CILT Industry Alliance Program

Phil Vahey. Major funding by NSF and Intel.

Where We Started...

- Goal of $1M/year in industry funding
- Exploring new models in a new economy
- Initial support from Intel, with interest from other companies

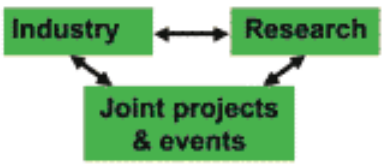
Program Goals

- Inform industry of latest research findings and implications
- Collaborate in joint projects with companies' "corporate" arm
- Inform researchers of latest technologies before they are in the classroom
- Create "pre-competitive" IP agreements that promote sharing of findings

Program Models

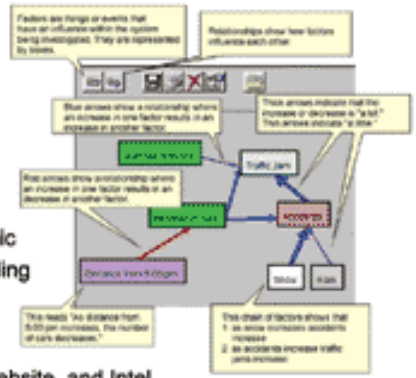
CILT has used:

- Research partnerships with CILT Core 5 researchers
- Research brokers: finding projects of mutual interest between CILT community and CILT IAP members
- Sponsorship of CILT activities, and opportunistic joint projects (our final model)



Successful Examples...

CILT Causal Mapping Tool (Intel)



Integral to pedagogy of Synergy Project: Developed by Post-Doc Eric Baumgartner in collaboration with the WISE team at the University of California, Berkeley, and based on prior work in concept maps, system dynamic engines (e.g., STELLA), and qualitative modeling systems (e.g., Model-It).

Adopted by Intel as "Seeing Reason": Seeing Reason is a cornerstone of the Intel website, and Intel has developed supporting materials to aid teachers in using the CMT.

Handheld Design for Education Contest: 1999-2000 (Palm)

Idea: Jumpstart development in handheld educational applications with a contest announced in Sept 99, final awards event in March 2000.

The Final Event: Webcast from the Exploratorium in March 2000. Participation from Mike Lorion, VP at Palm, Jeff Hawkins, inventor of Palm organizer, and others.

The Result: The start of a productive industry/ research collaboration that included the Palm Education Pioneers program.

Ongoing Industry Participation

Industry participated in CILT workshops and conferences:

- Approximately 15% of CILT conference attendees were from industry, representing over 50 companies
- Over 20 companies participated in seed grants

Industry support includes:

- Eighteen companies sponsored CILT conferences
- Intel Research Labs hosted the 2002 Ubiquitous Computing Theme workshop
- Six companies contributed to the handheld contest
- Equipment donations from Intel, Sun, Palm, ImagiWorks, and PASCO
- Software donations from AT&T and e-maginative

What's the Big Idea?

Research can create significant links with industry by being proactive.

Lessons

Industry is best engaged with:

- Clearly identifiable researchers and projects
- Clear timelines and objectives
- Name recognition or other indicators of face validity
- Clear IP benefits

Event-driven activities (such as conferences and contests) enabled interactions between research and industry

Challenges

- Low profit margin limits corporate investment
- Working with a multi-university collaboration that is not a legal entity is difficult
- Coordination issues in forming or brokering research relationships

Why Is This Important?

- Industry collaboration provides a potential funding and sustainability model
- Industry is a major force in school reform: collaborations benefit industry, research, and schools

CILT Workshops and Seed Grants

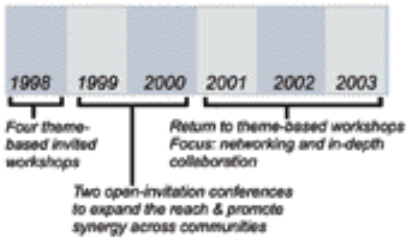
Melissa Koch, Linda Shear, Sherry Hsi, Sean Brophy, Eric Baumgartner, Jim Gray, Jason Ravitz, Yael Kali, Michele Spitulnik, Nathan Bos, & CILT PIs

Where We Started...

CILT's conferences and workshops provided a collaborative forum for the learning technology community to:

- Assess the progress of the field
- Define research agendas
- Initiate new partnerships

CILT's themes focused the workshops and seed-generating discussions.



