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Using Synergy Partnerships to Design Technology-Enhanced PBL Environments

Roy Pea, Sherry Hsi, Eric Baumgartner
Center for Innovative Learning Technologies



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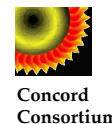


Introducing CILT



Berkeley
University of California

VANDERBILT
UNIVERSITY





Center for Innovative Learning Technologies

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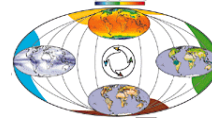
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“Uniting people, technology, and powerful ideas for learning”



Center for Innovative Learning Technologies

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- A distributed, open center for tackling important problems in new ways

Mission:

- To serve as a national resource for stimulating research on innovative, technology-enabled solutions to critical problems in K-14 learning in science, mathematics, engineering and technology




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CILT Structure

- **Leadership team from “Core 4” institutions:**
 - Roy Pea & Barbara Means, SRI International
 - John Bransford, Vanderbilt University
 - Marcia C. Linn, UC Berkeley
 - Bob Tinker, The Concord Consortium

SRI Vanderbilt
Concord Berkeley



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CILT Structure


- **Not just distributed, but *open*:**
 - CILT actively solicits participation from others in the learning technology community.

Research
Community

SRI Vanderbilt
Concord Berkeley

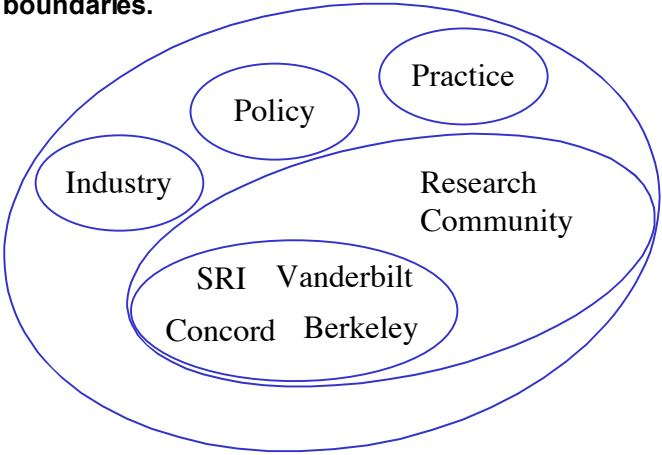


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CILT Structure

- **Bridging domains:**
 - CILT’s activities and programs foster collaboration across traditional community boundaries.





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CILT Programs

- **“Theme Team” leadership:**
Advancing the learning technology field
 - Visualization & Modeling
 - Ubiquitous Computing
 - Assessments for Learning
 - Community Tools
- **Annual CILT conference and Theme Team workshops:**
Offering a focus for community




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CILT Accomplishments

*Raising the bar for what
learning technology R&D can be*

- Capturing and sharing the collective intelligence of the field
- Promoting (*requiring*) generative cross-disciplinary partnerships
- Building a new generation of leaders
- Providing a catalyst for new initiatives
- Modeling new collaborative approaches to learning technology innovation: Synergy



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What is Synergy Collaboration?

- A **community** of educators, researchers, and developers working together towards shared goals
- A partnership approach to project-based curriculum **design** and educational research
- Recognition that curricula is adapted to local contexts and that this **customization** process needs to be supported



Synergy Beginnings

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- Collaboration within CILT to integrate curriculum, methods, and technology

WISE

Scientists in Action

Science Learning in Context



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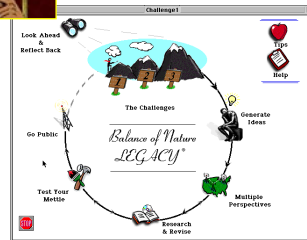
Synergy Beginnings

- Collaboration within CILT to integrate curriculum, methods, and technology

WISE

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Science Learning in Context



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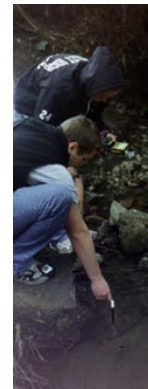
Synergy Beginnings

- Collaboration within CILT to share curriculum, methods, and technology

WISE

Scientists in Action

Science Learning in Context





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Why Water Quality?

