Engineering Learning
and Vice Versa

Chris Dede
Harvard University
Chris_Dede@harvard.edu
www.gse.harvard.edu/faculty/christopher-dede
Engineering Learning

Learning Engineering applies a principled set of evidence-based strategies to the continual re-design of educational experiences to optimize their effectiveness and efficiency.

“...learning engineers would have several responsibilities. The most important is that, working in collaboration with members of the faculty whose interest they can excite, they design and redesign learning experiences in particular disciplines.” Herbert Simon, 1967
Montessori
Co-Engineering Learning

LEAP Innovations
Personalized Learning Framework
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.
EcoMOD: Integrating Immersive Virtual Worlds and Computational Modeling for Ecosystems Science Learning

• 15 day curriculum
• Blends immersive virtual environments with computational modeling
• Supports the development of computational thinking, causal explanations and ecosystems science concepts in 3rd graders.
Supporting Modeling by blending Immersive Ecosystems with Programming

**Immersive World:**
“Expert” model of a real ecosystem
Observation and Data Collection
Develop theories and build causal relationships

**2D Programming Environment:**
Test theories by programming the behavior of agents in the system, and assessing how well the computer model “fits” with the virtual one.

**Modeling Cycle**
Movement back and forth between mediums as students iteratively refine their theories.
(Virtual) Embodied modeling to scaffold agent-based programming

• Virtual Embodiment scaffolds student programming work

“You have to see through the eyes of the beaver”

-Grade 3 student
We can personalize along many dimensions

We need to observe, document, measure to create “standards”

• Time, place, path, pace
• Student choice over how to learn, choice over what to learn
• Student voice
• Learner connected, learner focused, learner demonstrated, learner led
• Social-emotional learning, cognitive domain, executive function, student background
Tools for Transformational Insights