



# Scalability at the Level of Learning Technologies

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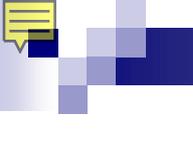
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# Overview

- ***Difficulties in Attaining Scale***
- A Framework to Aid in Designing for Scale—and Adapting for Scale
- Types of Interventions to Scale Up



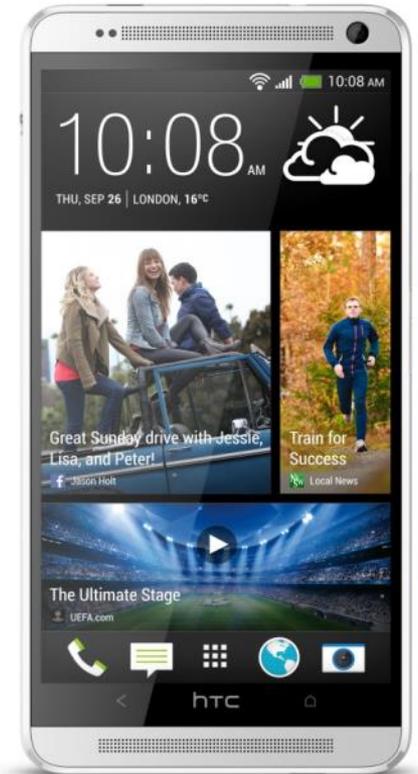
# Scaling Up Products

- Adapting an innovation successful in some local setting to effective usage in a wide range of contexts
  - Fast food as example
- Need not be one-size-fits-all; can be personalized
  - Cars as illustration
- Technology as a lever for scale
  - Can be used to automate or innovate, to make uniform or customized

# 1976



# 2015



# The Spectrum of Social Media

## ■ *Sharing*

- Social bookmarking
- Photo–video-data sharing
- Social networking
- Writers’ workshops and fan fiction

## ■ *Thinking*

- Blogs
- Podcasts
- Online discussion forums
- Twitter

## ■ *Co-Creating*

- Wikis–collaborative file creation
- Mashups–collective media creation
- Collaborative social-change communities

# Scaling Up in Education

- In contrast to experiences in other sectors of society, *successfully* scaling up successful programs has proved very difficult in education
- The more complex the innovation and the greater the influence of setting, the more likely a new practice is to fail crossing the “chasm” from its original setting to other sites
  - Avoiding the “replica trap”: the erroneous strategy of trying to repeat everywhere what worked locally, without considering challenges of size and contextual variations in needs/resources
    - Problems of magnitude
    - Problems of variation -- not adoption, but adaptation

# Scale is a Difficult Problem

- What scales is not an innovation, but *a model* of an innovation
  - Similar to, but different from a franchise
- Scaling to each site requires *adaptation* to local context and culture
  - “Tower of Babel” as a symptom of deeper confusion



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# Sources of Leverage for Scaling

- *Depth*: **evaluation and research** to understand and enhance causes of effectiveness
- *Sustainability*: **robust-design** to enable adapting to negative shifts in context
- *Spread*: modifying to retain effectiveness while **reducing resources and expertise** required
- *Shift*: **moving beyond “brand”** to support users as co-evaluators, co-designers, and co-scalers
- *Evolution*: learning from users’ adaptations about how to **rethink the innovation’s model**

You have a proven innovation you want to scale...



