21st Century Skills and New Models of Assessment for a Global Workplace

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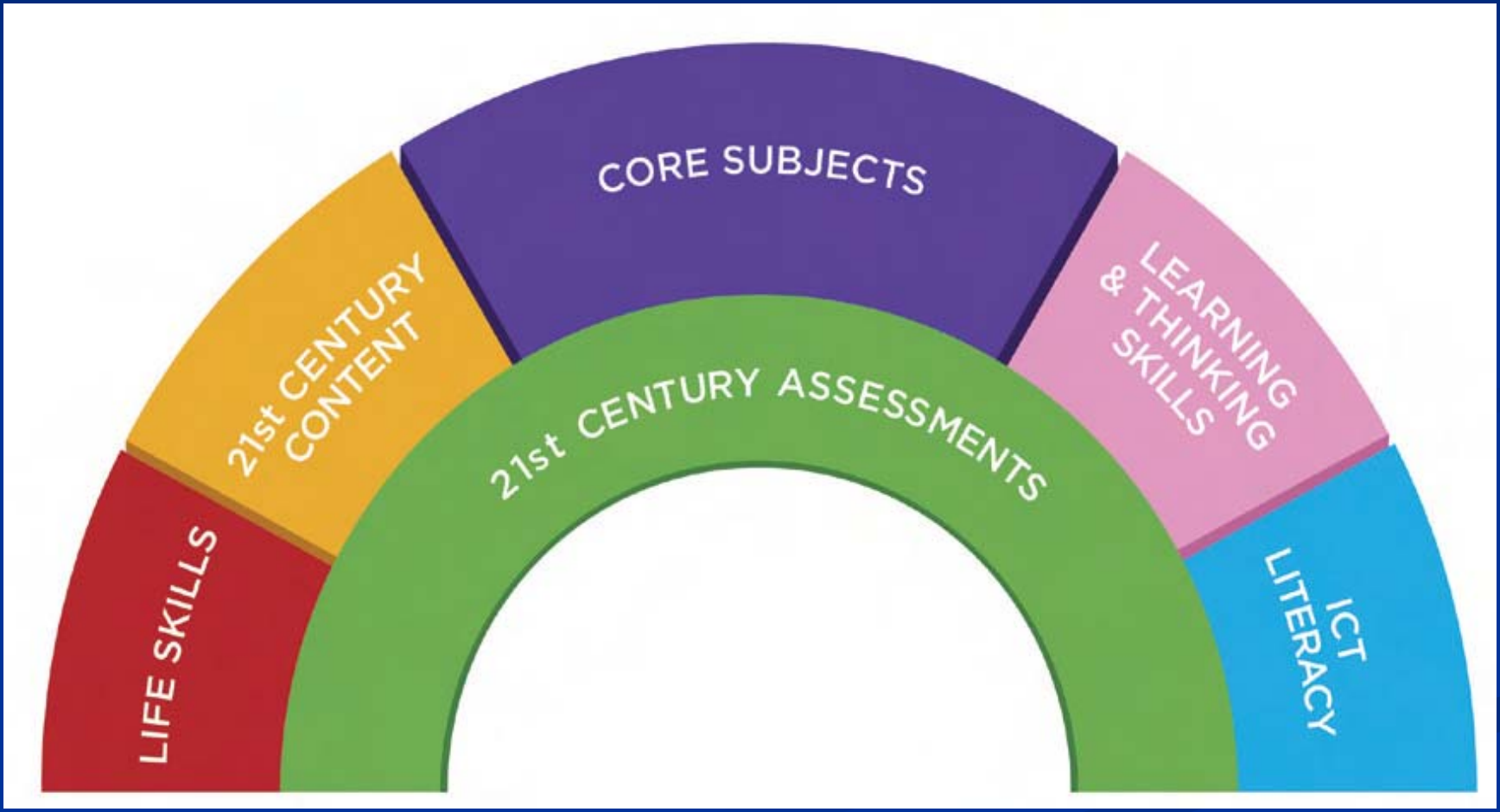
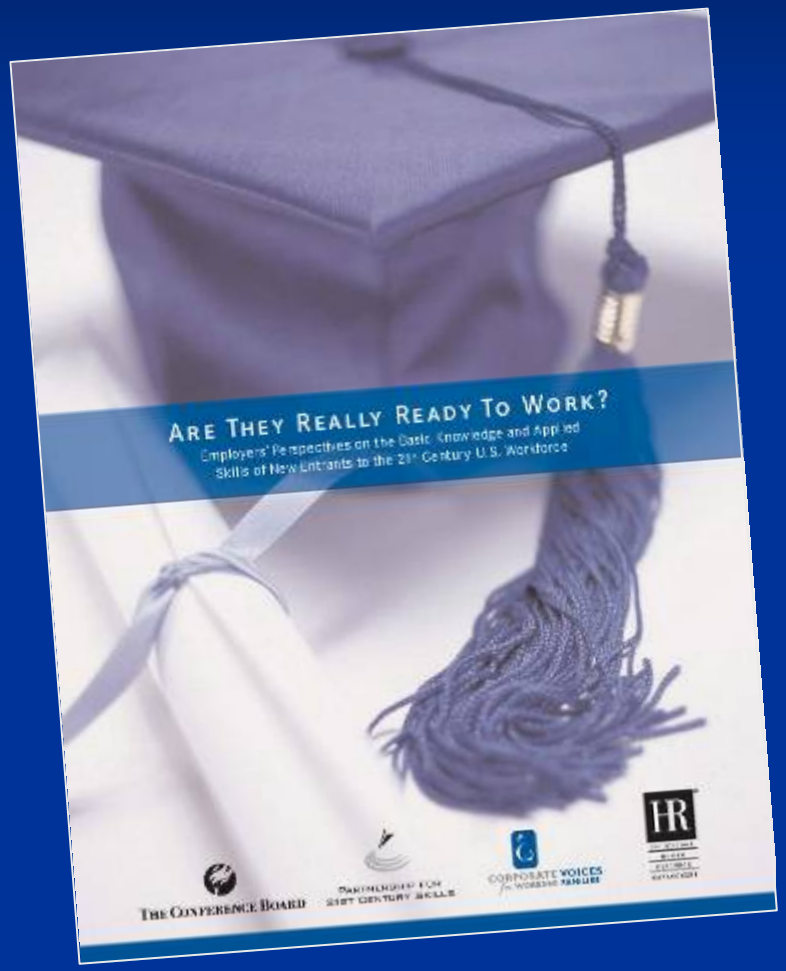
Partnership for 21st Century Skills