- Well suited to **active inquiry in project-based settings**
 - “What’s in my water?”
- Personally relevant
 - Students can **investigate local issues**
- Good candidate for **technology-rich inquiry-based support**
 - Data visualization
 - Conceptual and causal modeling
 - Guided inquiry
- Everyone could contribute



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Synergy Collaboration Revisited

- A **community** of educators, researchers, and developers working together towards shared goals
- A partnership approach to project-based curriculum **design** and educational research
- Recognition that curricula is adapted to local contexts and that this **customization** process needs to be supported



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Synergy: Community

- A **community** of educators, researchers, and developers working together towards shared goals
- Face to face “summits” and online collaboration
- Shared subject matter goals
- Shared cognitive learning goals



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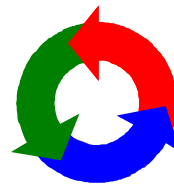
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Synergy: Design

- A partnership approach to project-based curriculum **design** and educational research
- Identify shared design principles
- Engage in iterative design studies
- Practice flexibly adaptive design





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Synergy: Customization

- Recognition that curricula is adapted to local contexts and that this **customization** process needs to be supported
- **Customization, teacher partnerships are key to broader use**
- **Understand and support classroom customization**
- **Document challenges, benefits of this approach**



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Synergy Example: Pine Creek

- **Investigate the health of a local creek**
- **6th grade Science, Students work in pairs**
- **2-3 week project**
- **Teachers have prior Pine Creek activities to anchor**





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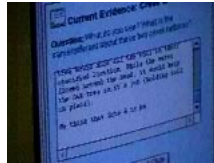


Water Quality Project Elements

1. Driving question relevant to local concerns
2. Exploration of key water quality factors
3. Develop and refine a causal model for water quality
4. Mobile inquiry and data collection
5. Data analysis
6. Reflection and Recommendations



Assessment measures



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Investigating Local Concerns with Driving Question

Is Pine Creek Healthy?

What are sources and causes of eutrophication?





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Starting point: WISE

WISE - Strawberry Creek - chemistry 3/99 Project

WISE EVIDENCE

Where does the water in a creek come from?

Image courtesy of United States Geological Survey

Whenever it rains some of the rain is absorbed into the soil but some runs off and forms little surface water flows that combine with other surface water flows, and then into little brooks and then creeks. So a lot of the water in creeks first flowed over the ground before it got into the creek. And what happens when water flows over surfaces? Just like in the creek, it takes things with it. It sweeps along debris, soil, dust, chemicals and any other living and nonliving things that are light enough to get pushed along by this runoff. And all this ends up in the creek! The creek becomes a temporary depository for all sorts of stuff that was on the surface around it. Most parts of the earth's surface will drain into one creek or another. And each creek (or lake, or bay for that matter) has a particular piece of the earth's surface that drains into it. That piece is called the creek's *watershed*.

So if you want to know what's in the watershed, look in the creek! And if you want to know how something got into a creek, look in its watershed. Of course, there are other ways that stuff end up in creeks. Sometimes people help things get into creeks. In some creeks that flow through cities, you might find shopping carts and other junk (Ughh!). Sometimes things blow in from other watersheds. Dust, plant seeds, and pollutants are examples of things that can travel through the atmosphere and get deposited in watersheds or directly into creeks. So you can't look only in the watershed, but it's the best place to start.

[Click here to see a map of a large watershed](#)

Evidence written by Henry Spilthoff using source material from the Internet.

Navigation menu on the left:
Introduction
Where Does the Water Come From?
Take a Watershed Note
Is Your Creek Healthy?
Take a Creek Health Note
What Affects the Chemistry of Your Creek?
Strawberry Creek
Take a Strawberry Creek Note
Make a Model
Find 'Chemistry' in the creek
Creeks are Complex Systems
Measuring Chemistry
Data Analysis
The creek in perspective

Read evidence => Make prediction => Build Model => Take Notes



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WISE student work & notes

Netscape: WISE - Alameda Creek Project

Location: <http://twi.berkeley.edu/WISE/projects/Alameda/Top.html>

WISE EVIDENCE

Turbidity

Is there a scientific at the thought of drinki...

