Creating Markets for Breakthrough Learning Technologies

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Initial Observations (1)

- Large gap between potential of Learning Science and Technology to improve educational outcomes and the status quo

- One of the reasons for this gap is **nature of the market** for learning technology, especially at K-12 level, and lack of investment in learning technology R&D

- Our aspiration should be the development of technologies that have **large impacts on learning outcomes** in core academic subjects.

Initial Observations (2)

- Accelerated acquisition of skills that lead to middle-class jobs is another fruitful area

- U.S. should experiment with "**pull mechanisms**" to accelerate development, evaluation, and adoption of high-impact learning technologies

- Other approaches that focus on the demand-side of the learning technology market worth trying as well (e.g. Gates-Digital Promise Teacher Wallet, ED and regional interest in learning technology ecosystems, NYC iZone)

Why Now?

- ConnectED – Administration effort to provide broadband to schools
- Emergence of low-cost connected devices such as tablets, smartphones
- College and career-ready standards, industry certifications can create national markets
- Interest in policy makers in paying for outcomes (as opposed to inputs)

Challenges Associated With K-12 Market

- Lengthy adoption cycles
- Fragmented market, difficult for new entrants
- General challenges of public sector procurement
- Low per pupil expenditures on educational software
- Lack of evidence to drive purchasing decisions, unclear to what extent existing evidence is used

Implications

- Do they limit investments in R&D, product development and rigorous, independent evaluation below what is desirable?

- Would we be more likely to see breakthrough learning technologies if there was a business case for significantly larger upfront investments?

Learning Science

- The design , use, and evaluation of learning technologies should be informed by advances in the learning sciences, such as cognitive science, educational psychology, social psychology, discipline-based education research….

- Example: Koedinger (2013) taxonomy of 30 instructional design principles for memory/fluency, induction, sense-making
  - Feedback during learning > no feedback
  - Worked examples + problem-solving practice > practice alone
  - Instruction relevant to student interests > not relevant

Potential of Learning Technology (1)

- **Digital tutor** (model the one on one interaction between expert and a novice, where expert has domain knowledge and is a good tutor)

- **Games for learning** (high level of time on task, Goldilocks principle of intermediate difficulty)

- **Continuous improvement** (rapid, low-cost evaluation, Internet-scale experimentation, feedback loops to learner, instructor, course designer, learning scientist)

Potential of Learning Technology (2)

- **Learning anytime, anywhere** (especially for adult learners)
- **Mastery learning** (students master each concept before proceeding to next concept)
- **Personalization** (personalized to needs, backgrounds, interests, skill levels)
- **Interactive simulations that enable students to engage in learning by doing** (e.g. Energy Skate Park)

Potential of Learning Technology (3)

- **Embedded assessment** using e.g. evidence-centered design – what behaviors are evidence of mastery, what tasks elicit those behaviors

- **Project-based learning:** provide the tools for students to design and make just about anything in both the digital and physical worlds