Why Are 21st Century Skills So Important?



Partnership for 21st Century Skills:
The requirements of the workforce are changing

Why Are 21st Century Skills So Important?

Of the two-year college/technical school graduates you recently hired, what were the deficiencies in the most important knowledge and skill areas?

Written Communication	47%
Work Ethic	31%
Critical Thinking/Problem Solving	23%
Oral Communication	21%
Reading Comprehension	13%
Collaboration	12%

Why Are 21st Century Skills So Important?

Of the four-year graduates you recently hired, what were the deficiencies in the most important knowledge and skill areas?

	Deficient	Adequate	Excellent
Oral Communication	9.8	65.4	24.8
Collaboration	8.1	67.3	24.6
Professional/Work Ethic	18.6	64.6	16.8
Written Communication	27.8	56.4	15.8
Critical Thinking/Problem Solving	9.0	63.4	27.6

Why Are 21st Century Skills So Important?

What skills and content areas will be growing in importance in the next five years?

Critical Thinking	78%
I.T.	77%
Health & Wellness	76%
Collaboration	74%
Innovation	74%
Personal Financial Responsibility	72%

Distributed Work, Cognition, and Learning

- Definition is morphing: number crunching, data processing, productivity, information, communication, expression, experience, collective creation and interpretation
- Cognition is distributed across human minds, tools/media, groups of people, and space/ time -- dispersed physically, socially, and symbolically
- Technology is not creative or intelligent, but is very sophisticated at doing "routine" tasks

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"

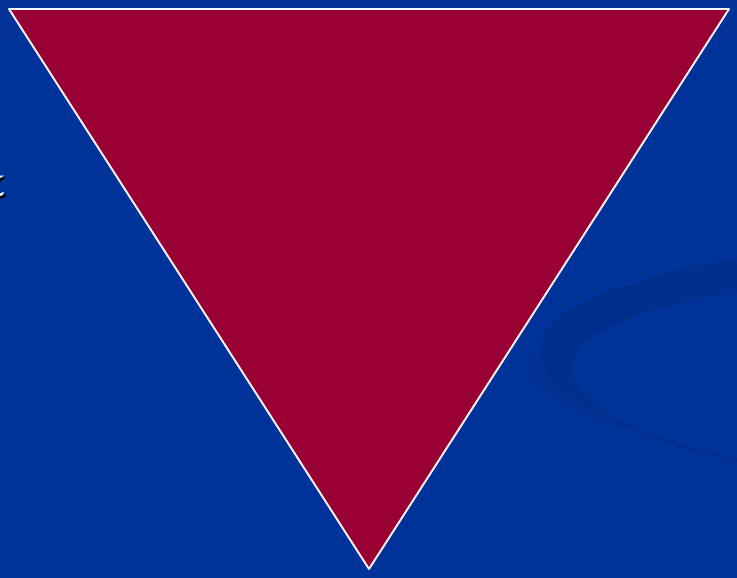
Preparation for the past rather than the future

The Assessment Triangle

Reasoning from Evidence

Cognition

Model of how students represent knowledge & develop competence in the domain



Observation

Tasks or situations that allow one to observe students' performance

Interpretation

methods for making sense of the data

Virtual Performance Assessments

- Funded by Institute of Educational Sciences
- Three year grant
- Design three virtual performance assessments to assess middle grade (6th and 7th) students' science inquiry learning in a standardized testing setting
- http://virtualassessment.org

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

Authentic Environments

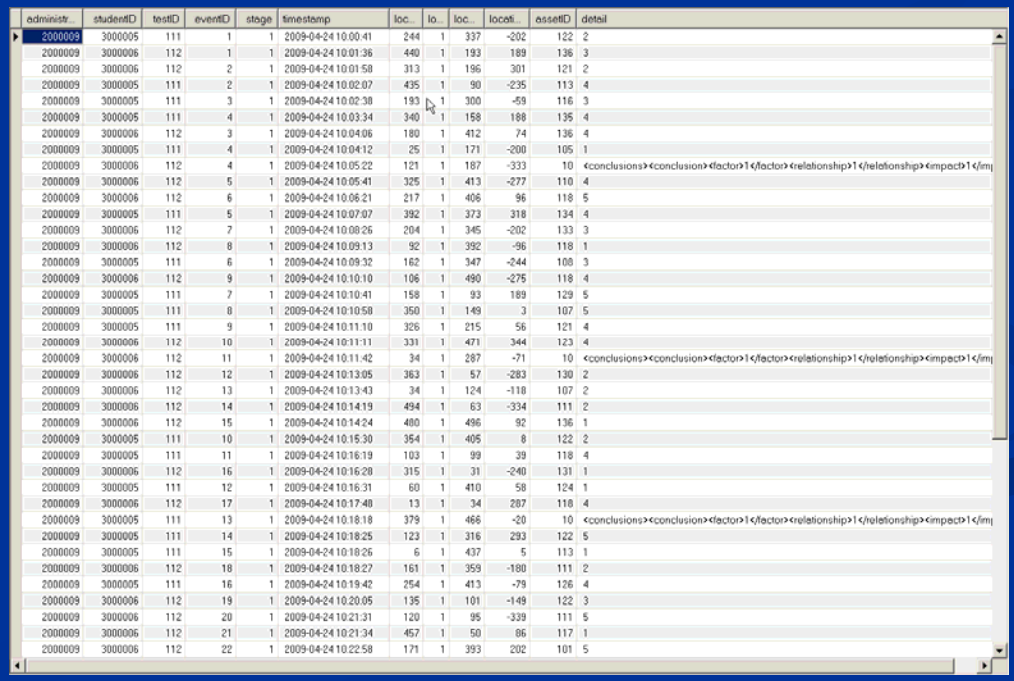
A Challenge on which Every Student has Roughly Equal Familiarity

