

Transforming Education for the 21st Century--**The Process of System Scaling**

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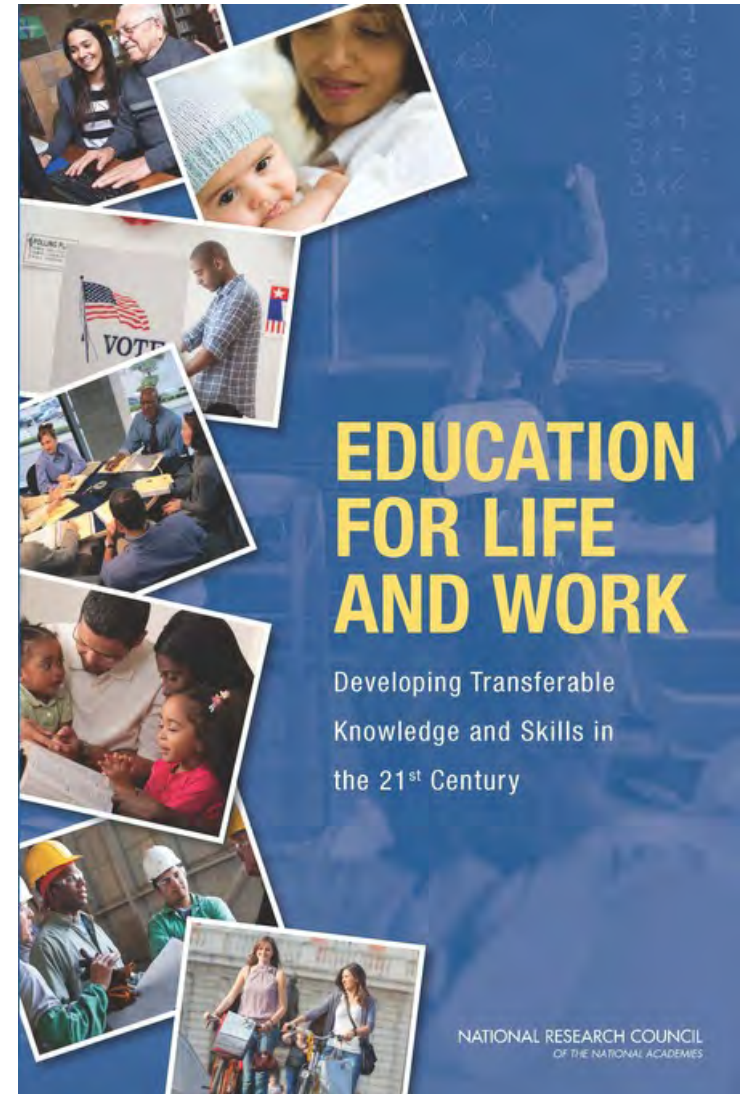


Overview

- ***A Grand Challenge in Education***
- Difficulties in Attaining Scale to Meet this Challenge
- A Framework to Aid Designing for Scale
- Implications for Ontario Initiatives

US National Research Council (2012)

Today's children can meet future challenges if their schooling and informal learning activities prepare them for adult roles as citizens, employees, managers, parents, volunteers, and entrepreneurs.