The Seed Grant program was designed to channel NSF funding to collaborative projects in priority research areas.

Goals:

- Encourage collaborations on synthetic and exploratory work
- Provide opportunities for early-career researchers
- Promote projects that build on multi-institutional expertise

Early challenges:

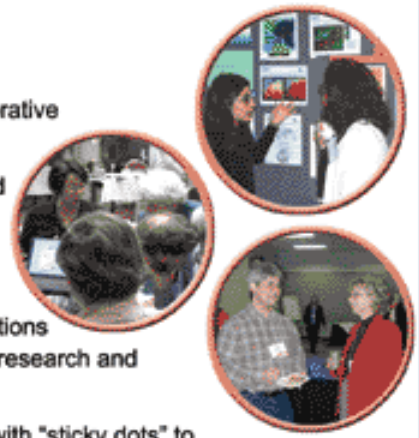
- Defining scope to make best use of small amounts of funding ($5K to $15K)
- Contracting challenges: pre-competitive IP, multi-institutional overhead

Current Focus...

CILT Workshop Model

CILT workshops promote focused collaborative activity on important topics:

- In-depth discussions, presentations, and networking around a central CILT theme, without competing concurrent sessions.
- Dynamic "firehose" and poster presentations where participants present their current research and collaboration needs.
- Brainstorming and collaborative voting with "sticky dots" to agree on critical areas of future research.
- "Voting with your feet" to form teams based on personal interest in agreed-upon high-priority topics.



CILT has conducted 13 workshops & conferences with more than 1,380 participants.

CILT has supported 60 seed grants involving approximately 169 institutions for a total of $617,369. In addition to the United States, institutions in Ireland, Israel, Norway, Finland, England, and Canada have also participated.

Seed Grant Selection Criteria

- Cross-institutional collaborations that build on each organization's strengths
- Innovative work important to the field
- Opportunities for early-career researchers
- Extend one of CILT's current themes, connect to emergent themes, or identify important cross-cutting ideas
- Demonstrate how a small amount of funding will enable future work

Seed Grant Management

- CILT distributed seed grant RFPs & guidelines at CILT conferences, workshops, & posted at www.cilt.org
- CILT used the selection criteria & developed key identifiers of success to select seed grantees
- SRI managed contracting & funds
- Post docs monitored seed grants
- CILT developed seed grant reporting format for interim and final reports

What's the Big Idea?

CILT workshops and seed grants are mechanisms for expanding the field and focusing collaborations.

CILT Workshop Model is Used Successfully in Many Meetings:

- Gordon Research Conferences
- National Academies
- Industry

Seed Grants:

- Have spawned continued collaborative work on important topics
- Expanded professional networks for early career researchers and others

Questions for the Field:

- How can the CILT workshop model and seed grant mechanism live on to enable future collaborative activity?
- What enablers of collaborative activity does the field need today?

Why Is This Important?

We need a mechanism for building capacity in the learning sciences and establishing collaborations on topics of importance.

Visualization and Modeling

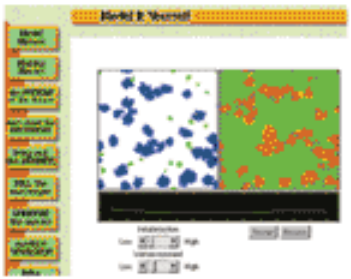
Marcia Linn, Yael Kali, Eric Baumgartner, Nancy Songer, Andy diSessa

Where We Started and Continued Efforts: Five Focus Areas

Modeling and Simulation Tools

Focus on the underlying models that drive scientific phenomena.

- Exploration with pre-designed simulations (Modeling Malaria)
- Models designed by Students (Agentsheets, Model-It)



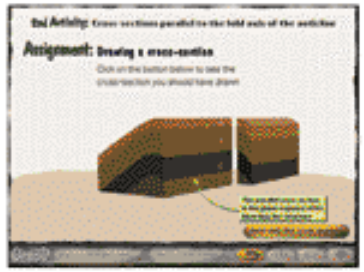
Modeling Malaria, PI: M. Corbit (http://www.scicentr.org/webexhibits.asp)

Visual Explanation Tools

Focus on the use of representations designed to communicate specific ideas.