If you turned on you water, you might thi...

in the house are erod...

the reason, your next...

instead of drinking it...

be naturally occurint...

water from your tap...

material, algae, etc.)...

that is not safe for h...

Pure water is clear because it allows light to be transmitted through it. Particles in the water will scatter light. The amount of light scattered depends upon two...

Netscape: Notes

Enter note below:

Question: Take note that you will be giving a presentation and this note will prepare you for your final report. What background information did you find out about Alameda creek? Please describe

Some main landmarks along the creek are....

Several things from the surrounding area of Alameda contribute to the health of the creek. First,.... (add more here)

In the 50s, there used to be lots of fish. Now, because of

Save and Close



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Develop & Refine a Causal Model

Why causal modeling?

- Make complex relationships visible
- Provide researchers with an external representation of student understanding
- Pine Creek Inspirations
 - Concept maps (Novak)
 - Model-It (Michigan)
 - Stella (HPS)



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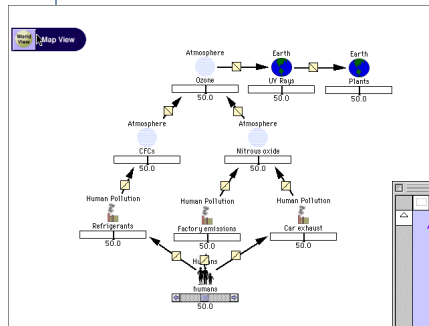
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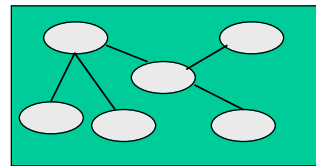


Leverage Visualization Tools: Support for representing dynamic systems

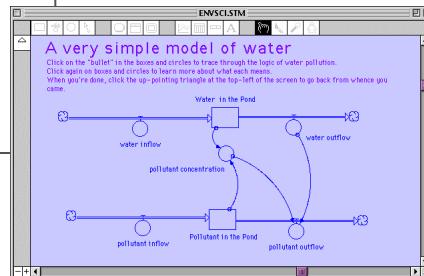
Model-It



Concept maps



STELLA

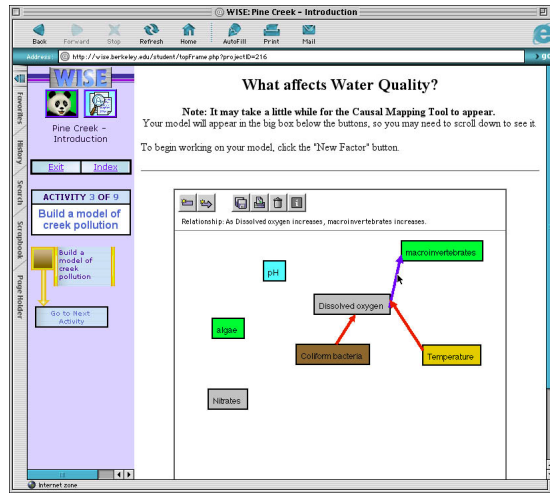




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Causal Mapping Within Pine Creek



[Http://wise.berkeley.edu/WISE](http://wise.berkeley.edu/WISE)

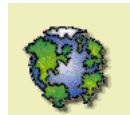


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Mobile Field Inquiry Surveying Ubiquitous Computing Efforts

- Research projects
 - CLP, KIE, SLIC, TERC Global Lab, Project GLOBE, Hi-C Newtons, eMates
- Activities
 - Foundations of Science, SEPUP, Kids & Creeks, LHS Outdoor Biology Inquiry Science
- Companies
 - ImagiWorks, Apple, Texas Instruments, Logal, OnSet, Vernier, Palm, HandSpring, Symbol





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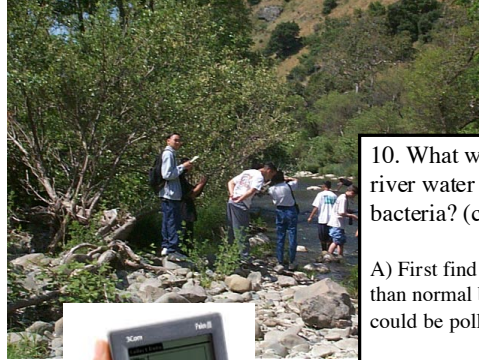
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Leveraging WISE, SIA, SLiC