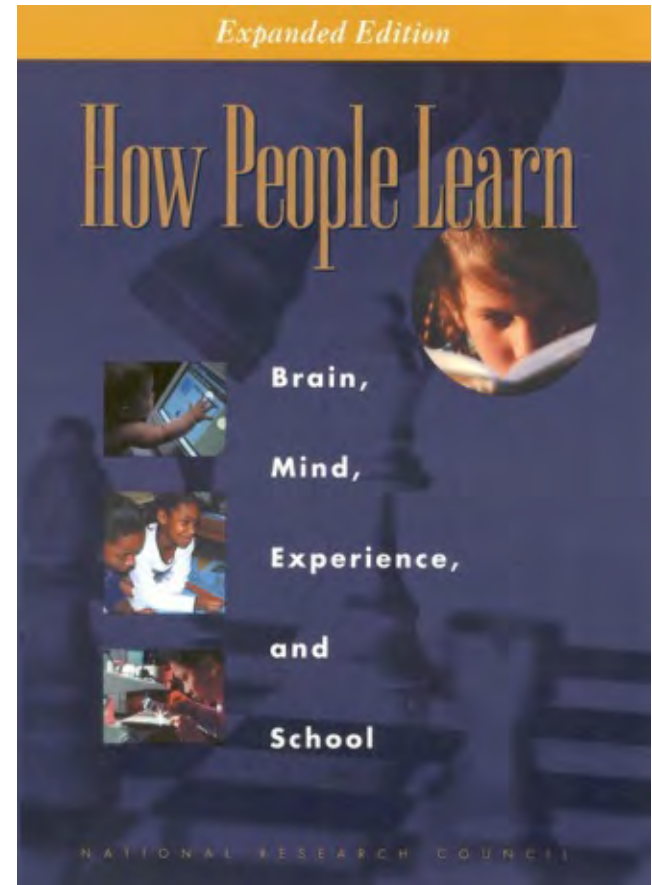


Types of Knowledge/Skills

<i>Cognitive Outcomes</i>	<i>Intrapersonal Outcomes</i>	<i>Interpersonal Outcomes</i>
Cognitive processes and strategies	Intellectual Openness	Teamwork and Collaboration
Knowledge	Work Ethic and Conscientiousness	Leadership
Creativity	Positive Core Self-Evaluation	Communication
Critical Thinking	Metacognition	Responsibility
Information Literacy	Flexibility	Conflict Resolution
Reasoning	Initiative	
Innovation	Appreciation of Diversity	

US National Research Council (2000)

New evidence from many branches of science has significantly added to our understanding of what it means to know, from the neural processes that occur during learning to the influence of culture on what people see and absorb.



4 Dimensions of Design

- ***Learner-centered***: preconceptions, needs, preferences, interests.
- ***Knowledge/skills-centered***: what is to be taught, why it is taught, and what mastery looks like.
- ***Assessment-centered***: diagnostic measures of learners' thinking and doing that are formative for further instruction and learning
- ***Community-centered***: encouraging a culture of collaborative questioning, respect, and risk taking [a context for the other three]

3 Contexts for Learning

- Classrooms
 - Presentation and discussion
- Richly Contextualized Real World Learning
 - Internships, apprenticeships
- Learning Communities
 - Interpretation and transfer

face to face, virtual, blended

A Grand Challenge

3 times 4 = 19

3 contexts


4 dimensions of learning

19 types of knowledge and skills

cognitive, intrapersonal, interpersonal

“Deeper Learning”

- Case-based learning
- Collaborative learning
- Apprenticeships
- Self-directed, life-wide learning
- Learning for transfer
- Interdisciplinary studies
- Diagnostic assessments



US National Science Foundation – Cyberlearning

- An innovative type of learning
- A substantial technical advance necessary to support new learning approach
- A potentially transformational impact

High Risk, High Gain



European Learning Industry Group

- **we.learn.it** – a network of European school children, teachers, and facilitators for exploratory and creative real life learning experiences
- **VISIR** –collect, analyze and share micro innovation practices to propose a new vision for learning technologies in Europe

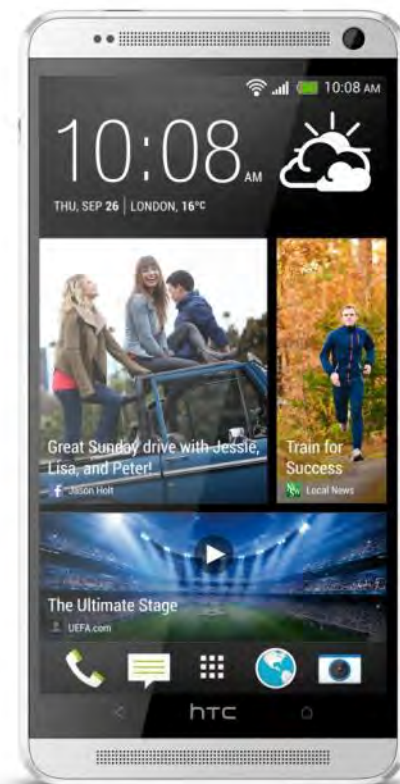
Scaling Up Products

- 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
 - Apps as illustration
- Technology as a lever for scale
 - Can be used to automate or innovate, to make uniform or customized