R&D focus:

- Cognitive benefits of these tailored visual explanations
- The role of animation, video, & virtual reality in learning

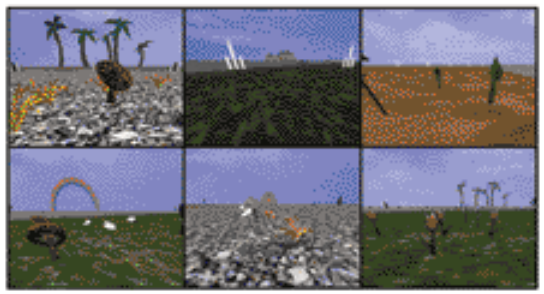


Geo3D, PI: Y. Kali (http://yaelkali.org)

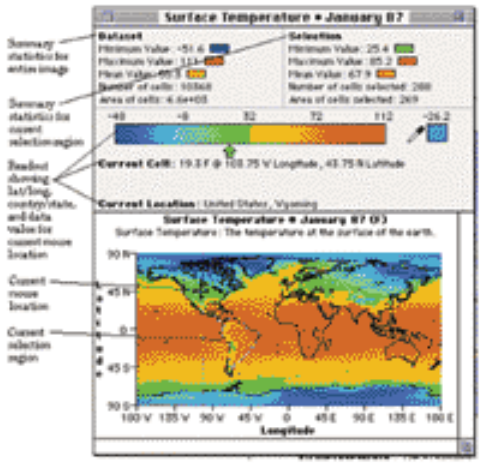
Exploring Student Needs in the Context of VisMod

This area explores needs that different uses of VisMod tools can address.

- Representational approaches for young children



Visual Ambients, PI: Tom Moher (http://www.evl.uic.edu/correlations)



WorldWatcher, PI: D. Edelson (http://www.covis.nwu.edu/sciviz/sciviz.html)

Exploring Instructional Frameworks for VisMod

Focus on the pedagogical implications of different instructional approaches:

- What do we know about instructional frameworks that support VisMod tools?
- How do these frameworks work together in different environments?
- How can the best features be converged into a single, coherent context?

A linked national graduate seminar:

Roadmap for Modeling and Visualization in Learning

PI: Kenneth Hay (http://cilt.org/seedgrants/visualization/1999.html)

Visual Data Analysis Tools

This area focuses on making sense of complex empirical data sets for use by learners, usually by adapting scientific visualization tools for the specific needs of students.

What's the Big Idea?

Visualization tools make complex concepts accessible to K-14 students.

Next Steps: Synthesizing Principles of Findings

Design Principle:

"Help students identify meaningful patterns by reducing complexity"

(See Design Principles poster)

Oscillation and Resonance Simulation (diSessa & Parnafes)

DC Circuits enables students to build and test circuit models (Ronen, Langley, Eylon)

Why Is This Important?

We need to synthesize the knowledge of visualization and modeling in the field.

Design Principles for Educational Software

Yael Kali, with Michele Spitulnik, Nathan Bos, Marcia Linn, Nancy Songer, Andy diSessa

Where We Started...

- Need for synthesis and design guidelines expressed at CILT2000
- Workshops with leading designers to come up with framework

✓ Connectedness

DPs are meaningful only when anchored with example software features (and vice versa).

✓ Grain Size Level

Need to be specific enough to guide new designs but general enough to cut across contexts.

✓ Limits, Tradeoffs, Pitfalls

- When does a DP stop working?
- What do you gain and what do you lose when designing with the DP?
- How can others avoid your mistakes?

✓ Where to Start?

Principle → Feature?
Feature → Principle?

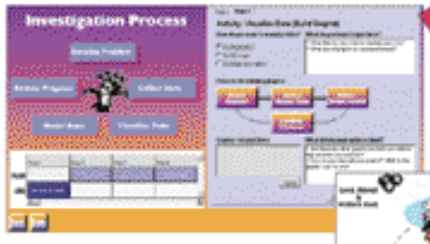
✓ Discussions

Public discussions about design principles are at least as valuable as the principles themselves.

Current Focus...

