New Wine in No Bottles: Immersive, Personalized, Ubiquitous Learning

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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.
Cognitive: critical thinking, decision-making, adaptive learning, executive function, analysis, reasoning/argumentation, interpretation, information and communications technology (ICT) literacy, innovation, creativity.

Interpersonal: social influence with others, leadership, assertive communication, empathy/perspective-taking, trust, interpersonal competencies, coordination, service orientation, negotiation, teamwork, cooperation.

Intrapersonal: integrity, appreciation for diversity, intellectual interest and curiosity, self-monitoring, continuous learning, initiative, productivity, metacognition, self-direction, professionalism/ethics, artistic and cultural appreciation, self-evaluation, flexibility, physical and psychological health, grit, citizenship, perseverance, responsibility, self-reinforcement, career orientation.
## Dimensions of Advanced Knowledge and Skills

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<th>Cognitive Outcomes</th>
<th>Intrapersonal Outcomes</th>
<th>Interpersonal Outcomes</th>
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Multi-dimensional Learning

- Classrooms
- Richly Contextualized Real World Learning
  - Internships, apprenticeships
- Community
  - Face-to-face and virtual
The Promise of Learning@scale

- Serves a broader range of learners
  - increased human capital
  - greater diversity in co-learners
- Wider opportunities for social capital and for links to workplace and life
- Self-improving via research and continual feedback
- Excellent return on investment by learners and by society

*If effective (mastery, full range of skills)*
X-MOOCs: Filming a Play
C-MOOCs: Reality Television
Advancing to Movies

- Special effects
- Manipulation of space and time
- Close-ups
- Point of View
- Composition and Editing
- Shooting on location for contextual richness, authenticity, large-scale
Next-Generation Learning@scale

Immersive

Personalized

Ubiquitous
Special Effects
Interfaces for “Immersive” Learning

- **Multi-User Virtual Environments:** Immersion in virtual contexts with digital artifacts and avatar-based identities
- **Virtual Reality**
  Full sensory immersion via head-mounted displays or CAVES
- **Ubiquitous Computing:**
  Wearable wireless devices coupled to smart objects for “augmented reality”

January 2009 issue of *Science*
Module 1: Pond Ecosystem

Modeled after Black’s Nook Pond in Cambridge, MA

http://ecomuve.gse.harvard.edu
Manipulation of Space
Manipulation of Time
Manipulation of Social Interaction

TSI: Facial Identity Capture
Next-Generation Learning@scale

- Immersive
- Personalized
- Ubiquitous
Point of View
### Database of Logdata - Track students’ behaviors: where they went, what data they collected, path to solve problem

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Path Analysis for Defined Tasks

Individual and Group Paths

Heat Maps
Usage of Individualized Guidance

[Image of a virtual environment showing a sign labeled "Water Sampling Station: Bog" and a interface for "Bug Catcher: Bog Hints". The interface includes three hint tabs: Hint 1, Hint 2, and Hint 3. The hints are as follow:

- Hint 1: Click on one of the message tabs above to view hints about this area, object, or River City citizen.

Another image shows a "Mosquito Catcher - Next to the Bog" with a graph indicating the current site is the Bog. The graph includes a counter for number of observed mosquitoes and a reset button.}
Interacting with Animated Pedagogical Agents

Ask Dr. C. Your Personal Mars Expert

Brian N
Diane K
Jody C

Why is Mars called the Red Planet?

Dr. C: Busy day today! But I still have time to answer any of your questions about Mars, space, or science.

Diane K: Why is Mars called the Red Planet?

Dr. C: Mars probably got the nickname, The Red Planet, due to the rusty color of its soil, which is comprised of iron-rich minerals. The Egyptians called it the red one because it appears more reddish in the night sky. What makes it appear reddish is a combination of the fact that its surface is comprised of iron-rich minerals that essentially rust (or oxidize) and that the dust made of these minerals is kicked up into the atmosphere, giving the atmosphere a reddish hue from far away. The Martian surface is not all
Documenting Progress and Transfer in Similar Settings

- Student takes on identity of a scientist
- Students complete quests
- 60 minutes
- Four Phases:
  1. Orientation
  2. Problem Identification
  3. Experimentation
  4. Competing Explanations

http://vpa.gse.harvard.edu
What Can We Inculcate and Assess?

