Next Generation Professional Development: Learning about Teaching and Vice Versa

Chris Dede
Harvard University
Chris_Dede@harvard.edu
www.gse.harvard.edu/~dedech
The Core Challenge We Face

- shifts in the knowledge and skills society values
- development of new methods of teaching and learning
- changes in the characteristics of learners

emerging information technologies are reshaping each of these – and changing how we learn and know
What is Educational “Transformation”?

If we were to redesign education not to make historic models of schooling more efficient, but instead to prepare students for the 21st century – simultaneously transforming teaching in light of our current knowledge about the mind – what types of scalable, sustainable learning environments might sophisticated technologies enable us to create?
Automation vs. Amplification


- Expert Decision Making
- Complex Communications
New Tools for 21st Century Work

- Life size telepresence with translation
- Complex visual interfaces on touchscreens
- Digital ink
  - Cards
  - Transfer from screen to paper and back
  - Customized newspaper with videos
- Wall-sized semi-transparent holographic surfaces
- Flat digital “mouse”

Preparation for the past rather than the future
What is “Web 2.0”?

- Web 2.0 is a perceived second generation of web-based communities and hosted services—such as social-networking sites, wikis, and folksonomies—which aim to facilitate creativity, collaboration, and sharing between users.

--Wikipedia [stresses the intellectual]

- [Web 2.0 technologies include] weblogs (blogs), social bookmarking, wikis, podcasts, RSS feeds (and other forms of many-to-many publishing), social software, and web application programming interfaces (APIs)
The Spectrum of Web 2.0 Media

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

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

- **Co-Creating**
  - Wikis/Collaborative File Creation
  - Mashups/Collective Media Creation
  - Collaborative Social Change Communities

May 2009 issue of *Educational Researcher*
Implications for Research

- Through communal bookmarking, geographically distributed research group could continuously scan for resources of interest, including non-archival material such as unpublished papers and YouTube videos.

- **Photo/video-sharing tools** could enable sharing and annotating research data as multimedia artifacts.

- A **ning** could provide background information to foster informal professional exchanges among members of this community.

- A **wiki** could serve as the basis for a negotiated exposition of theoretical principles.
  - the theoretical wiki at the National Science Foundation (NSF)-funded Pittsburgh Science of Learning Center ([http://www.learnlab.org/research/wiki/index.php/Main_Page](http://www.learnlab.org/research/wiki/index.php/Main_Page)) illustrates the value of this.

- **Mashups** could offer ways to contextualize individual datasets against a larger context of practice.
“Web 2.0” Redefines What, How and With Whom We Learn

- Effective use of Web 2.0 media requires fluency in their rhetoric.

- Almost any piece of information can now be found online in less than a minute – perhaps intermingled with inaccurate and biased data – so what core knowledge should every student learn to prepare for 21st century work and citizenship?

- Web 2.0 “knowledge” is constructed by negotiating a consensus articulation across various points of view, so how do we help students understand the differences between facts, opinions, and values – and appreciate the interrelationships among them that go beyond accuracy to create “meaning?”
Jenkin’s Framework for New Literacies

- **Play** — experimenting with one’s surroundings in problem-solving
- **Performance** — adopting alternative identities for improvisation and discovery
- **Simulation** — interpreting and constructing dynamic models of real-world processes
- ** Appropriation ** — the ability to meaningfully sample and remix media content
- **Multitasking** — scanning one’s environment and shifting focus to salient details
- **Distributed Cognition** — fluently using tools that expand mental capacities
- **Collective Intelligence** — pooling knowledge with others toward a common goal
- **Judgment** — evaluating the reliability and credibility of different information sources
- **Transmedia Navigation** — the ability to follow the flow of stories and information across multiple modalities
- **Networking** — the ability to search for, synthesize, and disseminate information
- **Negotiation** — the ability to travel across diverse communities, discerning and respecting multiple perspectives, and grasping and following alternative norms
Leu’s Characteristics of New Literacies

1. Emerging ICT tools, applications, media, and environments require novel skills, strategies, and dispositions for their effective use.

2. New literacies are central to full economic, civic, and personal participation in a globalized society.

3. New literacies constantly evolve as their defining ICT continuously are renewed through innovation.

4. New literacies are multiple, multimodel, and multifaceted.
The formal educational system extends beyond the school: in time, in space, and in people.

- Parent tutors, informal-educator coaches, and community mentors complement teachers.
- Schools of education prepare and certify teachers, tutors, coaches, and mentors.
Core Principles of Professional Development

- Teachers teach as they were taught
- The important issue is not technology usage, but changes in content, pedagogy, assessment, and learning outside of school
- Continuous peer learning is the best strategy for long-term improvement
Focus on A Particular Suite of Understandings and Performances

Collaborative Problem Resolution via Mediated Interaction:

- Problem Finding Before Problem Solving
- Comprehension by a Team, Not an Individual
- Making Meaning Out of Complexity:
  - Utilizing sophisticated tools and representations
  - Recognizing and matching patterns
  - Judging the value of alternative formations
  - Communicating to others with differing perspectives
Situated Learning and Transfer

- constellations of architectural, social, organizational, and material vectors that aid in learning culturally based practices
  - apprenticeship (the process of moving from novice to expert within a given set of practices)
  - legitimate peripheral participation (tacit learning similar to that involved in internships)
  - high fidelity is not important unless essential for task (e.g., interpreting photographic images)
Next Generation 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*
EcoMUVE