# Exploring the Process of Scaling Up

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



<p><b>Dimensions of Scale</b> 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.</p>	<p><b>Depth</b> Getting to scale produces deep and consequential changes in practice. Requires evaluation and research to understand and enhance the causes of effectiveness.</p>	<p><b>Sustainability</b> Sustaining scaled growth means maintaining these changes in practice over substantial periods of time. Requires robust design to enable adapting to negative shifts in context.</p>	<p><b>Spread</b> 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.</p>	<p><b>Shift</b> 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-scalers.</p>	<p><b>Evolution</b> The innovation as revised by its adapters is influential in reshaping the thinking of its designers. Requires learning from users’ adaptations about how to rethink the innovation’s model.</p>
<p><b>Sources of Leverage</b> Each dimension provides leverage for the scaling process by evolving the intervention to increase its power, durability, applicability, and flexibility.</p>	<p><b>Evaluation and Research</b> What are the sources of the innovation’s effectiveness? What conditions does each source depend on for success? How sensitive is each source to these conditions? How consistent is the innovation with the current political and cultural context of educational improvement?</p>	<p><b>Robust Design</b> How can the innovation be modified so that it functions in various types of inhospitable conditions? How typical is each condition for success in the target population of users? How can developers support varied users while evolving toward conditions for success that enable full effectiveness?</p>	<p><b>Reducing Resources and Expertise</b> 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 light version that requires fewer resources or less expertise of its users? How can developers support light users to achieve full effectiveness?</p>	<p><b>Moving Beyond Brand</b> How can developers support users going beyond what the originators have accomplished? How can developers build users’ capacity as co-evaluators, co-designers, and co-scalers? How can users form a “community of practice” that helps answer questions about scale?</p>	<p><b>Rethinking the Model</b> 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 redesign” with other innovators?</p>
<p><b>Traps to Avoid</b> Evolving along each dimension requires the developers of the innovation to overcome traps that have both cognitive and affective aspects.</p>	<p><b>Trap of Perfection</b> Developers should not seek an unattainable goal of perfection at the cost of deflecting resources from other dimensions of scale. (The great should not be the enemy of the good.)</p>	<p><b>Trap of Mutation</b> Developers should ensure that the ways they modify the innovation to adapt to various inhospitable contexts do not undercut its core conditions for success.</p>	<p><b>Trap of Optimality</b> Developers should realize a somewhat less powerful innovation that reaches much greater numbers of users is a step forward.</p>	<p><b>Trap of Origination</b> Developers should not attempt to control the original innovation in ways that deter adaptation and further innovation by users.</p>	<p><b>Trap of Unlearning</b> Developers’ unwillingness to take a fresh look can prevent genuine evolution.</p>

Source: Christopher Dede, Harvard University Graduate School of Education; Cynthia Coburn, “Rethinking Scale: Moving Beyond Numbers to Deep and Lasting Change,” *Educational Researcher* (2008).

Illustration by Patrick Corigan

# River City Interface

The screenshot displays the River City MUVE interface, which is a virtual environment for learning. The interface is divided into several key areas:

- 1. View and Action Space:** This area is located at the top of the interface, containing navigation and control icons such as a home button, a play button, and various camera controls. It also includes a menu bar with options like 'File', 'View', 'Options', 'Chat', 'Login', 'Avatar', and 'Visibility'.
- 2. Virtual Space:** This is the main 3D environment where the user's avatar, named 'Jody', is positioned. The scene shows a large, multi-story building with a sign, a paved walkway, and a grassy area under a cloudy sky.
- 3. Chat Window:** Located at the bottom left, this window displays text from other users or system messages. The visible text includes instructions like 'the residents at this point. Remember to be observant of your surroundings. Write down the changes you observe and keep track of the information.' and 'Immigration Off... the sign for the session you will... the University here and your role is two-fold: to learn how to become a great scientific investigator and to help us uncover the mystery of why so many River City residents have been getting sick.'
- 4. Student Workspace:** This area is on the right side of the interface, featuring a 'Web' browser window. It contains a navigation menu with 'GUIDE', 'NOTEBOOK', 'MAP/TOOLS', and 'HELP'. The main content area displays a 'Welcome to River City' message, followed by a mission description: 'It is 18... getting sick. The Mayor of River City has commissioned you and your teammates to find out what is causing their health problems. River City University scientists are excited that you (and your 21st century knowledge, skills, and tools) will be helping them uncover the sources of their health problems!'. Below this, it states: 'If you are successful in your mission, you will be named a Certified Scientist (quite an honor!). In order to attain this level of expertise, you must first go through 4 training stages:'. A numbered list follows:
  1. Scientist-in-Training
  2. Junior Scientist
  3. Assistant Scientist
  4. Scientist The workspace concludes with the instruction: 'To move to a new stage, you must complete a series of activities and assignments. Once you and your team complete a stage, show your work to your teacher before moving on.' A green arrow button labeled 'Next Page' is located at the bottom right of this workspace.