10. What would do if you tested some river water and found that it contained bacteria? (circle one)

- A) First find out if there are more bacteria than normal because if there are, the river could be polluted.
- B) Don't do anything. All healthy rivers contain bacteria.
- C) You should add more bacteria because bacteria keeps rivers free of waste.
- D) Put some chlorine in the water to kill the bacteria.



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Monitoring Creek Health: Field Inquiry and Data Collection





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Supporting data analysis

Dimensions of support

- Multiple representations
- Leverage visual inferences/local landscape
- Scaffold comparisons across space and time
- Inspirations
 - ArcView/GRASS (ERSI, Baylor)
 - WorldWatcher (NWU)
 - BGuILE (NWU)



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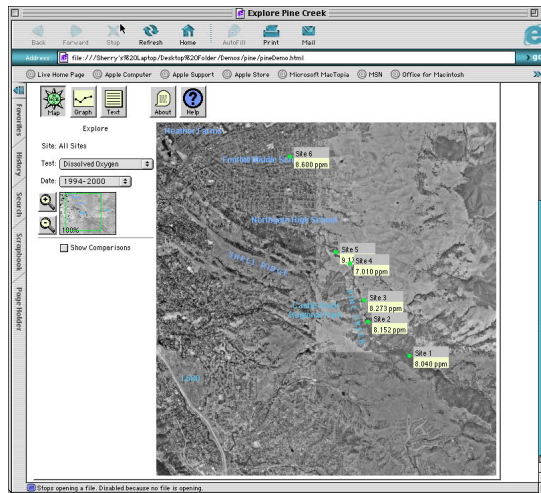
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Leveraging GIS tools





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Test understanding on another problem: Rocky Creek



Rocky Creek flows down from the hills and through a fertile farming valley. After joining Davis Creek, it flows into Lake Hollis.

Continuing south from the lake, the creek goes through an industrial district and the city of Springfield before it joins the Blue River.



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Supporting reflection and recommendations

- **Reflection: WISE, review models**
- **Make a Recommendation: town council model**



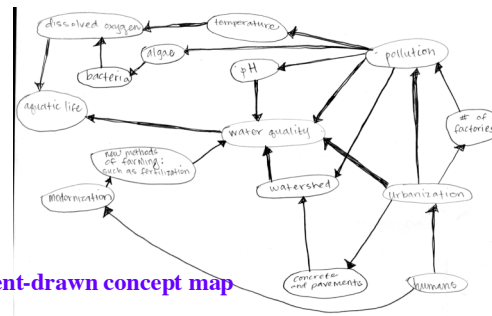


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Supporting assessment

- Don't wait until the end!
- Formative assessments are important
- Can be embedded in tech. (e.g. Billy)



Student-drawn concept map



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Leveraging Assessment Tools: Teachable Agent



Sample						
Macro-invertebrates						
Dissolved Oxygen						
River Ecosystem						
Question Number	1	2	3	4	5	6