- Funded by the Institute of Education Sciences of the U.S. Department of Education.
- Middle school science
  - Ecosystems, Causal complexity.
- Two MUVE-based modules implemented over two weeks within a four week ecosystems curriculum.
- Timeline: July, 2008 - July 2011
  - Module 1 is almost finished.
  - Prototypes are being tested with students now.
Project Overview

- Ecosystems have complex causal dynamics.
- Even after instruction, students often retain misconceptions.
- In our experience, MUVEs can help students engage in authentic science inquiry and gain deeper understanding.
- Our goal is to develop EcoMUVE as a MUVE that, as part of a larger curriculum, will enable a richer understanding of ecosystems and complex causality.
Module 1: Pond Ecosystem

Modeled after Black’s Nook Pond in Cambridge, MA
Change over Time
Things have been pretty quiet in this duck pond at the bottom of the pond. Oh boy – here come the water bacteria. There are a lot of them down here. Bacteria are good at getting energy out of molecules that other organisms consider waste. Through the process of respiration, they can get their energy from dead plants and animals. They break apart molecules that were once locked up in dead plants and animals. In this process of decomposition they make the atoms and molecules that were once a part of other organisms available to be used again.

Non-Obvious Causes
Hi, I'm Manny. We've been working really hard to get the new housing development ready for the open house. I'm probably going to have to work overtime every day this week to get these lawns in shape! I think this extra fertilizer I picked up should do the trick.
Interaction between Biotic and Abiotic Factors

Runoff causes increased phosphate levels, leading to increased plant growth. Plant decomposition by bacteria consumes oxygen, causing the eventual fish kill.

www.ecomuve.org
Assessing Sophisticated Performances Based on Rich Observations
NSES Model of Inquiry

- Identify questions that can be answered through scientific investigation (not independent of knowledge)
- Design and conduct a scientific investigation
- Use appropriate tools and techniques to gather, analyze, and interpret data
- Develop prescriptions, explanations, predictions, and models using evidence
- Think critically and logically to make the relationships between evidence and explanations
- Recognize and analyze alternative explanations and predictions
- Communicate scientific procedures and explanations
- Use mathematics in all aspects of scientific inquiry
An Immersive Model

• Student takes on identity of a scientist

• Students complete quests

• 90 Minutes

• Four Phases:
  1. Orientation
  2. Problem Identification
  3. Experimentation
  4. Competing Explanations
Setting Modifiable for Experimentation

XML file for setting data values and turning on/off objects

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**Performance Palettes for Explanation**

Flash–based Performance Palettes:  *Explanation Builder*

**Explanation Builder**

*Directions:* We want you to complete the following statement with a reasonable explanation of why the kelp is dying. Use the data you collected as evidence. Complete the statement by dragging the appropriate evidence, objects, and effects to the empty spaces in the statement.

**Evidence**
- nitrate
- salinity
- population
- temperature
- turbidity

**Objects**
- sea otters
- power plant
- drainage
- wharf
- glacier
- logging operation

**Effects**
- no change
- increase
- decrease

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My evidence shows that the...

- of the **Kelp** has **decreased**
- and that there has been a(n) **in**
Actions as Basis for Assessments

Logfiles Indicate with Timestamps

- Where students went
- With whom they communicated and what they said
- What artifacts they activated
- What databases they viewed
- What data they gathered using virtual scientific instruments
- What screenshots and notations they placed in team-based virtual notebooks
- What hints they accessed

http://virtualassessment.org/
Logfiles: Events, Chats, Notebooks...

Database of Logdata - Track students’ behaviors: where they went, what data they collected, path to solve problem

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Differences from Item-based Tests

Multiple Forms of Complex Measures

**Products of Inquiry** - Create conclusions and select evidence

**Processes of Inquiry** - Gather data and interview people
Formative/Diagnostic

- Formative, diagnostic assessment provides *more leverage for improvement* than summative measures.
- Formative, diagnostic assessment is *richer and more accurate* than summative measures.
- Potentially, formative, diagnostic assessment *could substitute for* summative measures.
An Inclusive Model of Pedagogy and Assessment

Every Theory of Learning is Right Some of the Time

- Experiences are central as a complement to information as pre-digested experience
- Knowledge is situated in a context and distributed across a community as a complement to knowledge located within an individual
- Reputation, experiences, and accomplishments are measures of quality, measured by performances, as a complement to tests and papers

Customization based on both and
More Mobile Devices

- Always-On Connectivity
- All-Day Battery Life
- Instant On (NO standby/sleepstates)
- Location Aware
U.S. 2010 Educational Tech Plan

1. Learning
2. Assessment
3. Teaching
4. Infrastructure
5. Productivity

http://www.ed.gov/technology/netp-2010
Professional Development: Communities of “Unlearning”

- Developing fluency in using emerging interactive media
- Complementing presentational instruction with collaborative inquiry-based learning
- **Unlearning** almost unconscious assumptions and beliefs and values about the nature of teaching, learning, and schooling

Crucial issue for professional development
“Sea Change”

- **Evolution, Transformation, or Disruption**
- In Shakespeare’s “The Tempest,” Ariel sings to Ferdinand:

  *Full fathom five thy father lies;*
  *Of his bones are coral made;*
  *Those are pearls that were his eyes:*
  *Nothing of him that doth fade*
  *But doth suffer a sea-change*
  *Into something rich and strange.*
Next Generation 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*
“Overlay Devices”

- Wireless mobile devices offer substantial power, at a fraction of the cost for laptops and with greater mobility.
- Entertainment and learning are infused anywhere.
- One-to-one person-to-device ratio becomes affordable in education.

“Augmented Reality” for entertainment and learning.