

Design Principles for Educational Software

Yael Kali, Nathan Bos, Marcia Linn

Center for Innovative Learning Technologies

Jody Underwood

Educational Testing Service

Jim Hewitt

University of Toronto

ABSTRACT

This interactive session at CSCL 2002 will present, and add to our ongoing study of design principles for educational technology. We are seeking to capture key findings of the field using a three-level framework, including these interlinked components: educational goals, design principles, and software features.

Keywords: design, design principles, educational technology, representation, visualization

Education takes place in a complex system and needs methods matched to the challenges. We view education as a design science like architecture (Alexander, 1977) computer science (Simon, 1985; Moran and Carroll, 1996), manufacturing (Wright, 2001) and medicine. All these fields evidence creative innovations that succeed in complex settings.

This interactive session represents our attempts to capture the collective breakthroughs in our field and to enable researchers to benefit from the successes and failures of others. The initial impetus for this project came from a workshop on visualization and modeling at the CILT conference in the fall of 2000, where it was acknowledged that methods for communicating design knowledge between projects were inadequate. To progress as a design science, educational researchers need new ways to communicate and build on each others' work.

To pursue these goals we have formed a group including researchers from eight University projects and three commercial design companies. This group has since collaborated both online via email, and offline at CILT-sponsored workshops.

Project Methods

The first step in our process was to develop a rubric for identifying and presenting design principles. We quickly found that identifying 'principles' are not enough, because this information is usually too decontextualized to be useful. The current rubric calls for principles to be connected to one or more higher-level educational goals that they address, illustrated with one or more proven examples, and accompanied by designer's observations about tradeoffs, pitfalls, appropriate contexts of use, and evidence of effectiveness. We considered many variations on this structure, and refined the rubric with an iterative process of team discussion, obtaining feedback from colleagues, and attempting to analyze existing projects with draft versions of the principles. The goal was to have a rubric that 'felt right' for designers trying to articulate their principles, but was also useful to outsiders in understanding and applying principles to new projects. The current rubric is instantiated in an online database.

With a fairly stable framework in place, we developed an online database, designated for the use of computer-based curricula designers. Since then, the task has been to aggregate and synthesize design principles from many different projects, and to feed them into this mutual design-principles online database. (<http://cilt.berkeley.edu:8080/design>)

Framework for describing design principles

The database is built on a three level hierarchical framework with these three components:

Educational goals-- addressing a specific prl of the field. Each goal is related to one or more design principles.

Design principles-- the rational behind features in software. Each principle addresses one or more educational goals, and is illustrated by one or more features.

Software/curriculum features -- This includes attributes of features needed in order to make them communicative such as: Background and rationale, Illustration of the feature, Recommendations of how to use the feature, Use case scenarios, References & web links. A feature can exemplify one or more design principle.

This framework is illustrated in figure 1. One strength of the database lies in the "many-to-many" type of connections between the three hierarchical levels of the framework. These connections make it possible to search or browse the database from one of several starting points. For example, one could browse the database with a particular educational goal in mind, and find multiple related principles that other designers believe help address this goal, as well as tradeoffs and possible pitfalls of this design principle, and example software features where this design principle is implemented. Alternately, one could start the browsing with the database's principles, or the software features. Providing multiple access points will, we

hope, accommodate different audiences (designers, researchers, educators) who will come to the database with different purposes (creating new designs, evaluation, customization etc.).

At CSCL 2002 we will present the framework and example principles, and then participants will join facilitated small groups to discuss the project. Small groups will feedback on the rubric or suggest new principles. The workshop will finish with presentation and discussion of small group work.

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Figure 1: The structure of the database