DARE Force -Teachable Agent

WELCOME TO


the Dare Force

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Online Assessment Tools

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Netscape: SMART Page

Back Forward Reload Home Search Netscape Images Print Security

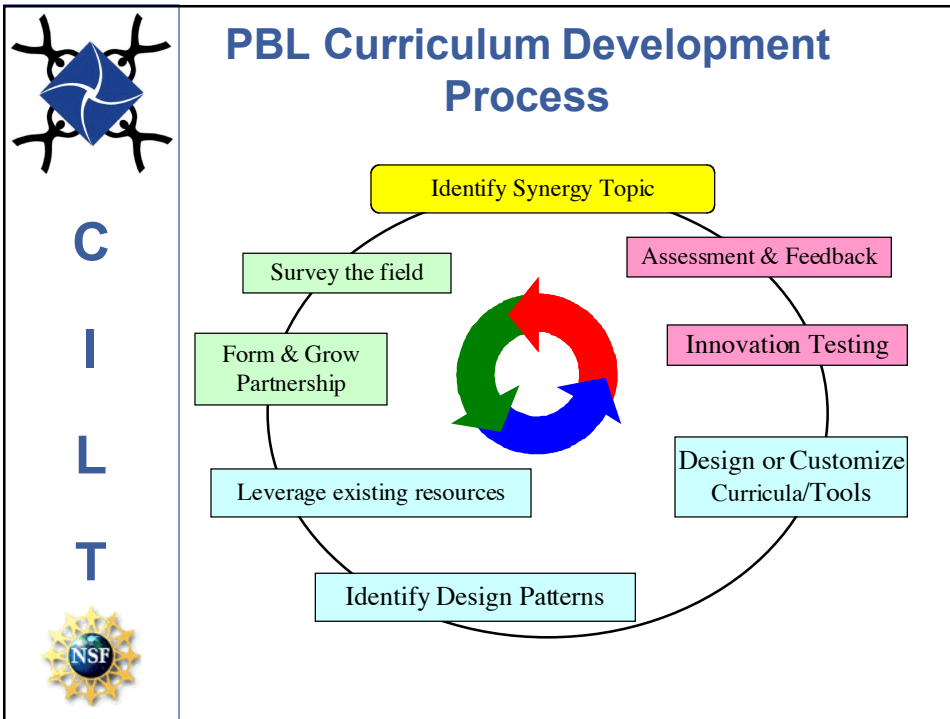
You are **Angelo Knocknee** in **Demonstration3's** Class, Right? [No, I'm not!](#)

The Dare Force Asked Billy: Explain why the formula for water quality gives more points to some types of macroinvertebrates? Billy said that he had not seen the formula before and could not explain it.

Billy would like to know what you think. Are you ready to give Billy some advice about his answer or would you like to look at the resources first?

A. [I am ready to teach Billy](#)

B. [I would like to see some resources](#)



-
- Lessons Learned: Challenges to Synergy**
- **Intellectual and pedagogical obstacles**
 - Competing goals and expectations among stakeholders
 - Collaboration process can uncover tacit assumptions with mutual respect
 - **Curricular obstacles**
 - Meeting state and local standards
 - Underscores value of flexibly adaptive design
 - **Technological barriers to adoption**
 - How to support a range of technologies?
 - Coordinated development can mitigate cross-platform and legacy issues



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Next Steps: Get Synergized!

- Explore water quality materials online
- Join the Synergy Community
- Join the CILT Knowledge Network



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Explore Water Quality Materials Collaborating Research Groups

- Web-based Integrated Science Environment (WISE)
 - <http://wise.berkeley.edu/>
- Scientists in Action
 - <http://peabody.vanderbilt.edu/projects/funded/sia/sia.html>
- Center for Learning Technologies in Urban Settings (LeTUS)
 - <http://www.letus.org/>



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Synergy Communities: Aggregating Learning about Education

- Extending the synergy water quality community
- Encouraging partnerships between schools, researchers, and developers
- Coordinating classroom-based research across institutions
- <http://scale.soe.berkeley.edu/>



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CILT Knowledge Network: Capturing and Sharing Collective Intelligence

- CILT Knowledge Network provides a growing resource covering the collective work of the learning technologies field
 - So far: 786 registered members from 502 institutions in 29+ countries
 - <http://kn.cilt.org/>





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Resources

Master list of resources:
<http://cilt.berkeley.edu/synergy/>

CILT and Synergy Research	http://www.cilt.org/
CILT Knowledge Network	http://kn.cilt.org/
Synergy Communities Project	http://scale.soe.berkeley.edu/
WISE Water Quality Projects (Pine Creek et al.)	http://wise.berkeley.edu/
Scientists in Action Project	http://peabody.vanderbilt.edu/ projects/funded/sia/sia.html
Center for Learning Technologies in Urban Settings	Http://www.letus.org/
Pocket Inquiry Resources	http://www.concord.org/~sherry/ cilt/resources.html
Computers, Teachers, Peers — Design Principles	http://www.clp.berkeley.edu/