- Lower marginal cost, ability to scale if IT infrastructure is in place

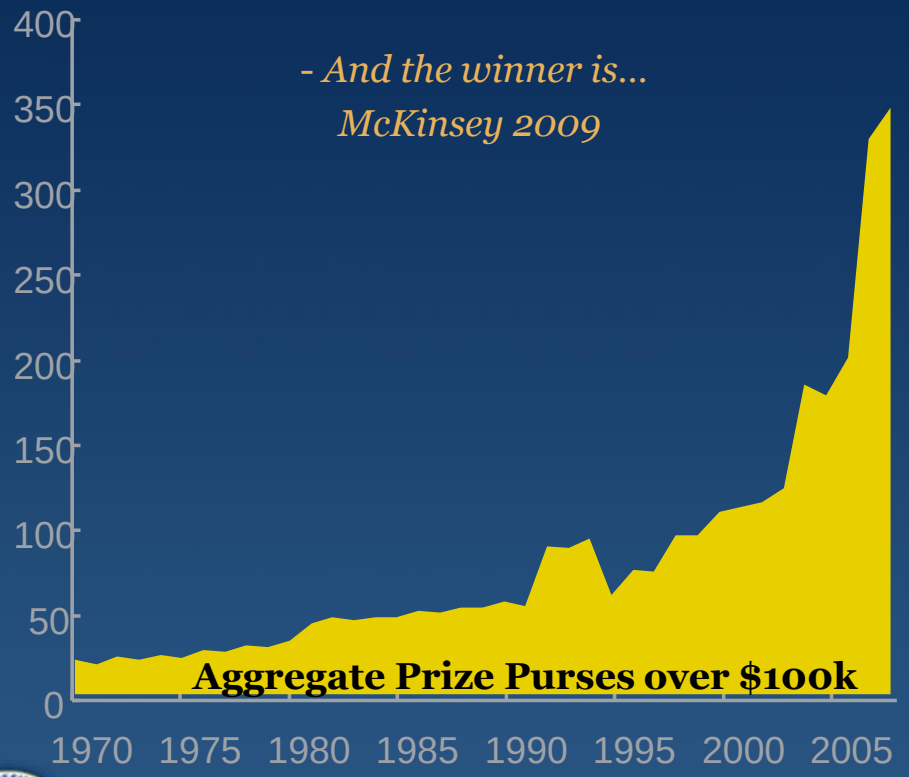
Types of Pull Mechanisms

- Incentive Prizes – X Prizes
- Advance Market Commitments – vaccines for diseases of the poor
- Milestone Payments – NASA-SpaceX collaboration
- Pay for Success – reduce prison recidivism
- Buyer's Consortia

Long Track Record of Spurring Innovation

"[T]otal funds from large prizes have more than tripled over the last decade to surpass $375 million."

- And the winner is…
McKinsey 2009



Benefits of Prizes

1. Shine a spotlight on a problem or opportunity
2. Pay only for results
3. Target an ambitious goal without predicting which team or approach is most likely to succeed
4. Reach beyond usual suspects to tap top talent
5. Stimulate private sector investment many times greater than the prize purse
6. Bring out-of-discipline perspectives to bear
7. Inspire risk-taking by offering a level playing field
8. Establish clear target metrics and validation protocols

Key Components of Pull Mechanisms

- **An outcome of interest** (e.g. performance in 8th grade math)
- **Baseline data** (only 20 percent of low-income students are "proficient" as measured by NAEP)
- **Goal/target** (increase this from 20 percent to at least X percent)
- **Assessment/judging process** (widely-accepted assessment given to a sufficiently large pool of students before and after intervention)
- **Incentive** (5 large school districts pledge to purchase a product that can do this, at a cost of $x/student)

Examples of Educational Outcomes

- Reduce the gap in vocabulary size between children from rich and poor households by increasing the level and quality of parent talk

- Increase number of students that are proficient in reading by 4th grade

- Increase the number of low-income students that can pass 9th grade courses (grade retention costs $10,000 per student)

Examples of Educational Outcomes (2)

- Significantly increase the rate of completion in community colleges for students that require remediation (Robin Hood Prize)

- Give a worker without a college degree a skill in 4-6 months that leads to a middle-class job

- Increase English proficiency for immigrants for work/civics

Additional Design Issues (1)

- Importance of involving teachers in problem definition
- Scope (e.g. performance over an entire academic year vs. difficult concept)
- Context of use (e.g. virtual high school, school, preventing "summer melt" during summer school).

Additional Design Issues (2)

- What decisions is "pull mechanism" trying to influence?
  - Get school districts to be more explicit about learning goals, how they will evaluate learning technology
  - Increase the willingness of companies to have their products rigorously evaluated
  - Increase private sector investment in R&D

- How large does the incentive need to be to have an impact? How legally binding does it need to be?

Additional Design Issues (3)

- Reward tied to predefined “finish line” or largest improvement (or both)
- Use of comparative effectiveness research to determine societal “willingness to pay”, prospective benefit: cost ratio
- Portfolio of approaches (e.g. combining pull mechanisms and impact investing)

Additional Design Issues (4)

- Staging
  - Ideation challenge to stimulate concept papers
  - Milestone payments for intermediate progress (small scale demonstration of efficacy)
  - AMC or “pay for success” for large-scale demonstration of effectiveness

Critique

- In education, we are sometimes simultaneously arguing about both ends and means

- Approach may not work if educational outcomes contingent on many factors not under control of developer of intervention (student motivation, school environment, etc.)

- Many participants (e.g. researchers, non-profits) have limited ability to self-finance

Next Steps

- Sponsor more detailed design efforts in particular areas
- Interview potential participants and sponsors to determine level of interest
- More discussion of mechanisms and potential changes in budget/procurement policy
  - Make binding commitment in 2014 – but payout may not occur for 3-5 years
- Your idea here

Thank You

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