1976



2014



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

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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

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

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>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.</p>	<p>Depth Getting to scale produces deep and consequential changes in practice. Requires evaluation and research to understand and enhance the causes of effectiveness.</p>	<p>Sustainability 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>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.</p>	<p>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-scalers.</p>	<p>Evolution 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>Sources of Leverage Each dimension provides leverage for the scaling process by evolving the intervention to increase its power, durability, applicability, and flexibility.</p>	<p>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 these conditions? How consistent is the innovation with the current political and cultural context of educational improvement?</p>	<p>Robust Design 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>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 light version that requires fewer resources or less expertise of its users? How can developers support light users to achieve full effectiveness?</p>	<p>Moving Beyond Brand 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>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 redesign” with other innovators?</p>
<p>Traps to Avoid Evolving along each dimension requires the developers of the innovation to overcome traps that have both cognitive and affective aspects.</p>	<p>Trap of Perfection 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>Trap of Mutation 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>Trap of Optimality Developers should realize a somewhat less powerful innovation that reaches much greater numbers of users is a step forward.</p>	<p>Trap of Origination Developers should not attempt to control the original innovation in ways that deter adaptation and further innovation by users.</p>	<p>Trap of Unlearning 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* (2009).

Illustration by Patrick Costigan

River City Interface

The screenshot displays the MUVEES - River City MUVE interface. The main window shows a 3D virtual environment with a character named Jody in a green dress. The interface includes a menu bar with options like File, View, Options, Chat, Login, Avatar, and Visibility. A toolbar contains various navigation and interaction icons. A red box labeled "1. View and Action Space" highlights the toolbar area. Another red box labeled "2. Virtual Space" highlights the 3D environment. A third red box labeled "3. Chat Window" highlights the chat area at the bottom left, which contains text about immigration and scientific investigation. A fourth red box labeled "4. Student Workspace" highlights the right-hand panel, which contains a "Web" browser window with a "GUIDE" tab selected. The guide text includes a welcome message, a mission objective, and a list of training stages: 1. Scientist-in-Training, 2. Junior Scientist, 3. Assistant Scientist, and 4. Scientist. A "Next Page" button with a green arrow is located at the bottom right of the workspace. The status bar at the bottom shows system information like "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".

1. View and Action Space

2. Virtual Space

3. Chat Window

4. Student Workspace

the residents at this point. Remember to be observant of your surroundings. Write down the changes you observe and keep track of the information. Immigration Off... the sign for the session you will Immigration Off... the University here and your role is twofold: 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.

Welcome to River City... 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!

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:

1. Scientist-in-Training
2. Junior Scientist
3. Assistant Scientist
4. Scientist

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.

Next Page

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 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

Knowledge Diffusion (Rogers)

- Compatibility
- Simplicity
- Trialability
- Observability
- Opinion leadership

Not Proof of Effectiveness

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

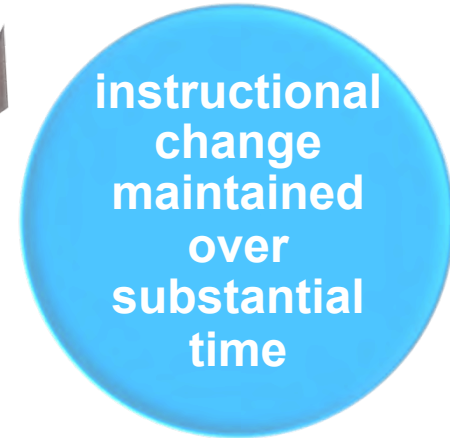
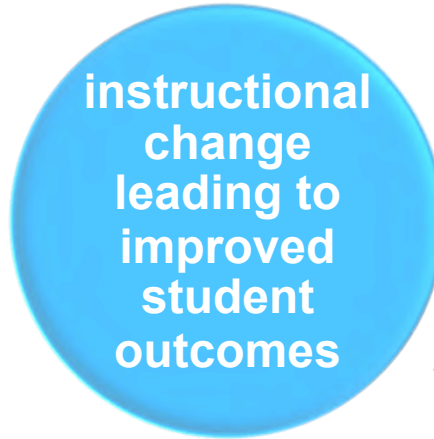
Illustrative Evolution in River City

