



Common Features and Design Principles Found in Exemplary Educational Technologies

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ABSTRACT

As part of a larger project for the NASA-sponsored Classroom of the Future™ to benchmark the effectiveness of educational technologies, researchers used multiple data sources to develop a list of exemplars and delineate common design features. The exemplars included promising educational technologies, tools, Web sites, resources, software, and hardware. Each exemplar was placed into one of six categories: knowledge and comprehension tools, interactive technologies and problem-solving tools, product-creation tools, efficiency and productivity tools, communication and collaboration tools, and technology tutors. The features of each exemplar were described, and a set of common design principles for that category was developed.

Keywords: *communication technology; design principle; digital information; educational technology; exemplar; instructional design; pacesetter*

INTRODUCTION

Emerging technologies present enormous potential for improved teaching and learning as schools and universities worldwide embrace and use the new media. The growth of multimedia and digital information and communication technologies has revolutionized the opportunity to learn. We are on the cusp of a new era that will see the ability for information, audio, and video to be accessed nearly anytime and anywhere in the world. Users expect their media to be cross-platform and available for consumption on a variety of devices. Social networks, especially among young people, are expansive, immediate, and important. Information is

consumed in nuggets, much like fast food, and shared virally—sometimes reaching millions of consumers within minutes of release.

As educators we must look forward—testing promising developments—while holding on to the established best practices of the past. We must integrate the new and the old using a thoughtful, principle-driven approach. The continuum of opinion on how to do so is broad. At one end is the desire of the early adopter to “try it out.” The advantage to this approach is that the novelty alone increases student motivation (Clark & Sugrue, 1991). The disadvantage is the inefficient use of class time during the trial-and-error process and the need to maintain

motivation through novelty. At the other end of the continuum is the desire, sometimes imposed by the administration, to use only research-based tools, techniques, and approaches. The advantage here is in using proven methodologies. The disadvantage is that such methodologies might be disconnected by more than a few years from the most current educational environments and constraints.

In our approach to this study, we accommodated both ends of the continuum. With a futuristic perspective we developed a list of exemplary educational technologies that have promise for improved teaching and learning. With an eye toward integrating existing best practice, we derived the common *design principles* from these exemplars.

METHOD

Data Sources

We derived the items on the list of exemplars from three sources: comments from interviews of educational technology leaders, articles from trade journals, and expertise derived in-house. The interview process with the educational technology leaders is described elsewhere in this special issue. These leaders, or *pacesetters*, were chosen from a multitude of regions in the United States and represented the forefront of the newest national or regional initiatives in educational technology. Pacesetters included staff from the U.S. Department of Education, program officers for federal and state educational technology initiatives, grant awardees, professional organizations, futurists, gaming and simulation experts, journal editors, and university professors. As research subjects, their identities are not disclosed here. The trade journals were from the United States and included *Campus Technology Magazine*, *Converge*, *Education World*®, *Edutopia*, *eLearn Magazine*, *eSchool News*, *Innovate*, *T.H.E. (Technological Horizons in Education)*, and *Technology and Learning*. Our in-house expertise from the NASA-sponsored Classroom of the Future™ included a team of educators, researchers, in-

structional designers, programmers, multimedia producers, technology specialists, and subject matter experts.

Procedure

As in other studies in this special issue, we defined educational technology as *a device or system that makes use of digital media to enhance the teaching and learning process*. Here is the procedure our team used, with a detailed description following:

1. Draft an initial list of exemplary technologies.
2. Elicit comments from pacesetters on the list. Revise list.
3. Examine trade journals. Revise list.
4. Finalize the list.
5. Categorize exemplars into six categories.
6. Conduct background research on each exemplar.
7. Examine features and derive design principles for each category.

Initial List of Exemplary Technologies

Our first step was to use the combined expertise of more than a dozen Classroom of the Future team members to generate an initial list of wide-ranging educational technologies. The list was to be used in the pacesetter interviews. Members were asked to identify assorted technologies that they have seen, experienced, or heard about that they considered powerful educational tools or have potential to be effective in education. We generally stayed away from hardware, unless it was specifically for use in education such as probeware or electronic whiteboards. We also stayed away from technologies used for those with disabilities. This was a topic outside the scope of the project. Items were added to and deleted from the list until group consensus was formed. The list focused primarily on types of technologies, but we used specific instances when the product was well known. For instance, simulations and games were on the list without mentioning any specific titles, but PowerPoint® and Inspiration® were listed specifically.

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