Using Technology to Personalize Students’ Learning of Global Competencies

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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

Digital technologies are reshaping each of these—changing how we learn and know.
Social Media Gave Everyone a Voice

The Conversation Prism debuted in 2008 as social media was exploding online. Social media would change everything about how we communicate, learn and share. It forever democratized information and reset the balance for influence.

The Conversation Prism was designed as a visual map of the conversational networks that continue to reshape everything. Its purpose is to help you understand and appreciate the statusphere so that you can play a productive and defining role in the conversations shaping our future.

For more information check out conversationprism.com
Jenkins’ 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
# Changing Metaphors

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<th>Work</th>
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The Future of Skills: 2030

- Judgment and Decision Making
- Fluency of Ideas
- Active Learning
- Learning Strategies
- Originality Abilities
- Systems Evaluation
- Deductive Reasoning
- Complex Problem Solving

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.
## 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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“Deeper Learning”

- Case-based learning
- Collaborative learning
- Apprenticeships
- Self-directed, life-wide learning
- Learning for transfer
- Interdisciplinary studies
- Diagnostic assessments
Immersion
Continuum of Immersive Media

REAL ENVIRONMENT

Tangible User Interfaces (TUI)
A TUI uses real physical objects to both represent and interact with computer-generated information (Ishii & Ulmer, 2001).

VIRTUAL ENVIRONMENT

Virtual Reality (VR)
VR refers to completely computer-generated environments (Ni, Schmidt, Staadt, Livingston, Ball, & May, 2006; Burdea & Coiffet, 2003).

MIXED REALITY (MR)

Augmented Reality (AR)

Spatial AR
Spatial AR displays project computer-generated information directly into a user’s environment (Bimber & Raskar, 2005).

Augmented Virtuality (AV)
AV 'adds' real information to a computer-generated environment (Regenbrecht, et al. 2004).

‘See-through’ AR (either optical or video)
A user wears a head-mounted display, through which they can see the real world with computer-generated information superimposed on top (Cakmakci, Ha & Rolland, 2005; Billinghurst, Grasset & Looser, 2005).

Semi-immersive VR
A semi-immersive VR display fills a limited area of a user’s field-of-view.

Projection-based immersive VR
The users are fully immersed in the ‘CAVE’ (FakeSpace, 2006; Cruz-Neira, Sandin & DeFanti, 1993).

Using physical objects to create a virtual model (Ichida, Itoh, & Kitamura, 2004). As a user adds a physical ‘ActiveCube’ to the construction, the equivalent virtual model is automatically updated.

The ‘Bubble Cosmos’ – ‘Emerging Technology’ at SIGGRAPH06. The paths of the smoke-filled bubbles are tracked, and an image is projected into them as they rise.

See-through AR: the butterfly is computer-generated, and everything else is real (Fischer, Bartz & Straßer, 2006; Kölsch, Bane, Höllerer, & Turk, 2006).

Semi-immersive VR using the Barco Baron workbench (Drettakis, Roussou, Tsingos, Reche & Gallo, 2004).

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Welcome. EcoLearn is an educational research group at the Harvard Graduate School of Education that explores the use of advanced immersive technologies to support learning about the complex causal dynamics of ecosystems.

EcoMUVE is a curriculum that uses immersive virtual environments to teach middle school students about ecosystems and causal patterns.

EcoMOBILE is an extension of the EcoMUVE curriculum that blends immersive virtual environments and real ecosystems infused with digital resources.

EcoXPT is a new project being designed to work alongside EcoMUVE to support experiment-based inquiry in immersive virtual environments.

The EcoMOD project will explore the power of immersive virtual environments to support computational thinking and ecosystem science learning in elementary grades.
Augmenting Real World Ecosystems

http://ecomobile.gse.harvard.edu
Virtual Binoculars
Interface for Your Digital Life

IN THE FUTURE YOUR MOBILE PHONE WILL ACT AS YOUR DIGITAL “6TH SENSE”

SENSES
Local Content and Services

DISCOVERS
Things Relevant to You

LEARNS
What You Like

FILTERS
Out the Irrelevant

KNOWS
You and What is Around You

INTERACTS
With Networks
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Supporting Inquiry through Modeling

Computational modeling and programming activities are integrated with an immersive ecosystem such that the epistemic goals of science are visible to young learners.

**Immersive Ecosystem:**
- Authentic Ecosystem
- Observation and Data Collection
- Develop theories and build causal relationships

**Modeling Cycle**
Movement between mediums to iteratively refine & test theories.

**2D Programming Environment:**
- Test theories by programming the behavior of agents in the system
- Assess how well the computer model “fits” with the immersive ecosystem
Immersive Ecosystem

Mixed hardwood forest spanning four distinct time periods

Perceptual overlays allow investigations of cause and effect from both overview and on-the-ground levels.
Woodpeckers as A Keystone Species

Woodpecker Model - Relationships

- **Trees**
  - Healthy (sapling or mature)
  - Cuts down & Eats
- **Snag**
  - Causes
  - Lightning
  - Fungus
  - Insects
  - Enlarges and Nests
- **Cavity**
  - Nests
  - Generates
  - Beaver
  - Pond
  - Merganser or Wood Duck (Obligate Cavity Dweller)
- **Secondary Excavators**
  - Other Obligate Cavity Dwellers (birds, squirrels, raccoons)
  - Eats
  - Generates

- **Mallard**
  - Nests and Forages
  - Forages
  - Nests

- **Other Excavators**
  - Generates
ViMAP (Sengupta et al, 2015) programming environment utilizes a simple, scaffolded block interface, customized to focus on ecosystems modeling and designed specifically for younger children.
Constructing explanations

“Were there measurements that surprised you? If so, tell us why?”

“Was the pond healthy? Explain why.”

Explanations included:
- plausible scientific mechanisms
- connections to prior knowledge
- comparison among variables

Students exposed to EcoMUVE provided richer explanations
Concept Map Tool
**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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GoPro Cameras Capture EcoMOBILE Experience
Tools for Transformational Insights
A Different Model of Pedagogy

- Experiences central, rather than information as pre-digested experience

- Knowledge is situated in a context and distributed across a community

- Reputation, experiences, and accomplishments as measures of quality
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.
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