- Inquiry skills?
- Collaboration?
- Leadership?
- Self-efficacy?
- Metacognition?
Close-ups
# Rubrics and A/B Experiments

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<td>question 10 final</td>
<td>All Data: Experiment: Bloo</td>
<td>29</td>
<td>green bee</td>
<td>5</td>
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</tbody>
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Composition and Editing
Next-Generation Learning@scale

- Immersive
- Personalized
- Ubiquitous
Shooting on Location
1976

2014
Augmenting Real World Ecosystems

http://ecomobile.gse.harvard.edu
In the future your mobile phone will act as your digital “6th sense.”

- **LEARNS** What You Like
- **FILTERS** Out the Irrelevant
- **SENSORS** Local Content and Services
- **DISCOVERS** Things Relevant to You
- **KNOWS** You and What is Around You
- **INTERACTS** With Networks
Community: Social Media

- **Sharing**
  - Social Bookmarking
  - Photo/Video Sharing
  - Social Networking
  - Writers’ Workshops and Fanfiction

- **Thinking**
  - Blogs
  - Podcasts
  - Online Discussion Forums
  - Twitter

- **Co-Creating**
  - Wikis/Collaborative File Creation
  - Mashups/Collective Media Creation
  - Collaborative Social Change Communities
Next-Generation Learning@scale

- Immersive
- Personalized
- Ubiquitous
Multi-dimensional Learning

- Classrooms

- Richly Contextualized Real World Learning
  - Internships, apprenticeships

- Community
  - Face-to-face and virtual
Advancing to Movies

- Special effects
- Manipulation of space and time
- Close-ups
- Point of View
- Editing
- Shooting on location for contextual richness, authenticity, large-scale

Synergistic: writing, painting, sculpture, music
Advances in technology and in knowledge about expertise, learning, and assessment have the potential to reshape the many forms of education and training past matriculation from high school.
How technology can empower teachers to personalize learning (customizing to each student’s strengths, interests, and needs) in the group setting of the classroom.
8 Aspects of 21st Century Classrooms

1. Interactive digital infrastructure
2. Teacher administrative tools
3. Student tools
4. Course authoring tools
5. Differentiated curriculum content
6. Diagnostic assessments linked to curriculum, formative for instruction
7. Support for classroom monitoring and management
8. Support for a range of instructional methods, including creative problem-solving, project work, brainstorming, team work, collaboration, and solution sharing
Biggest Challenge: 
A Different Model of Pedagogy

- Experiences central, rather than information as pre-digested experience (for assimilation or synthesis)
- Knowledge is situated in a context and distributed across a community (rather than located within an individual: with vs. from)
- Reputation, experiences, and accomplishments as measures of quality (rather than tests, papers)
Professional Development: “Unlearning”

- Developing fluency in using the full range of emerging interactive media
- Complementing presentational instruction with situated, collaborative learning
- Unlearning almost unconscious assumptions and beliefs and values about the nature of teaching, learning, and schooling
Transformation of Formal Education
New Models for Financing

- Attract 0.5% of the 1B people who are looking for learning experiences over twelve months
- Start a new session of 10,000 people 50 weeks of the year
- $5 a person for a twelve hour experience over six weeks
- $2.5M annual revenue
Rethinking Educational Processes

- Credentialing/certification based on competency rather than time
- Many sources of accredited learning, based on alternative business models and new marketplaces
- Continuous improvement via analytics applied to rich databases and embedded A/B experiments
- Generic tools and media repurposed for learning
Organizational Strategies for Adoption and Scale

- Develop authentic assessments based on outcome objectives
- Select initial innovations carefully so that strong models of learning are implemented
- Emphasize user-friendly interfaces
- Study design strategies for effective media that have scaled
- Accomplish tasks instructors/institutions want to relinquish
- Use organizational development strategies to change culture
Limits of Tutoring System Model

- Effective for subjects based on procedural skills (e.g., mathematics, grammar, vocabulary, computer programming)
- Does not work for parts of the curriculum that are not reducible to algorithmic recipes (e.g., reading comprehension, creative writing, design, inquiry, collaboration, leadership)
“Next Generation”
Motivation and Learning

- Virtual Peers in Complementary Study Group
- Synchronous Back-Channel with Archives
- Virtual Worlds
- Local Augmented Realities
- Virtual Performance Assessments