Entering Interconnected Research-based Principles & Features into the Database

Design Principle: Provide a Visual Overview for the Inquiry Process



Symphony's inquiry wheel

http://hi-ce.org/teacherworkroom/software/symphony

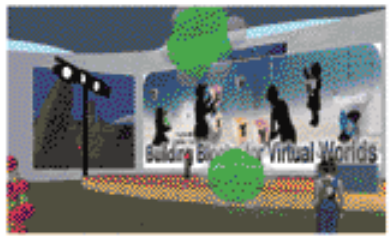
WISE's inquiry map

http://wise.berkeley.edu

Star Legacy's learning cycle

http://peabody.vanderbilt.edu/ctrs/ltc/brophys/legacy1.html

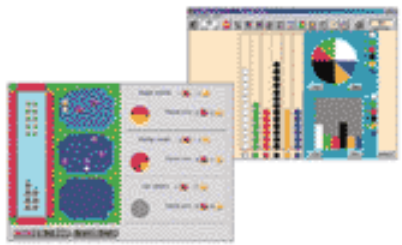
Seed Grants in 2002



Building Blocks for Virtual Worlds: Design Principles for a Starter Kit for Educational Virtual Worlds

K. Börner, M. Corbit, B. DeVarco

http://vw.indiana.edu/building-blocks



Identifying Emergent Design Principles through Analysis of Learning Technology in Action

J. Underwood

http://firefly.ctl.sri.com/wiki/jsp/wiki.jsp?DesignRetreat

What's the Big Idea?

Synthesize design principles and provide guidelines for educational technology.

Next Steps:

✓ Add Data: Online Workshops

Educational software designers gather to synthesize design principles for educational software and enter them into the database. (Lessons learned from February 2003 workshop.)

✓ Establish an Editorial Board to Ensure the Quality of the Database

✓ Widen the Audience

Currently intended for educational software designers but holds the potential to benefit students in learning science and teachers.

✓ Continue to Improve the Application

✓ Research

What are common patterns of activity?
What are users' purposes for their activities in the database?
To what degree are these purposes met?
How does the usage of the database affect designers' practices in developing new educational software?

Why Is This Important?

We are building a common design knowledge for the field.

Unlocking the Potential of Assessments FOR Learning

John Bransford, Barbara Means, Edys Quellmalz, Sean Brophy, Jason Ravitz

Where We Started...

Expanding the vision for how assessments are used as tools for learning

Emerging themes from early CILT workshops

Exploring technologies to enhance classroom instruction

- Real time feedback
- Providing indicators of meaningful learning
- Making assessments available

Providing assessments for multiple audiences

- Establish various uses of data, e.g., formative versus summative

Communicating about assessments

- Raising public awareness of the role of assessments and how they are used, e.g., standardized tests

Measuring meaningful outcomes

- How do we do it efficiently?

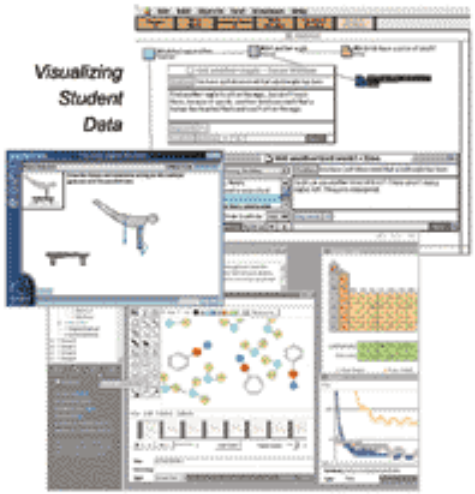
Our Focus...

Defining and sharing meaningful assessments that support instruction

Formative assessments for the classroom

Using handheld devices to monitor students progress and provide formative feedback

- Classroom Communications Systems
- Dynamic Assessment, Diagnoser



Meaningful performances for assessment

- Developing rubrics for meaningful outcomes (e.g., PALS)
- Tracking student problem solving (e.g., IMMEX)
- Evaluating writing and discourse with technology (e.g., Latent Semantic Analysis)
- Assessing construction of visualization (e.g., ChemSense & Free Body Diagram Simulation)
- Assessing collaboration using handhelds (e.g., Teamlab)

Teachers and instruction

Support educator's decision making with well defined & evaluated instruments

- Sharable assessments (e.g., PALS)
- VaNTH Observation System for classroom dynamics
- Curriculum based measures to monitor students' progress efficiently (e.g., reading fluency - mClass)

Netcourse for educators

- Web-based tools
- Linking developers to users
- Replication and dissemination

What's the Big Idea?

The need to promote and support ongoing formative assessments with technology.

Helping educators find and use new assessments

Validating and sharing effective assessments; interpreting evidence; choosing and implementing assessments.

Providing rapid feedback to students for self-monitoring

Embedding assessment in authentic activities can provide students with timely feedback & ongoing formative assessments.

