Knowledge Forum: A Knowledge Building Environment

This summary account provides a quick sketch of the evolution, characteristics and theoretical ideas behind Knowledge Forum, and its predecessor, CSILE (Computer Supported Intentional Learning Environment).

Carl Bereiter and Marlene Scardamalia, Professors in the Institute of Knowledge Innovation and Technology (IKIT) at the University of Toronto, co-founded IKIT and the program of research that has informed Knowledge Forum development. IKIT (www.ikit.org) conducts research, develops technology, and helps build communities aimed at advancing beyond "best practice" in education, knowledge work, and knowledge creation. The following summary of IKIT's accomplishments is from a press release by the Ontario Research and Innovation Optical Network (ORION), announcing that IKIT was chosen to receive its 2007 award for innovation in learning:

IKIT has been a global leader in research-based innovations in theory, pedagogy, and technology, all aimed at making citizens part of a 21st-century knowledge-creating culture. It has brought awards and innovations to Ontario, including the first collaborative networked learning environment. IKIT hosts the Knowledge Society Network, uniting innovators worldwide who are using IKIT's ground-breaking Knowledge Forum software and producing striking advances across sectors and at all levels from pre-kindergarten to professional continuing education.

In addition to the ORION award, other recognition has come in the form of the World Cultural Council's "World Award in Education" (2006); the first ever Computer-Supported Collaborative Learning (CSCL) Lifetime Achievement Award (2005)—citing our pioneering work in collaborative technology and creation of the *Knowledge Society Network*; and TeleLearning Network of Centres of Excellence First-Prize awards, 1999 and 2000, for "Knowledge Forum®: Groupware for Knowledge Building" and virtual visits to Knowledge Forum classrooms.

The social dimension of our work aims to ensure the ubiquity of capacity for knowledge work-ubiquity of human rather than technological capacity. The term "knowledge building" originated with CSILE. Although the term "knowledge building" is now in wide use (in almost 500,000 Web documents, as of Dec 2007) we were, as far as we can ascertain, the first to use the term in education, and certainly the first to have used it as something more than a synonym for active learning. It refers to the production of knowledge as a social product. Knowledge building makes it possible to bring the process of knowledge creation to all citizens.

In 2008 we will celebrate the 25th anniversary of the CSILE/Knowledge Forum initiative that brought the first collaborative learning environment to the world. The goal of our work, which extends from kindergarten to continuing professional development, has been to help bring education into the Knowledge Age. The technology helps by (a) making advanced knowledge processes accessible to all participants, including young children, (b) fostering the creation and continual improvement of public artifacts or community knowledge, and (c) providing a community space for carrying out knowledge work collaboratively.

The distinctive characteristics of Knowledge Forum are perhaps most easily grasped by comparing it to the familiar technology of threaded discussion. Threaded discussion is a one-to-many form of e-mail most commonly embodied in "bulletin-board" systems. "Threading" produces a downward-branching tree structure, which is the only structuring of information, besides chronological, that the technology allows. There is no way to create higher-level organizations of information, to comment simultaneously on a number of notes, or to make a connection between a message in one thread and a message in another. Thus the possibilities for knowledge building discourse are extremely limited. Many Web 2.0 applications have these same limitations.

Knowledge Forum's technological roots are not in e-mail at all. CSILE was built prior to the World Wide Web and has evolved to take advantage of new technological capabilities. Initially based on a local area network, it subsequently moved to an Internet basis, and then, as Web Knowledge Forum, to a Web-based HTML environment, and more recently to a versatile Web-based application. As computing power increased, computationally intensive Analytic Tools were built for use first by researchers, then by teachers and students themselves. We are now poised to take advantage of Web 2.0/3.0 advances, including leading-edge work on knowledge visualization and semantic analysis. Our continuing emphasis on flexibility and responsiveness to new ideas is reflected in Knowledge Forum being one of the few operational applications of "tuple store" technology, used for flexible modification of storage parameters-an important enabler of on-the-fly pedagogical experimentation and one difficult to achieve with standard relational databases. Early versions of the

new analytic and visualization tools are already in use.

The heart of CSILE/Knowledge Forum is a multimedia community knowledge space. In the form of notes, participants contribute theories, working models, plans, evidence, reference material, and so forth to this shared space. The software provides knowledge building supports both in the creation of these notes and in the ways they are displayed, linked, and made objects of further work. Revisions, elaborations, and reorganizations over time provide a record of group advances, like the accumulation of research advances in a scholarly discipline. Thus the database itself is an emergent, representing at different stages in its development the advancing knowledge of the community.

