Is EdTech the “Hack” We Have Been Looking For?

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Theory of the case: Can innovation “disrupt” education and give us more for less?
What do we think technological tools can do for teachers and students?

• Digitization of content/distance learning=Greater access & lower costs
• New hardware=More engagement and collaboration
• New hardware + software=More flexibility for teachers and data management
• New software=“personalized learning”
  • Learn at your own pace
  • Focus on weaknesses
  • Adaptive to “learning styles”
But the evidence on tech in the classroom is mixed

- E-Rate program increased investments in educational technology but not student performance (Goolsbee and Guryan 2006)
  - ~1-1 ratio between computers and students; 88% of schools have 100kbps per student

- Rouse and Krueger (2004) find little/no impact from a popular reading software application

- Barrow et al. (2009) find positive effects from a popular algebra software application

- Bottom line is that there are conflicting findings (Bulman and Fairlie, 2016)
What can explain these conflicting findings?

• Technology can mean lots of different things (software, hardware, student information systems, etc.)

• Fidelity of implementation matters! (LA Unified and Tablets)

• Teachers are complements not substitutes

• Tech might be more distracting than beneficial

• Students might be acquiring knowledge that is not on the test

• We are not using the “right” technological tools
170,000 choices but no way to know which apps work for which students under what conditions

Very little R&D in education—0.2% of spending
What’s wrong with the market?

- Diverse customer base (~130,000 secondary schools in the U.S.)
- Many key decisions made at the local level
  
  ![Demand not sufficiently aggregated](arrow)

- 70% of K-12 content is still printed material and dominated by a small set of companies with existing relationships
- No comprehensive way to demonstrate quality of new products
  
  ![Incentives to supply innovative new tools are dampened, despite large market (~$8B/year)](arrow)
Approaches to aggregating demand

• Alliances between schools to make joint purchasing decisions and fund R&D

• Environments for experimentation (coupled with rigorous evaluation and reporting!)

• Could we make more procurement decisions using evidence-based criteria?
On the supply side, one approach is applying the same methods that companies like Google and Amazon use to develop the best content:

A/B testing (EDUSTAR example)
Example 1: Two activities that teach the same skill

Skill: Dividing Fractions (Common Core Standard 6.NS.A.1)

“Dividing Fractions”

“Basketball Dividing Fractions”

How Many?
A question like 20 divided by 5 is asking “how many 5s in 20?” (=4)
So \( \frac{1}{2} \) divided by \( \frac{1}{6} \) is asking “how many \( \frac{1}{6} \)'s in \( \frac{1}{2} \)?

\[
\frac{1}{2} + \frac{1}{6} \quad \text{is really asking:} \\
\frac{1}{6} \quad \text{in} \quad \frac{1}{2} ?
\]

Now look at the pizzas below ... how many “1/6th slices” fit into a “1/2 slice”?

How many \( \frac{1}{6} \) in \( \frac{1}{2} \) ?

Answer: 3

So now you can see why \( \frac{1}{2} + \frac{1}{6} = 3 \)
Example 2: Two versions of the same digital learning activity

**Baseline video**

Have you ever wondered what would happen if you divided a whole number by a fraction, instead of dividing by another whole number?

I wonder... \( 2 \div \frac{1}{2} \) ?

**Baseline video + section on “common mistakes”**

A common mistake is to confuse division by \( \frac{1}{2} \) with division by 2.

- \( 1 \div \frac{1}{2} = 2 \)
- \( 1 \div 2 = \)

\[
\begin{array}{c|c|c}
\hline
1 \text{ whole} & & \\
\hline
\frac{1}{2} & \frac{1}{2} & \\
\hline
\end{array}
\]

\[
\begin{array}{c|c|c}
\hline
1 \text{ whole} & & \\
\hline
\frac{1}{2} & \frac{1}{2} & \\
\hline
\end{array}
\]
FIGURE 1.
EDUSTAR Results for Two Pilot Examples

Pilot Example #1
- Dividing fractions vs. basketball dividing fractions: 4.8*

Pilot Example #2
- Video tutorials vs. control: 3.2**
- Video tutorials vs. video tutorials with common mistakes unit: 2.0+
Without evaluation, we do not know if shiny objects actually improve education....
Summary

• Educational technology has tremendous untapped potential to improve K-12 education (and perhaps training programs too!)
  • Lack of rigorous and consistent evaluation is a key challenge
  • Personalized learning needs to be better understood
  • Aggregated demand, competition on quality, R&D

• Policy Implications
  • ARPA-ED to spur innovation in education and learning sciences?
  • Tie edtech evaluation to procurement or future federal proposals ala Race to the Top
  • Prizes for workplace training apps and other market creation mechanisms