Assessment Platform

- 3-D Immersive Environment for Science Experimentation Based on Authentic Setting
- Highly Secure, Cross Platform Application Built in the Unity Framework
- Realistic Complex Causal Model For Science Experimentation

Back End Architecture

- Real-Time Analysis of Student Paths
- All Interactions are Logged for Future Research
- Ensure Data Integrity by Encrypting Data Along the Way
- Complex Student Work Product is Recorded as XML, which can be tokenized



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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 currently being developed.
  - Prototypes will be tested with students this fall.

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.

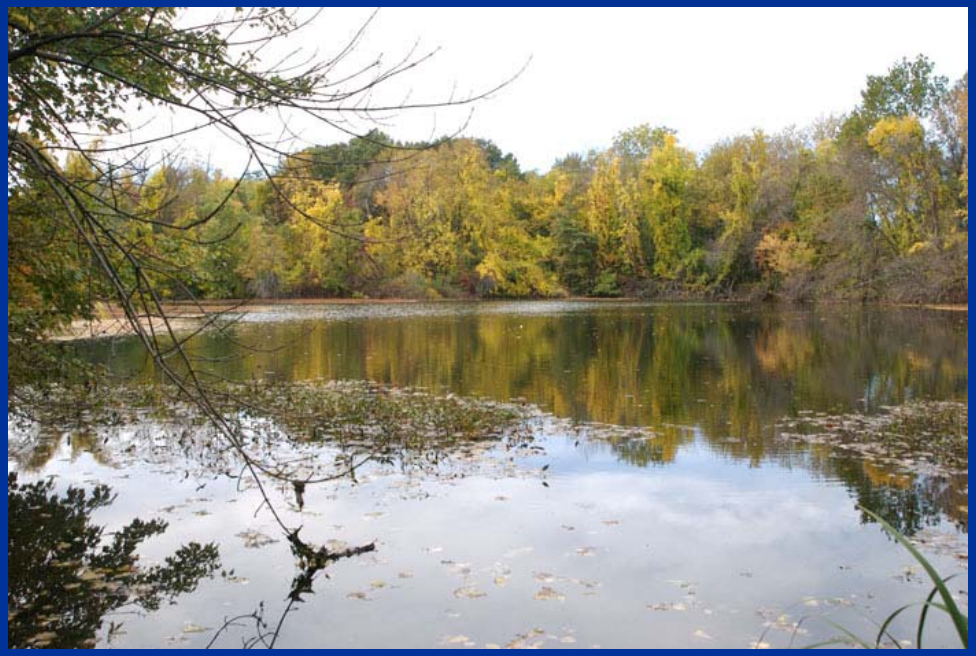
Causal Patterns in Ecosystems

- Many ecosystems concepts require students to reason about complex causal patterns that do not fit with their default assumptions about the nature of causality.
- For the past ten years, The Understandings of Consequence Project has been studying how students reason about ecosystems concepts and the embedded causal patterns.