Timing assessments and tracking change

Identifying points in instruction that allow students to demonstrate learning over extended periods of time.

Creating transfer tasks

Test what people can do, not just what they know. Move beyond sequestered problem solving to preparation for future learning.

Using multiple views of data

Individual and groups; global-local, levels of analyses.

Why Is This Important?

There is not sufficient understanding of how to achieve and measure successful learning.

CILT Netcourses

Michele Spitulnik, Nathan Bos, Jim Gray, Jason Ravitz, Yael Kali

Where We Started...

Why Netcourses?

Five online netcourses were constructed to disseminate knowledge and build community around each of the CILT themes.

Netcourse Structure:

- Netcourse structure based on Concord Consortium's netcourse model
- Post docs developed and moderated the netcourses
- All netcourses occurred online, hosted by Concord Consortium
- Netcourses lasted six weeks
- Four of the five netcourses were offered twice
- Enrollment in the netcourses ranged from 5 to 25 participants for each of the offerings
- Participants included teachers, school administrators, higher education professors, and researchers
- A syllabus for each course outlined the weekly activities

Netcourses Offered:

From the Assessments for Learning Theme:
Technology Supported Assessments as Tools for Teaching and Learning (Jason Ravitz)

With the wide variety of technology innovation taking place in schools, assessment remains one of the most pressing challenges teachers face. Participants are given access to exciting projects that demonstrate the power of technology to support teaching and learning through ongoing feedback and assessment.

From the Community Tools Theme:
Computer-supported Group Work
Nathan Bos

Knowing how to select the right tools and the right social practices can provide a basis for effective group work at a distance. Students of this netcourse will review some of the latest and greatest tools for groupwork, learning what these tools do and how to use them well.

From the Community Tools Theme:
Culture, Cognition, and Technology
Jim Gray

Culture, Cognition and Technology is an investigation of how technology use and sociocultural context shape student thinking and learning. We will draw on research, theory, and our own experience to investigate specific examples.

From the Ubiquitous Computing Theme:
Supporting Student Inquiry
Michele Spitulnik

This netcourse engages participants in collaboratively creating their own inquiry-based science projects and also focuses on the teaching strategies that can be used to support students throughout an inquiry project.

From the Visualization & Modeling Theme:
Uses of Technology for Teaching Spatial Visualization-based Content
Yael Kali

Spatial visualization is an ability required in many scientific, mathematic, and technological domains. There is also evidence that technology has a great potential in assisting students to develop their spatial skills! During the course you will collaborate and learn about your students' (or colleagues' students') spatial visualization difficulties across different subject matters, and consider software designed to assist students in spatial visualization.

What's the Big Idea?

Provide the education technology community with synthesis and common understanding around these central themes in the learning sciences.

Challenges:

- Developing a compensation structure for course instructors
- Offering a credit structure for teachers
- Developing a model to sustain ongoing offering of these courses

Successes:

The community continues to use these netcourses:

- New Jersey Virtual University used Technology Supported Assessments
- Design Principles online workshop used netcourse format. See the Design Principles Poster

Why Is This Important?

Developing and publishing syllabi and reading lists:

- Shares expertise of the CILT team
- Contributes to the capacity building needs of the field

Ubiquitous Computing

Robert Tinker, Stephen Bannasch, Sherry Hsi, Jeremy Roschelle, Ray Rose, Michele Spitulnik, Carolyn Staudt, Phil Vahey

Where We Started...

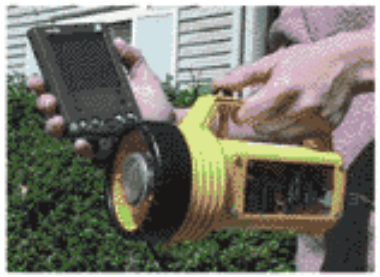
In 1997 the idea that every student might have a small, portable, wireless computer seemed far-fetched. No research supported handhelds and no products were available for schools.

Examples of CILT's multi-pronged approach to changing ubiquitous computing in education:

- Introduced 3-Com, then the largest maker of handhelds, to the educational potential of handhelds.
- Datagotchi project, a collaboration with IDEO Designs, results in visionary sketches that sparked discussions with leaders in industry and research.
- The first probeware for the Palm.
- The first classroom studies of probes and handhelds.
- At The Exploratorium: the first Electronic Guidebook.
- Imagiworks and Palm support classroom studies.
- Competition: Handheld Design Awards for Education.
- Palm Education Pioneers Grants Program established.

Current Focus...

Science Learning in Context. A unique affordance of portability is the ability to provide technology support for learning in real-world contexts. Can this help situate learning? Overcome mental processing limitations? Make learning more robust?



One important CILT advance was the development of low-powered, portable probeware.

This supported research and stimulated commercial development of probeware.

Probes, Sensors and Platforms support the learning-in-context theme and provide one of the most valuable science learning tools.

Yet too little is known about the details of probe use: appropriate scaffolding, developmental sequences of concepts, and user interface design.

With the plunging costs of handhelds, new probeware is needed that is similarly inexpensive. As new platforms are introduced, platform-independent software is increasingly important. Our response is WABA, an open source Java-like language.

Classroom Studies

As the technology stabilizes, we are looking at classroom management issues and student learning gains in classrooms equipped with large numbers of portable computers.

What's the Big Idea?

When CILT was Formed, There was a Need to:

- Stimulate interest in educational uses of handhelds
- Show by example some educational possibilities
- Stimulate collaborations between researchers and businesses

Handhelds in Schools

The increasing computational power, the collaborations that wireless and "beaming" enable, the portability, and the skills and sense of ownership that comes from a personal computer could lead to important new learning opportunities, particularly for young students. Low costs have obvious significance for providing equitable access to technology. We expect increased & earlier student understanding of causal explanations, familiarity with abstract representations of data, & use of models.

Students insert a probe inside their shoe to test the temperature and record their data.

Why is This Important?

These capacities raise deep questions about how to guide & support student explorations by younger students using sophisticated technology.

Tools for Learning Communities

Roy Pea, Jeremy Roschelle, Mark Schlager, Jim Gray, Nathan Bos

Starting Points

Needs:

- Move beyond common information transmission models of "distance education"
- Extend learning sciences research on collaborative learning through project-based, active inquiries.
- Better connect research & industry developments
- Consider core methodological issues and tool design

Achievements & Publications:

- Learning communities R&D knowledge feeds into Teachscape.com to provide integration of K-12 video case studies of exemplary teaching with online communities (R. Pea, co-founder)
- *Designing for Virtual Communities in the Service of Learning* book (Cambridge U Press)
- Digital video learning (LEA book, in prep)
- NAP *How People Learn* book
- Papers in Educational Researcher, JSET, ETRD
- National Academy of Education chapter: "New media communication forums for improving education research and practice"

Focus Areas and Sample Projects

Network Improvement
Tools enhance learning by linking individuals to new sources of knowledge, like-minded peers, domain experts, or teachers.

"Young Learning Scientists" Research Group (Seed Grant)

Researching Online Communities (Theme Project)

Digital Video Inquiry Workshop & Collaboratory (Seed Grant; follow-on grant)

CILTKN *The Center for Innovative Learning Technologies*
CILT Knowledge Network

ICSAR, Interoperable Components for Shared Active Representations (20-person seed and related work)

Media Rich Annotations for Learning (Seed and related work)

Playful Learning Environments (Seed Grant)

Collaborative Representations to support conversation & reflection on complex topics using diverse visualizations, notations, & models.

Scaffolding Tools to structure educational activities for enabling more advanced performances than learners would be capable of without such supports.

What's the Big Idea?

Research on community tools is advancing social and technology design principles for distributed learning environments.

Creating Value

- Social, distributed, collaborative processes essential to learning
- Tools for learning communities support and extend processes
- Online teacher learning communities promise ongoing professional development rather than isolation

Future Directions

- Digital video collaboratories for learning sciences R&D
- Collaborative learning groupware using wireless handheld computing
- Web-based video case studies as records of teaching practice for a learning medium
- High-performance group learning environments using wall-size displays and wireless computing for collaborative representation building

Why Is This Important?

Systematic empirical inquiries of learning within online communities are needed to fulfill the promise of effective learning environments.

Synergy Research

Eric Baumgartner, Sherry Hsi, Sean Brophy, Jim Gray

Where We Started...

Synergy began as a CILT cross-theme effort to explore effective ways to improve cumulativity in learning sciences R&D.