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

DEPTH

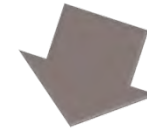
EVOLUTION

SUSTAINABILITY



SHIFT

SPREAD





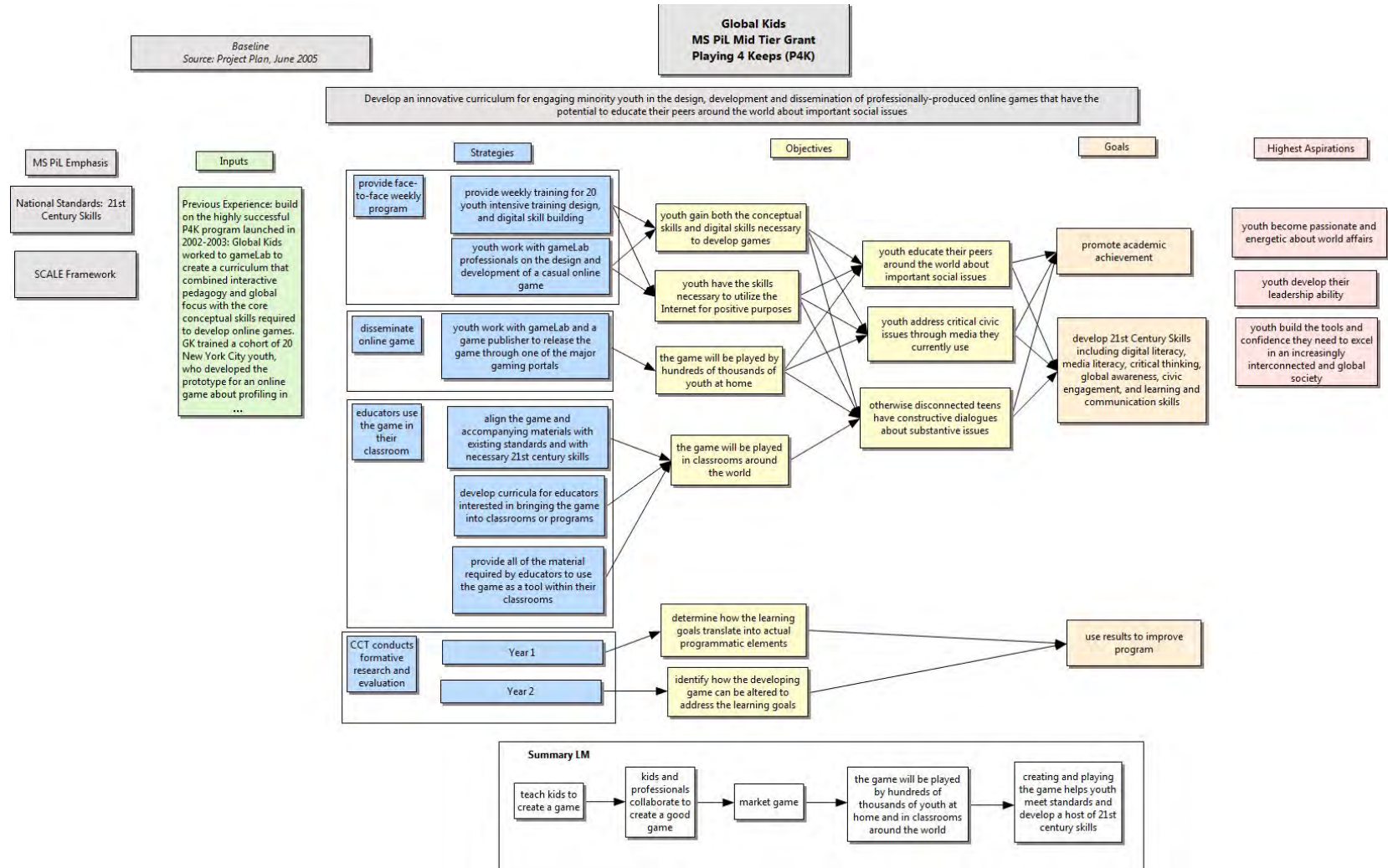
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Program Logic Models: Kellogg

The program logic model is defined as a picture of how your organization does its work – the theory and assumptions underlying the program. A program logic model **links outcomes (short- and long-term) with program activities/processes and the theoretical assumptions/principles of the program.**

P4K Baseline Logic Model

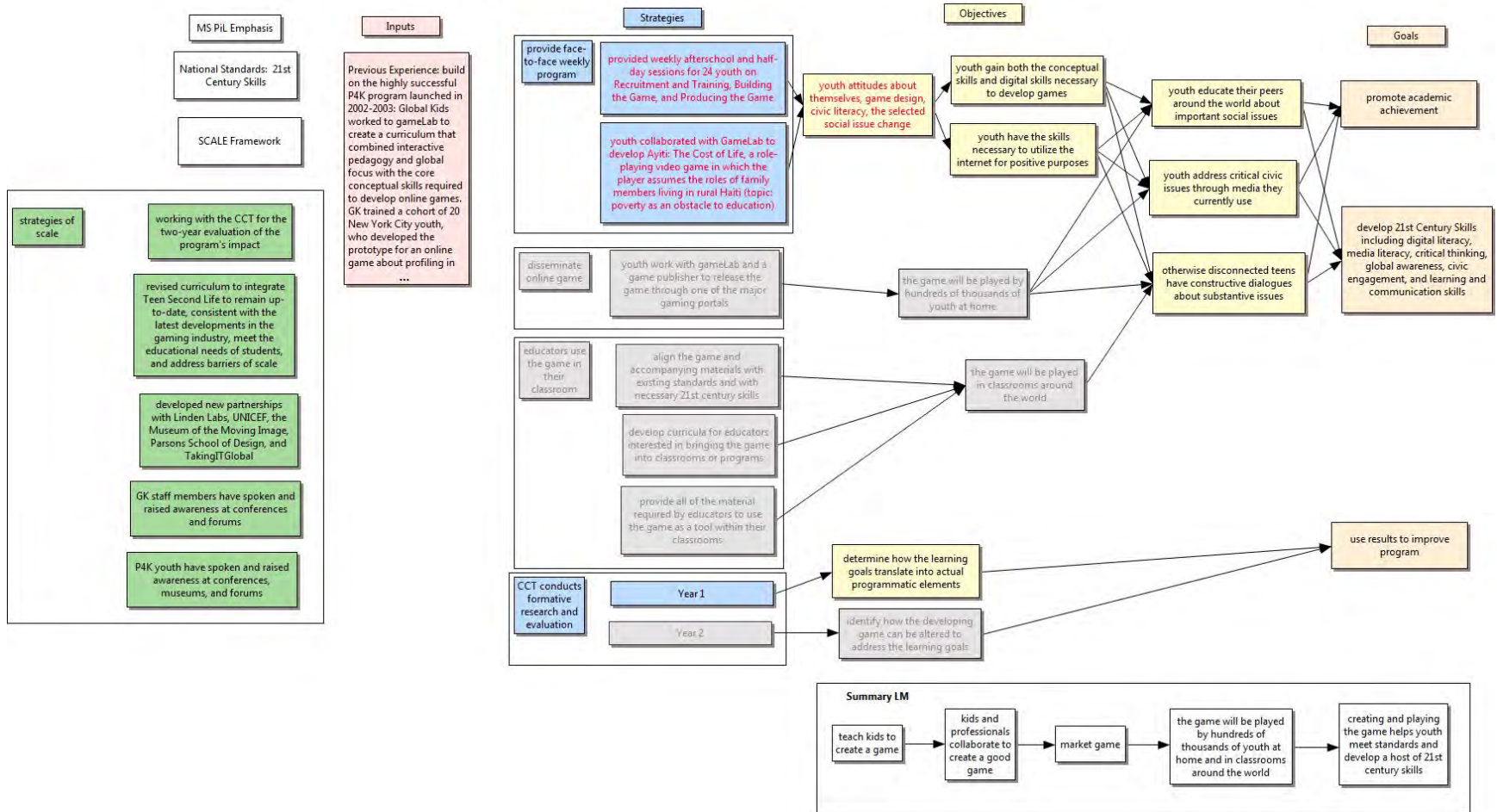


P4K Year One Enacted Logic Model

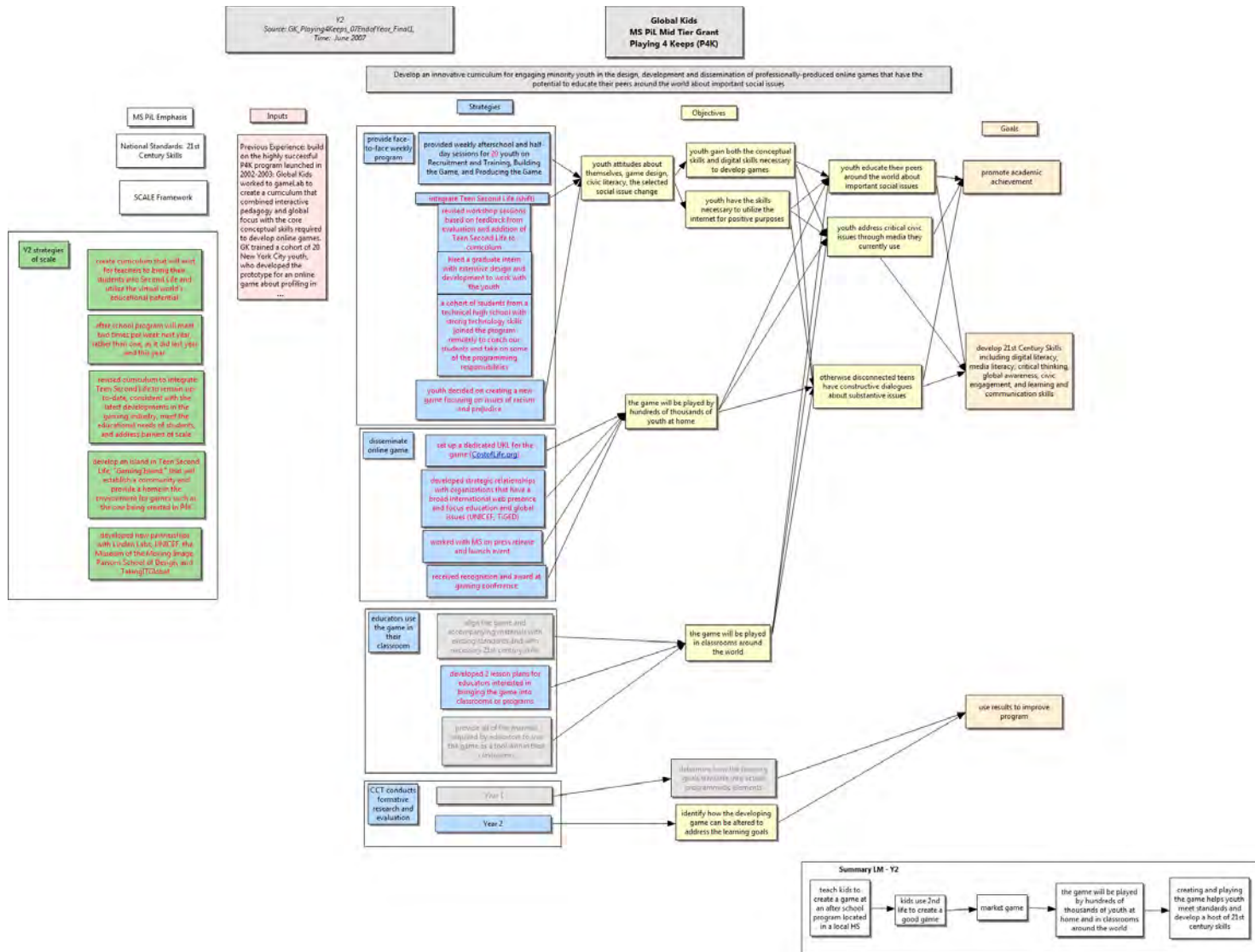
Y1
Source: GK_MS_P4K_June06_Final_Narrative,
GK_MS_P4K_June06_EvalSummary
Time: June 2006

**Global Kids
MS PIL Mid Tier Grant
Playing 4 Keeps (P4K)**

Develop an innovative curriculum for engaging minority youth in the design, development and dissemination of professionally-produced online games that have the potential to educate their peers around the world about important social issues



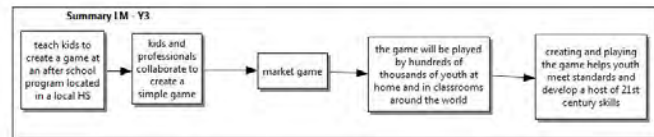
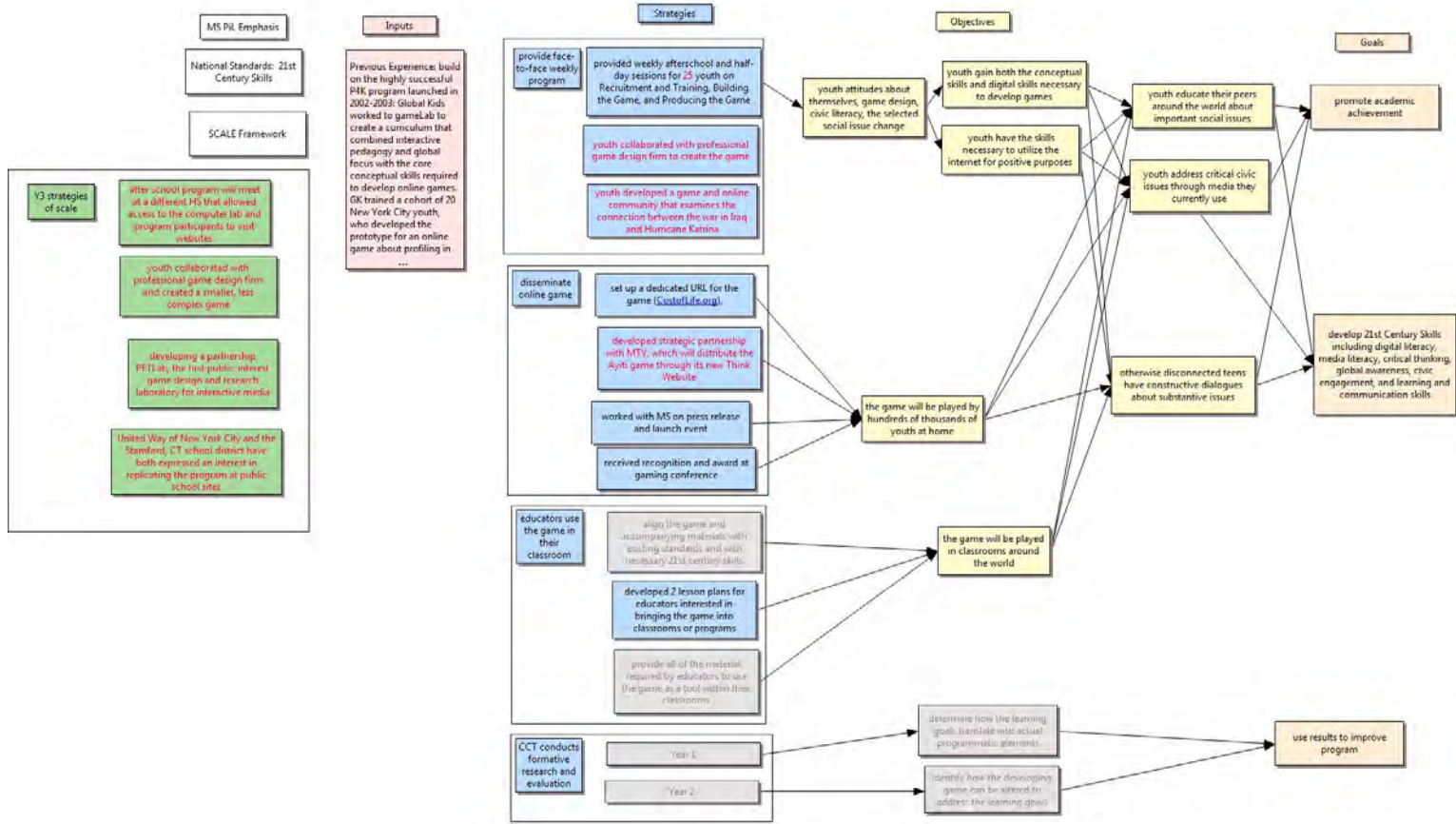
P4K Year Two Logic Model