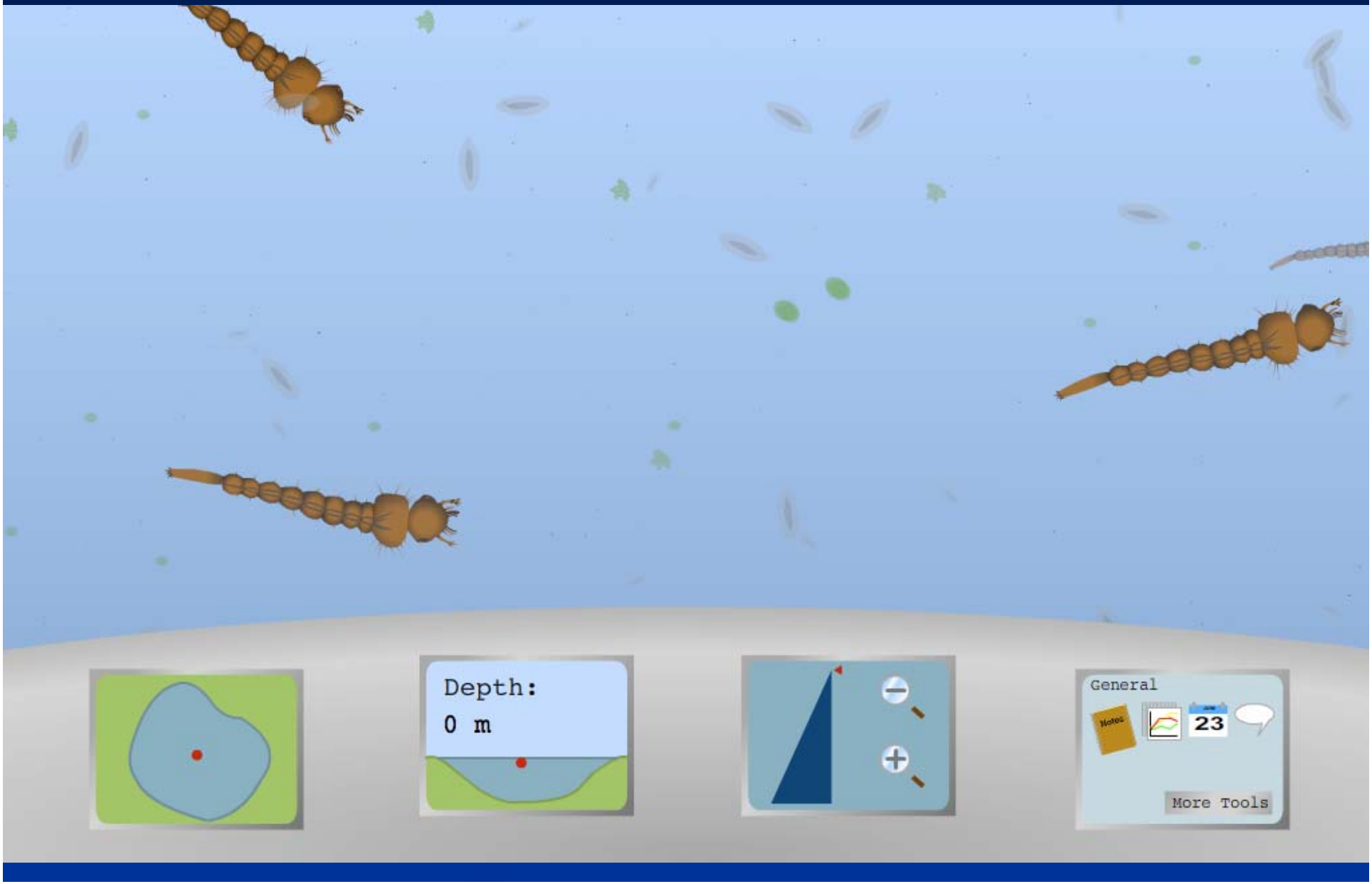
For more information about The Understandings of Consequence Project (Tina Grotzer, David Perkins) see
http://pzweb.harvard.edu/ucp/curriculum/ecosystems/

Module 1: Pond Ecosystem

Modeled after Black's Nook Pond in Cambridge, MA

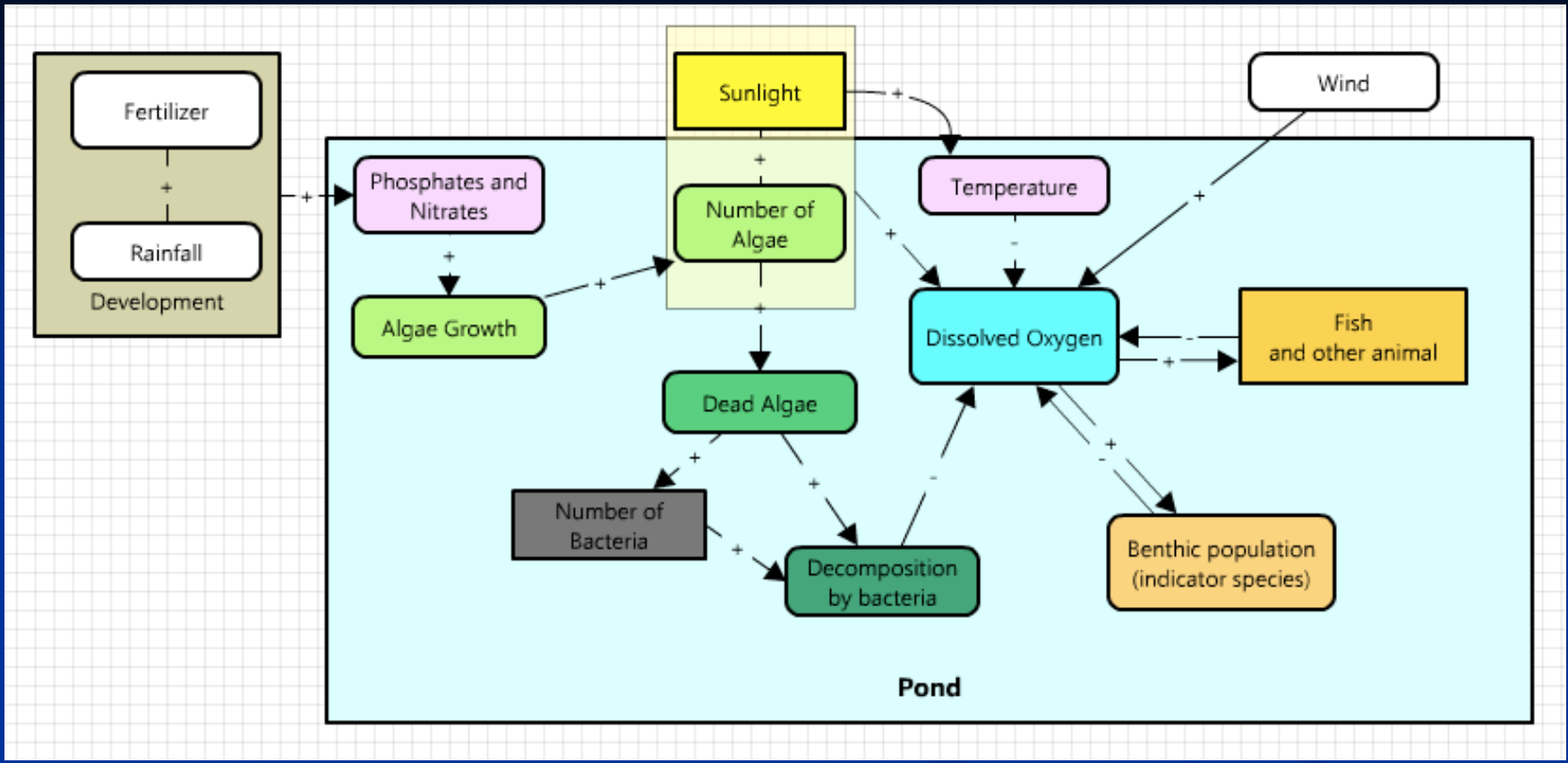


http://www.ecomuve.org/



Some of the Challenges in Understanding Ecosystems Concepts

- Domino Causality
- Cyclic Causality
- Two-Way Causality
- Indirect effects
- Time delays
- Non-obvious causes
- Reasoning about populations
- Reasoning about balance and flux



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.

Why Are 21st Century Skills So Important?

What knowledge and skills are most important for job success when hiring a two-year college/technical school graduate?

Work Ethic	83%
Collaboration	83%
Oral Communication	82%
Critical Thinking/Problem Solving	73%
Reading Comprehension	72%
Written Communication	72%

Why Are 21st Century Skills So Important?

What knowledge and skills are most important for those you will hire with a four-year college diploma?

Oral Communication	95%
Collaboration	94%
Professional/Work Ethic	94%
Written Communication	93%
Critical Thinking/Problem Solving	92%