From the users' standpoint, the main constituents of a Knowledge Forum database are notes and views. A view is an organizing context for notes. It may be a concept map, a diagram, a scene-anything that visually adds structure and meaning to the notes whose icons appear in it. Notes are contributed to views and may be moved about to create organization within views. The following screen shot illustrates some of Knowledge Forum's features.

• Citation Material copied from other sources appears in a visibly distinct font, with automatic links to original sources and compiled bibliography.

• Portfolios highlight different aspects of the work, created by an author, a group or a class.

• Automatic research tools continually operate in the background, recording activity patterns such as reading, building-on, referencing, and creating views.

• Analysis and visualization tools can locate others' work in similar semantic fields or on common problems, either within the local network or any other Knowledge Forum database worldwide.

As with the rise of computer games several decades ago, the challenge is to harness the new technological capabilities to high-level educational goals rather than lowering the goals to suit the technology. Wikis, for instance, are gaining popularity in schools but frequently as a tool for producing traditional fact-gathering reports. We see our main responsibility as working with colleagues worldwide to refine social innovations that take advantage of the underlying Web 2.0/3.0 technological advances but go beyond the surface structure of these innovations.
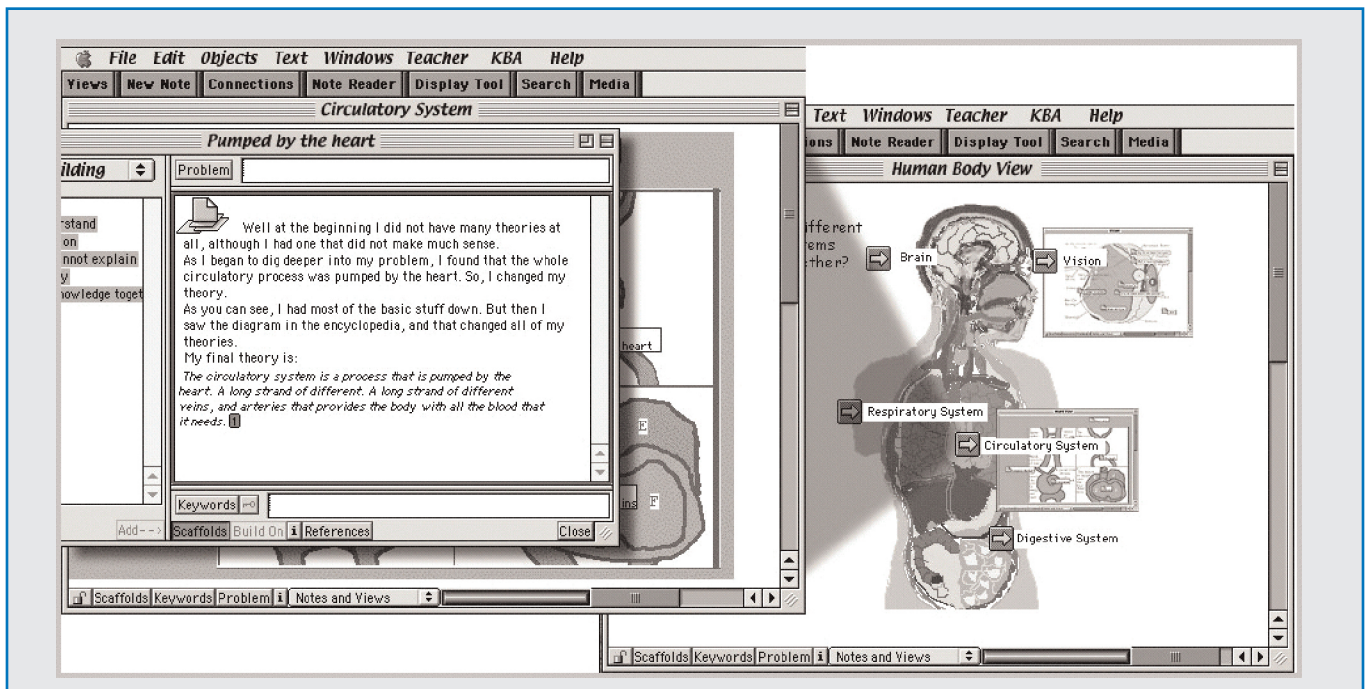
The "Human Body View" has a student-produced graphic of the human body, with sub-views shown as miniatures. The "Circulatory System" is one of these sub-views, again with a student-produced graphical background, upon which icons of student notes are located and moved to appropriate locations. In the foreground is a "rise-above" note, which synthesizes ideas or records idea change. Partially visible to the left are "scaffolds" that are helpful in structuring a certain type of knowledge building-in this case, theorizing. Other Knowledge Forum supports for knowledge work, not shown here, include: