Seed Projects

Sorted first by theme team, then alphabetically.

Formative and Summative Assessment of Inquiry Science.

Assessments for Learning: Presentation
Susan Goldman

Team Members: Rick Duschl, Kirsten Ellenbogen, Susan Goldman, Carrie Tzou, and Susan Williams, John Frederiksen, Barbara White, Jazlen Ebenezer.

This project focuses on examining and understanding how discourse interactions in an on-line database provide opportunities for formative assessment of argumentation discourse in science classrooms. Research indicates that students' discourse tends to be more reflective and thoughtful when it occurs in technologically-supported asynchronous learning environments such as CSILE (Lamon, 1993). The need to explain and to provide feedback on contributions to the database (by peers and by teachers) can play a powerful role in directing the discussion toward knowledge building and away from knowledge telling (Hewitt & Scardamalia, 1997). However, little is known about "carry-over" between argumentation patterns that occur in classroom discussions and those that occur in on-line venues. We will report on ongoing work in seventh grade science classrooms that are equipped with the asynchronous communication environment, Knowledge Forum (formerly CSILE). Students develop their arguments in this on-line discussion venue throughout the process of constructing and understanding the science content. Science content is taught through the creation and conduct of experiments over several cycles of revision. As a first step we are examining argumentation in the context of a unit on flotation and buoyancy. We are looking at how argumentation structures develop and emerge in response to (1) prompts (scaffolds) that emphasize evidence-based reasoning, and (2) the circumstances under which teachers and peers provide prompts that emphasize evidence for claims. Our baseline assessment data indicate that students' reasoning about evidence is often directed by surface properties of the claims and justifications. We are selecting scaffolds to help guide the students in the construction of evidence-based arguments.

We intend to compare the process data that we obtain from observation of classroom discussions and the Knowledge Forum discussions. The process accounts will also be compared with assessments based on the product or final reports, according to Frederiksen and White's (1998) Inquiry Scorer evaluation software. Our interest is in the relationship between the formative assessment data obtained during the argumentation process and the summative assessment arrived at based on examination of students' portfolios and final report.

Getting our act together with the CILT Knowledge Network

Community Tools: Presentation
Christopher Hoadley

One of CILT's primary functions is to support and encourage collaboration across institutions with academia, industry, and professional educators. The CILT Knowledge Network is a platform for sharing information about who we are, what we do, and how we can collaborate. Rather than a single piece of "groupware" through which you work with other individuals or groups, CILTKN is an infrastructure for storing, using, and sharing information vital to the field such as curricular materials, research papers, contact information, and the like. In this talk, I present the initial design for CILTKN and describe our plans to expand and enhance the tool.

Teacher Professional Development in a World of Advancing Technology: A Systemic Conversation

Community Tools
Mark Schlager, Margaret Honey, Susan Goldman, Marilynn Fong

Implementing the new California Content Standards Framework poses significant logistical and organizational challenges to schools across the state. To help meet these challenges, the Los Angeles County Office of Education Technology for Learning has initiated a project that unites educators from different schools with private organizations in Communities of Excellence (CoE). As the CoE projects have grown, it has become increasingly necessary to develop a new model for professional development, growth and communication to address the time and distance limitations inherent in face-to-face meetings and the need for continuous collaboration among the teachers in each community.

The project described here is designed to create a process for planning and implementing professional development that is both scalable and sustainable enough to achieve fundamental and lasting reform. Specifically researchers, teachers, administrators, school district support staff, and technology support providers are currently engaged in a 5-month planning process to support the expansion of the CoE. The result of this "systemic conversation" will be three products: 1) a plan for scaling up the CoE process that involves the use of advanced Internet technologies to help implement the professional development strategies outlines above, 2) a grant proposal to NSF to implement and study the scale-up process, and 3) a technical report aimed at the education reform research and policy communities describing our work. The project is scheduled to be completed in July, 1999.

Our work is based on prior professional development strategies successfully implemented in collaboration with their respective regional schools by researchers at EDC's Center for Children and Technology (CCT) and at the Vanderbilt University Learning Technology Center (LTC); and on experience with online collaboration through SRI International's TAPPED IN project. At the core of the current conversation are the following principles: (a) successful infusion of technology into classroom practice involves the teacherÕs acceptance of, and facility with, the technology being introduced; (b) acceptance of technology requires not only motivating students to use the technology but also helping teachers achieve their curriculum and assessment objectives within their local context; and (c) classroom technology needs to be designed and implemented within the context of ongoing school reform efforts with the full participation of school stakeholders.

Collaborative Representational Environments

Community Tools: Presentation
Dan Suthers
http://lilt.ics.hawaii/edu/

Collaborative learning is becoming increasingly important in computer-supported learning. At the 1998 CILT workshop on Tools for Learning Communities, question of how learner- constructed representations of their own emerging knowledge can serve as resources in the discourse processes of collaborative learning was identified as a major research priority. This led to the formation of the "ICSAR" focus group.

I will summarize three strands of work under the foregoing theme. First, I will summarize the conclusions of the ICSAR group, which examined several scenarios for "ideal" multi-representational collaborative learning environments to identify patterns of interactions that must be supported to build these environments. Second, I will describe ongoing research that compares discourse resulting from the use of different representations of evidential relationships (i.e., matrices, graphs, and text) while investigating problems in science. Third, I will propose a collaborative research project to create an empirically grounded theory of design for discourse within representationally rich collaborative learning environments by studying the actual use of many examples of these learning environments by students and teachers.

In the proposed project, videotapes will be analyzed with specific attention paid to the relationship between individual learner's manipulation of the software components and their interactions with other learners. Comparing results across multiple learning environments, we will identify recurring "interaction patterns" at three levels: discourse, representational, and computational. Primarily, we will seek to understand the effects that design decisions at the representational level have on the discourse level. Secondarily, we will identify the constraints that desirable interactions at the representational level place on software engineering tools at the computational level. This research is too ambitious for individual projects working in isolation. I will propose a model of research collaboration in which individual labs pursue distinct yet related efforts, but also aggregate results towards an empirically grounded theory.

SmartProbes in the Classroom and Beyond

Ubiquitous Computing
Stephen Bannasch & Carolyn Staudt
http://concord.org/slic/smartprobe.html

Recent developments in probeware have broken the barrier that prevents many teachers and students from using these powerful data collection and analysis tools. No longer are they just cumbersome "techie" toys that few would spend the time to use in their classrooms. The walls of the laboratory have been removed by making probeware portable and free of boxes and many of the wires. You can now easily allow students to test a wide variety of difficult parameters from dissolved oxygen in air and water to human functions including pulse, brain waves, and respiration response-even while

exercising! Presently new SmartProbes ease the process of investigation by automatically recognizing calibrations and connecting to very small handheld computers. We'll describe how SmartProbes are being used in schools, the technology behind them, and future trends including probes based on the USB interface. For more information see: http://concord.org/slic/smartprobe.html

Virtual Reality Solar System Project

Visualization and Modeling: Presentation
Sasha Barab

The VRSS Project is an experimental undergraduate astronomy course currently being taught at Indiana University (IU), Sasha Barab, and at the University of Georgia (UGA), Kenneth Hay. For this project we have completely transformed this traditional lecture based course into a constructionist course. Where previously listening to lectures constituted the primary learning activity, in the VRSS course listening to lectures is replaced by students building three VR models of different aspects of the solar system: 1. The Celestial Sphere, 2. The Earth Moon and Sun, and 3. The entire Solar System. Learners work in collaborative teams on high-end graphics computers with a VRML 2.0 WYSIWYG editor. In this environment, students build scale models of the solar system and do dynamic modeling with a key-frame animation tool. To aid in visualization of the student VR models, learners then take their solar system models into IU's CAVE or at UGA they will view their worlds with a HMD. This project will be one of the first educational applications of this technology at both universities.

In addition to understanding how the use of these powerful modeling tools aid students in learning about astronomy (including the potential for minimizing common alternative conceptions associated with 2D representations), our research program has focused on knowledge generation and diffusion. Our research team has used video cameras to capture groups of students as they construct their VR worlds. In addition to the videotapes, student and teacher interviews, document analysis, field notes, and various tests provide a rich data base for analyses. Using a methodology refined during previous studies, our research team selects various facts, practices (tool and concept related), student productions (e.g., projects developed), and conceptual understandings to serve as tracers. We use these tracers to follow or trace how student understandings evolve over time.

Of Museums, Sustained Scientific Inquiry, and Deformed Frogs

Visualization and Modeling: Presentation, Demo
Philip Bell, Linda Shear, Eric Baumgartner, Noel Wanner
http://scope.educ.washington.edu/partner

How can Web-based curriculum materials be integrated into an informal science learning environment to scaffold the public's inquiry, interest, and learning in science? In our partnership, members from the SCOPE, WISE, and CILT projects collaborated with designers from the Exploratorium museum of hands-on science in San Francisco to

develop a Web-based curriculum project to be used in conjunction with a major exhibit on frogs.