At the bottom of the interface, a status bar provides technical information: 'Download complete', 'Done', '0.0 K/sec', '33.4 frames/sec', '9:15:45 PM Mon Sep 17, 2007 VRT', '120 meters', '20.0 meters', and '0.0 m/s'.

# Depth Dimension of Scale

- How effective is the innovation?
- What are the sources of the innovation's effectiveness?
  - On what conditions for success does each source depend?
  - How sensitive is each source to attenuation or absence of a particular condition for success?

*Trap of Perfection*

# Illustrative **Depth** in River City

## ■ Design-based Research

- Iterative cycles of theory-design-implementation-reconception

## ■ Contrasting Theories of Learning

- Guided Social Constructivism
- Expert Mentoring
- Legitimate Peripheral Participation
- Best of the Best

## ■ Guidance System

# Sustainability Dimension of Scale

- How can the innovation be modified so that it functions in various types of inhospitable conditions?
  - How typical is each condition for success in my target population of users?
  - How can I support “hybrid” users in evolving towards conditions for success that enable full effectiveness?

*Trap of Mutation – Don't Want to Lose Depth*

# Illustrative Sustainability in River City

## ■ Increasing Engagement

- Access to Special Powers based on Performance
- Use of Intrinsic rather than Extrinsic Motivation

## ■ Embedding Formative Assessments

- Newspaper reporter Kent Brock
- Potential for Individualized Interventions based on Diverse Learning Styles

# Spread Dimension of Scale

- How can I modify the innovation to retain effectiveness while reducing resources and expertise required?
- How much is the overall power of the innovation affected by reducing its cost or the knowledge required to implement?
  - How much power is retained in a “light” version of the innovation that requires fewer resources or less expertise of its users?
  - How can I support “light” users to evolve towards sufficient resources and expertise to achieve full effectiveness?

*Trap of Scaling the Project, Not the Model*

# Illustrative Spread in River City

## ■ The River City Dashboard

- Tools for Teacher Management

## ■ Automated Email Reports

- Details on Student Behaviors and Interactions
- Potential Development of Visualizations (SGER)
- Potential for Sophisticated Formative Assessment

## ■ Aid for Inexperienced or Unprepared Teachers

- Videoclips for Student Induction
- Quick-Briefing Lesson Plans
- Professional Development Webinars

# Shift Dimension of Scale

- How can I move beyond “brand” to support users as co-evaluators, co-designers, and co-scalers?
- How can I support users going beyond what the originators have accomplished?
  - How can I build users’ capacity as co-evaluators? As co-designers? As co-scalers?
  - How can users form a “community of practice” that helps answer questions about scale?

*Trap of Origination*

# Illustrative Shift in River City

## ■ Approving Adaptations

- Special Education
- Teacher-to-Teacher Curricular Help

## ■ Teachers as Co-Designers

- Changes to the Online Lab Notebook

## ■ Teachers as Co-Evaluators

- Insights from Automated Email Reports
- Accounts of Unanticipated Student Behavior
  - Waterfall
  - Bug Catcher

# Evolution Dimension of Scale

- How can I unlearn my beliefs, values, and assumptions about the innovation?
  - How willing am I to start the innovation process over again?
  - How can I “make the familiar strange” to facilitate reconceptualization and discontinuous evolution?
  - How can I form a “community of reflective redesign” with other innovators?

*Trap of Unlearning*

# Illustrative Evolution in River City

- Shift in Professional Development Strategy
  - Delivery Method
  - Emphasis
  - Level of Detail
  - Train-the-Trainer Sessions
- New Study on Virtual Ecosystems and Complex Causality



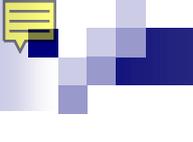
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# Types of Problems in Health Care

- **Simple:** building a hospital
- **Complicated:** developing a vaccine
- **Complex:** improving the health of a particular group  
(dynamic, nonlinear, and counter-intuitive, driven by multiple independent factors that interrelate in rapidly shifting ways)

Snowden & Boone, 2007



# Challenges/Concerns

- Tension between fidelity and necessary adaptation
- Impact of adaptations and diverse contexts on learner outcomes
- Effectively using formative data to intervene/correct course
- Facilitating transfer of “ownership” of the innovation & sustaining momentum/growth

# Organic Scaling “like a Weed”