P4K Year Three Logic Model

Y3
Source: GK_Playing4Keeps_08MidYear_Final
Time: June 2008

Global Kids
MS PIL Mid Tier Grant
Playing 4 Keeps (P4K)



“Emergent” Models for Investment

- In contrast to “outcome-based” funding centered on clear goals, data-driven strategies, heightened accountability, and rigorous evaluations
- Emergent models specify a design space and a general goal, but do not dictate pre-specified mechanisms for achieving the goals

Kania, Kremer, and Russell (2014)



Common 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

Potential Factors that Influence Scalability of Effective Instructional Usage of Technology

Classroom: Teacher's Pedagogical Beliefs
Teacher's Technology Beliefs
Teacher's Technology Preparedness
Teacher Demographic Characteristics
Technology Resources
Students' Home Access
Students' Home Usage
Students' Comfort with Technology
Students' Demographic Characteristics

- **From Russell et al, 2003: Elementary Teachers' Use of Technology: Characteristics of Teachers, Schools, and Districts Associated With Technology Use*



Potential Factors that Influence Scalability of Effective Instructional Usage of Technology at the School Level*

Leadership of Technology Initiatives

Principal's Pedagogical Beliefs

Principal's Technology Beliefs

Principal's Technology Preparedness

School Culture

***From Russell et al, 2003**

Potential Factors that Influence Scalability of Effective Instructional Usage of Technology at the District Level*

Community Attitudes about Educational Technology
District Vision for Technology
Leadership of Technology Initiatives
Resources for Technology Initiatives
Support Services for Technology Initiatives
Infrastructure of Computers and Telecommunications
Professional Development Related to Technology
Relationship Between Technology and Equity
Technology-Related Policies and Standards

***From Russell et al, 2003**



Planning for Scale

What are your goals in scaling up your model (internally and externally)? To whom do you hope to scale? Describe what “scale success” would look like.

What actions might you take to DEEPEN the power of your model?

What actions might you take to make your model SUSTAINABLE?

What actions might you take to SPREAD your model?

What actions might you take to facilitate SHIFT and EVOLUTION of your model?

Where are you strongest on these dimensions? Weakest?

Organic Scaling “like a Weed”



Resources

- Kania, J., Kramer, M., & Russell, P. (2014). *Up for debate: Strategic philanthropy for a complex world*. Palo Alto, CA: Stanford Social Innovation Review (Summer)
- Kellogg Foundation. (2006). *W.K Kellogg logic model development guide*.
- Snowden, D.J., & Boone, M. (2007). A leader's framework for decision making. *Harvard Business Review*, November 2007, pp. 69–76.

