Decoding the Dream

- Log = K-20 educational system
- Mandates to move:
  - Mismatch between industrial economy and global, knowledge-based, innovation-centered economy (NSF’s charter)
  - Common Core standards as ambitious goals for all students (Post-Sputnick curriculum reforms)
- Rabbits = our individual research projects; Big rabbit = Center research (SoLCs)
Research for Transformation

Chris Dede, Harvard U.
Where Does the Log Move?
Digital Teaching Platforms

Instructional Designer

Course Syllabus

Open/Closed Repository

Teacher

Content Management

Assessment

Grade Book

SIS
Linked Representations (SimCalc)
Learning Progressions (WISE)

Elicit Ideas

Why do you think hydrogen combustion may be more environmentally friendly than methane or ethane combustion?

Sort Ideas

Based on what happened to the speed and temperature of the atoms in the simulation, what happens to atoms and molecules in an explosion?

Add Ideas

In an explosion, atoms...

Distinguish Ideas

\[ 6 \text{H}_2 + 3 \text{O}_2 \rightarrow 6 \text{H}_2\text{O} \]

- Step 1: Before the reaction starts.
- Step 2: The beginning of the reaction.
- Step 3: During the reaction.
- Step 4: After the reaction.
(Embedded Tutoring - ASSISTments)
Virtual Worlds (EcoMUVE)
The 2010 NETP

- Response to Congressional mandate for five-year plan for educational uses of technology
- Plan for *transforming* education with technology in response to urgent need to remain competitive in a global economy
- Reflection of increased understanding of how to support learning and of growing capabilities enabled by technology
Scratch as Exemplar
Starship Colony MMORG
Animated Pedagogical Agents (Dr. C)
TSI: Facial Identity Capture
(Bailenson)
ECD Path Analysis (River City)
Elephants Are Disruptive
Illustrative Impediments to Transformative Research

- Structural Barriers
- Skeptical Stakeholders
- Unscalable Products
Structural Barriers

- Faculty review for tenure and promotion
- Emergent, peer review funding
- Limited resources for education research
Post-Sputnik Curriculum Reforms

- Common Core Standards are the modern equivalent
- Pasteur’s Quadrant (Stokes, 1997)
- Call for Grand Challenge funding
- Special mechanisms for assessing scholarly contributions
Skeptical Stakeholders

- The “Good-Enough-For-Me” error
  - People are different
  - The world is different
- “I’m the Victim; They’re the Villains”
- “Experimenting on Children”
- Little visible impact of education research
Knowledge Diffusion (Rogers)

*Not Proof of Effectiveness*

- Opinion leadership
- Compatibility
- Simplicity
- Trialability
- Observability

But Diffusion is not Transformation
Transformational S uasion

* * *

*Sesame Street* Disruptive Innovations

- directly addressing pre-school children and their families
- built up from educational objectives (i.e., not entertainment first)
- research-based, in content, formative evaluation, and summative assessment
- continuous collaboration of curriculum, research, and production
- hosted by African-American couple in urban setting
- national penetration, promotion, and publicity
Transformational Suasion

*Sesame Street* Bases of Resistance

- from people who feared *end of local control* of education; a national *curriculum* – with federal government in charge of what kids should learn

- from people who feared *racial integration* – e.g., Senator John Stennis of Mississippi – calling Head Start a “Communist plot to mix the races”

- from people who believed preschoolers were *just too young* to be subjected to *any* influence other than parents – or to any purposeful curriculum – “early childhood too precious a time to be used for education”
Unscalable Products

- Heroes rather than typical teachers
- Special resources
- Atypical populations

Unrealistic conditions for success

Fine for theory building, but not for problem solving
Exploring the Process of Scaling Up

What are the steps—and traps—in moving from innovation to broad-based adoption and consequential change?

Dimensions of Scale
- Taking an educational innovation completely to scale involves five dimensions that reflect different aspects of making an intervention effective in one setting useful across a wide spectrum of contexts.

Depth
- Getting to scale produces deep and consequential changes in practice. Requires evaluation and research to understand and enhance the success of effectiveness.

Sustainability
- Sustaining scaled growth necessitates maintaining these changes in practice over substantial periods of time. Requires robust design to enable adapting to negative shifts in context.

Spread
- Scaling up is achieved by diffusion of the innovation to large numbers of users. Requires modifications to retain effectiveness while reducing the resources and expertise required.

Shift
- Ownership of the innovation is assumed by users, who deepen and sustain the innovation via adaptation. Requires moving beyond "brand" to support users as co-evaluators, co-designers, and co-sponsors.

Evolution
- The innovation as revised by its adopters is influential in reshaping the thinking of its designers. Requires learning from users' adaptations about how to rethink the innovation's model.

Sources of Leverage
- Each dimension provides leverage for the scaling process by enhancing the intervention to increase its power, durability, applicability, and flexibility.

Evaluation and Research
- What are the sources of the innovation's effectiveness? What conditions does each source depend on for success? How sensitive is each source to change? How consistent is the innovation with the current political and cultural context of educational improvement?

Robust Design
- How can the innovation be modified so that it functions in various types of inestimable conditions? How typical is each condition for success in the target population of users? How can developers support various users while adapting toward conditions for success that enable full effectiveness?

Reducing Resources and Expertise
- How much is the overall power of the innovation affected by reducing its cost or the knowledge required to implement it? How much power is retained in a tight version that requires fewer resources or less expertise of its users? How can developers support right users to achieve full effectiveness?

Moving Beyond Brand
- How can developers support users going beyond what the original developers have accomplished? How can developers build users' capacity as evaluators, co-designers, and co-sponsors? How can users form a "community of practice" that helps answer questions about scale?

Rethinking the Model
- How can developers unlearn their initial beliefs, values, and assumptions about the innovation, and generate willingness to start the innovation process over again? How can developers facilitate reconceptualization and discontinuous evolution? How can developers form a "community of reflective re-design" with other innovators?

Traps to Avoid
- Evolving along each dimension requires the developers of the innovation to overcome traps that have both cognitive and evaluative aspects.

Traps of Perfection
- Developers should not seek an unattainable goal of perfection at the cost of deferring resources from other dimensions of scale. (The great should not be the enemy of the good.)

Trap of Mutation
- Developers should ensure that the ways they modify the innovation to adapt to various inestimable contexts do not undercut its core conditions for success.

Trap of Optimality
- Developers should realize a somewhat less powerful innovation that reaches much greater numbers of users is a step forward.

Trap of Orignation
- Developers should not attempt to control the original innovation in ways that deter adoption and further innovation by users.

Trap of Unlearning
- Developers' unwillingness to take a fresh look can prevent genuine evolution.
Greatest Risk is Business as Usual

- What scientists do today:
  - Formulating new opportunities/challenges
  - Collaborating and networking
  - Fostering diversity
  - Developing infrastructure

- “Rethinking the work and sharing the work”
- “What will the educational system be when all our innovations go to national scale?”

Hang Together or Hang Separately
All Children Can Ride the Elephant