Key Goals

- Leverage past solutions to shared challenges
- Explore nature of design/usable knowledge
- Customize research for new contexts

Potential Synergy Models

- Shared pedagogical approach, multiple test-beds
- Shared domain (e.g., dynamics, light, water) unifies research across themes
- Synergy researchers as knowledge brokers/ matchmakers
- Projects as hubs: CILT Knowledge Network
- Professional Development Community
- Chinese Menu/Micro niche studies/Lawn sprinkler model

"Sharing is a two way street"

Current Focus...

CILT Synergy projects were designed to facilitate knowledge exchange and teaming of individuals to collaborate on curriculum development around a particular topic.

Synergy and water quality

- Kickoff workshop to establish broader collaboration
- Online curriculum development that leveraged existing intellectual, curricular, and technological resources
- Customization efforts tied to specific school sites

Towards a model for synergy research

Customization research that explores the value of usable design knowledge in new contexts. Results of such research, along with coordinated collaboration across research groups, refine the outcomes of and value of traditional educational research.

What's the Big Idea?

Generalizing knowledge requires replication and comparison of implementations.

Why value synergy practices?

- ✓ Directly addresses calls for usable knowledge
- ✓ Focus on reuse leads to shorter design cycles & better opportunity for aggregation & understanding of research findings
- ✓ Foster long-term collaborations among junior researchers

What forms of design knowledge afford productive reuse?

- ✓ Annotated design resources
- ✓ Generative design principles
- ✓ Extensible environments

How can we identify & sustain synergy communities?

- ✓ Role of CILT workshops
- ✓ Nature of shared focus: curriculum, assessment, etc.
- ✓ Publication of design artifacts and design knowledge
- ✓ Support for customization research

Why Is This Important?

There are few mechanisms that support this type of cross-project synergy.

CILTKN http://www.ciltkn.org

Christopher Hoadley

Where We Started...

CILTKN began as an attempt to allow aggregation and community building through online tools. Initially, we thought this would be primarily through online discussions.

Key Goals

- Improve connections among and between researchers, teachers, developers, and policymakers
- Aggregate information by capturing it at the source and then sharing it across audiences
- Use realistic incentives to make the online community as self-sustaining as possible

Early Findings

- Online discussions don't mesh with workflow
- Information sharing and knowledge management was hampered by diverse information practices and formats
- Contribution is tied to incentives (fame and favors)

CILTKN *The Center for Innovative Learning Technologies*

CILT Knowledge Network

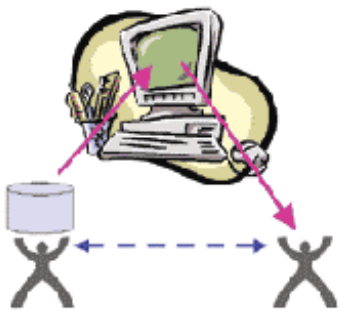
Current Focus...

CILTKN is a portal for information for, by, and about the learning and technology research and development community, and contains a wealth of information including over 5000 bibliographic citations, contact information for over 5000 people, and collections of high quality course syllabi and research projects.

CILTKN

People
Places
Projects
Collaborations
Syllabi
Bibliographies

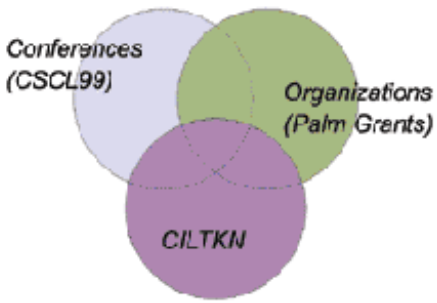
A person behind every object



CILTKN facilitates knowledge exchange about research on learning and technology, either within the system (through download) or outside the system (by fostering connections among individuals around resources).

CILTKN supports multiple, overlapping "portals" that share data using *passive-capture, active-publish* which allows users total control over how data is shared while encouraging republishing to new communities.

Overlapping communities have shared data



What's the Big Idea?

Knowledge networks are useful for organizing and connecting an emergent community.

Creating Value

Can we serve the needs of teachers, policymakers, and researchers?

Information solicitation is a significant effort:

- Can the sources of information (e.g., conferences, researchers, etc.) be brought in to truly allow capture at the source?
- What tools and social facilitation are necessary to collect, discriminate, and publish valuable information?
- How can we encourage the sharing of syllabi and online courses?

(See Noticourses poster)

Group & Community Support

- Would small-group tools (yahoogroups-style) enhance connections to information and people?
- How can community caretakers be rewarded and sustained?

Why Is This Important?

The field needed the experience of developing a KN in order to understand how to support its growth.