numbers."

In the 1910s and 1920s, the dynamo allowed the provision of commercial electricity to spread, but it took a long time for electricity use to become prevalent.

Why?

Infrastructure turnover takes time. There were already things like gas lamps and steam engines in places that worked so many saw no need to replace them with something that used electricity. In order for homes and businesses to actually use electricity, you needed transmission lines in place, which takes time and money. Motors used in manufacturing took quite awhile to change over to electricity. Additionally, electricity use allowed US plants to be located anywhere there were transmission lines rather than right near hydroelectric or coal sources. It also took awhile for people to work out the kinks of using electricity to power many everyday things and manufacturing machines and tools.

The same was true of computers. When they were first introduced to offices, they were often just used as typewriters. As networking and digital information sharing developed, productivity rapidly increased.

The same case could be made for educational technology—the technology in place now is still in a very early state but has great potential.

How is software involved in:

Basic Skills:

Computer aided learning is very good for online tests, tutorials and engaging students in drills, which you can customize based on students needs and past performance. In fact, if exercises are rules based, then additional practice is great for them. If a particular wrong answer corresponds to a specific wrong model or approach, then a computer can address that immediately. One advantage is of using computers to help students practice rules based problem solving is the freeing up of

teachers' time for other activities. Also, students are given immediate feedback on their performance, instead of having to wait for a teacher to grade their work.

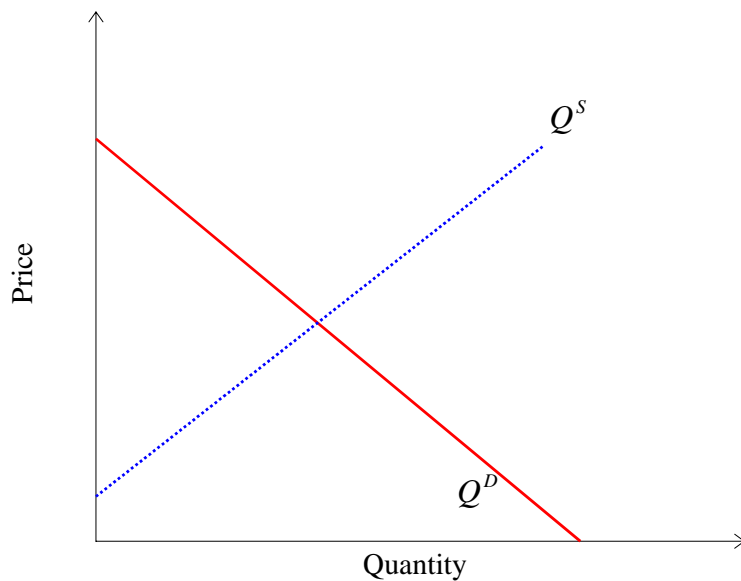
Advanced Skills:

Case based reasoning can be developed and tested using computers by giving, for example, Toyota mechanics problem solving experience more quickly that they would accumulate it on the job by throwing a bunch of simple and not so simple problems at them. By running them through a lot of difficult simulations, then they would be prepared when faced with a difficult problem on the job.

How can you begin to use software instruct people in complex problem solving when the rules aren't easily articulated? You can use the software to dialogue with the user, acting like an "expert" in the field giving suggestions and hints and telling the person what information to focus on.

Say you were designing a simulation for 14.01 to teach students about how markets worked.

You could either just put this diagram on the board:



Or, you could have the class simulate the market for a certain book.

½ of the class would be assigned as buyers and given a unique valuation for the book.

The other ½ of the class would be assigned as sellers and given a unique reservation price.

We can think of the supply curve as a collection of points representing different sellers and their reservation price for the book.

Each seller would want to make the most money possible by maximizing the gap between their selling price and their reservation price.

Each buyer would want to get the book for as low a price and possible and maximize the gap between their buying price and their valuation of the book.

Using multiple rounds where sellers advertise their selling price and buyers advertise their buying price, the price should eventually converge to the market equilibrium shown in the diagram.

Is this better than just putting up a diagram?

Yes. It engages students intellectually and forces them to pay attention. It also allows students to internalize the process of risk evaluation that is central to business decision making, often discussed in classes, but very difficult to understand until you have experienced it.

For this market game, technology isn't essential but would help in compiling buyer and seller offers.

Two studies:

Angrist and Lavy: Foundation in Israel had a significant amount of money to put computers in some Israeli schools. They asked for applications, a portion of Israeli schools applied and some did not. Ideally, we'd want the foundation to assign funding randomly to schools that applied. Unfortunately, they allocated funding based on a set of criteria.

$$(AchievementTest)_i = \alpha_0 + [CharactersicsofSchool] + \delta_i(0,1) + \varepsilon_i$$

$\delta = 1$ if a school gets computers, 0 otherwise. It only represents intent to treat. It doesn't mean that schools actually used the computers or used them correctly. It says nothing about how the computers were used or whether or not teachers received training on using computers in the classroom.

Angrist and Lavy found no positive results of computers in the classroom and slightly negative results on 4th grade math scores. Perhaps teachers spent so much time trying to understand how to use the computers that they slacked on actual teaching, negatively affecting math scores.

Rouse and Krueger: Studied computers used for reading education combined with auditory stimulation and fMRI data. Unfortunately, results only included students who completed the whole program so there was a very small sample size.

Higher Education

US News and World Report: Top 10 Colleges in the US

- 1) Princeton
- 2) Harvard
- 3) Yale
- 4) Caltech
- 4) Stanford
- 4) MIT

- 7) UPenn
- 8) Duke
- 9) Columbia
- 9) Dartmouth

Suppose you want to rank the top 10 car companies:

- 1) Toyota

Clearly, you don't use the same criteria to rank the top car companies and the top colleges.

We understand what car companies do. They maximize profits—over the short run or the long run--. What do universities maximize? Why? How can we rank them?

College graduates:

1940: 5% of the workforce had an undergraduate degree or higher

1950: 10%

2000: 30%

2020: 32% (projected)

The baby boom generation went to college at much higher rates than past generations and was much larger than previous generations.

1990: Only Canada and Finland had more college graduates than the US

Now: 4 countries have more college grads than the US

Steps to a college degree:

- 1) Getting in
- 2) Graduating

1968: 36% of 23 year olds had gone to college at some point, 14% had BA's

2000: 55% of 23 years olds had gone to college at some point and 19% had BA's

Why? College is getting more expensive so many students are forced to drop out and work before they finish. Additionally, there is a lot of pressure from teachers, parents, peers, etc to attend college, even if a student isn't prepared or suited for college.

In other words, the problem in the US isn't getting people to start college in the first place but rather getting them to stay in college and finish.

What if students just aren't prepared for colleges?

Currently, colleges do a lot of remedial work the summer before freshman year and during freshman year with unprepared students. This may not be the best way to use university resources, but its being done.

Back to our rankings:

Why is Toyota the #1 car company?

-Quality of product

-Profits

-Market share, # of cars sold

- Brand
- NOT based on whom Toyota sells cars to

For colleges:

Top colleges have very low overall enrollment and market share.

What makes Princeton the #1 college in the US?

- Facilities
- Expenditure/student
- Quality of other students
- Brand/prestige
- Selectivity, the product is only offered to select customers