The materials we developed were focused on a current scientific controversy -- an apparent dramatic increase in frog deformities being documented across North America. Middle school students in Minnesota used the Internet in 1995 to bring media attention to the phenomenon when they published their field observations. The deformed frog controversy represents a complex, multidisciplinary problem involving environmental, chemical, and genetic arguments. We adapted and augmented curriculum materials developed and refined for use in middle school science classrooms to create this new project for the museum setting. The project offers museum patrons an authentic way to explore the competing hypotheses and associated scientific evidence being vigorously explored and debated by the scientific community. It includes instructional visualizations that depict the complex hypothetical mechanisms being investigated by scientists. The instructional experience is a 1.5-hour immersion into detailed aspects of the controversy facilitated by a moderator in the Learning Space -- a new, enclosed computer lab that is integrated into one of the main exhibit spaces.

We are investigating several aspects of this partnership. First, how can curricular materials and instructional practices developed for a classroom setting be re-purposed for use in an informal science learning setting? Second, how successful will this project be at fostering sustained scientific inquiry in a museum setting? Finally, how can such materials be designed to coordinate productively with the surrounding exhibit space and to accommodate the broad range of patrons visiting the science museum?

Scientific Modeling Tools for Young Children

Visualization and Modeling: Presentation
Andrea diSessa

Modeling has come to be seen more and more as an excellent approach to engaging students in the process of doing science. On the other hand, very little attention has been paid to modeling for young children. In particular, the vast majority of software modeling tools has proven to be difficult for high school students and teachers, let alone for elementary school students. We intend to design and experiment with a family of flexible modeling tools to be used with children in the early elementary years.

In designing these tools, we will employ three basic strategies. First, we want to make sure that student's ideas concerning how things work can be adequately expressed. Although children may not start with normative models, if a modeling system cannot engage children where they begin, it is unlikely to support a natural process of evolution toward more standard models. Instead, students will have difficulty "saying" anything they feel is sensible with the tool. For example, few, if any, current modeling tools easily express the idea of stages so that at different times, different processes are in action, such as "old age" in plant growth. Similarly, naive ideas about ecosystems assume that perturbations result in quasi-permanent changes, rather than in a disturbed dynamic equilibrium, as is the natural result of most existing modeling tools.

Our second strategy is to experiment with extremely generic modeling tools. We want to extend our prior work that shows upper elementary school students can use simplified programming to express models about such things as how a ball falls.

Our third strategy is to design tools to fit the activity context of classrooms where modeling is successfully being engaged. This reactive strategy will result in tools that address specific difficulties and limits found even when children do begin to use modeling effectively.

Digital Weather Station

Visualization and Modeling: Presentation
Ken Hay
http://lpsl.coe.uga.edu/LIVE/

The Digital Weather Station (DWS) is an exhibit at The Children's Museum of Indianapolis. The goals of the DWS are to develop students' understanding of the weather as a three-dimensional system and their skills in the scientific process of visualization. The DWS runs on three high-end SGI Workstations and utilizes an interface that we designed to enable young children to manipulate sophisticated, expert level scientific visualization tools (VIS5D). The tool supports learner's immediate creation of 3D interactive, dynamic visualization of standard weather parameters. These tools are not scaled down tools visualizing fictitious data, rather they are built on the same tools and data that hundreds of scientists use everyday. We have designed and developed a learner's interface that almost eliminates the technical and domain learning curve these tools create for novices. This tool provides an unprecedented opportunity for inquiry-based and problem-based learning activities where the technology can visualize a 3D phenomenon.

The research program will explore the abilities of the learner using this tool in a variety of contexts. We have three major goals for this research program. First is the establishment of a research base on dynamic 3D visualization by learners of a broad age range. This project is the first known by the authors to make dynamic 3D visualization tools publicly available to learners as young as 8 years old and will give us unprecedented opportunities to develop this research base. Second, we will explore small group knowledge construction about visualization processes and atmospheric phenomena through a series of studies where the DWS is used within a macrocontext. Third, we are interested in tool design issues for learners. We would like to develop and test LCD features that are empirically derived, refined, and then generalized within the aforementioned instruction strategy.