Information Appliances

Powerful Ideas Shaping Our Educational System

By David Moursund

In my September 1999 editorial (*L&L* vol. 27 no. 1), I briefly discussed 10 powerful ideas that are helping shape the present and future of information technology (IT) in education. This editorial is about information appliances—number 2 on the list. It also touches on ideas from number 4 (user interface) and number 6 (problem solving). See the whole list at www.iste.org/L&L.

What Is an Information Appliance?

Many years ago, I memorized the statement, "A computer is a machine for the input, storage, processing, and output of information." In those days, my "model" of a computer was a mainframe housed in an air-conditioned building and supported by a large staff of technicians and computer operators. Eventually minicomputers and then microcomputers were developed. The need for a special air-conditioned building and staff disappeared. The human–machine interface improved to the level that ordinary people could use a computer to accomplish tasks such as writing and e-mail communication.

However, microcomputers are not very user friendly. The human–machine interface favors the machine, not the human.

Contrast this situation with the *smart card*. A smart card looks like a credit card, but it has embedded electronic circuitry. It can be used for the input, storage, processing, and output of information—that is, it satisfies the definition of being a computer. I recently saw a newspaper article indicating that 1.25 billion smart cards were produced this past year. That is approximately one smart card for every five people on earth. They cost about $4 each to manufacture.

A smart card is an example of an information appliance. It can be thought of as a special-purpose computer designed to accomplish a specific task. For example, the task for a smart card might be fiscal (a credit card and a device that actually stores money) or medical (storage of medical records). The human–machine interface is quite easy to use, and the focus is on the task to be accomplished, not the technology.

How many handheld calculators do you own? My wife and I collectively

have a dozen or more. They are scattered around our various work and home offices and at convenient locations around the house. The handheld calculator is an information appliance. A person tends to have more than one of an appliance, like a radio or television, that is particularly useful. Moreover, the brand name tends not to be important. All four-function calculators are pretty much alike. They all can accomplish the task they are intended for, and it is quite easy to transfer one's calculator knowledge and skills from one of these inexpensive information appliances to another.

> The human–machine interface favors the machine, not the human.

Chances are you have used a digital camera or a scanner. Digital cameras are still relatively expensive—they can be thought of as an emerging information appliance. Scanners are now available for less than $100, and some are now quite specialized. For example, one can purchase a scanner for digitizing photographs. Both a digital camera and a scanner are quite easy to use, and each is oriented to accomplishing a specific task. From a user point of view, the focus is on learning to accomplish the task, not on learning to use the technology.

Disruptive Technologies

Donald Norman (1998) presents a comprehensive picture of the gradual but accelerating emergence of information appliances. He also analyzes how a new technology can disrupt an industry. You are probably familiar with how IBM failed to adjust to microcomputers (a disruptive technology) and was severely damaged by this failure. Similarly, Microsoft was slow to adjust to the Web (a disruptive technology) but then rapidly made the necessary changes.

From the point of view of our education system, distance learning (especially Web-based distance learning) is a disruptive technology. At the postsecondary education level, distance education has introduced new courses that compete with existing courses and will eventually supplant some of them. Clearly, higher education will be disrupted. Moreover, such distance education is already available to a number of secondary school students. Disruption at the secondary level will also occur.

Information appliances are disruptive technologies. They disrupt businesses, and some of them will disrupt education. We see signs of this with calculators, which have affected math curriculum content and assessment. We see signs of this with handheld messaging devices (which may also be calculators, dictionaries, or word processors) that students may use to exchange information when taking a test. And, of course, students carrying electronic pagers or cell phones can be quite disruptive in class.

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A deeper issue is illustrated by the following questions: If an information appliance can accomplish a task that we currently teach students to do by hand or by other means, how should this affect education? Should curriculum content, instructional processes, and assessment change to reflect inexpensive, readily available information appliances?

To stretch your mind a little bit, think of the emerging electronic digital global library. Imagine each student having a library appliance. It contains a huge built-in library, and it automatically accesses the global library as necessary when wireless or wired connectivity is available. Moreover, the user can readily add to this library with a personal database of people and documents and an appointment calendar. This library appliance contains the books and other resource materials that the student is studying now and has studied in the past. How would this affect what we currently teach about library use or about any specific subject matter? Should students use such an information appliance while taking tests?

Final Remarks

Information appliances such as the handheld calculator and electronic dictionary have been with us for a long time. The continued rapid progress in chip technology, flat panel display screens, batteries, and connectivity will bring us many more information appliances in the near future. Many of these will be disruptive to our education system.

Think about how you deal with such technologies. Are you taking a proactive approach to acquiring these information appliances and introducing them to your students? Do you work to make these information appliances a routine part of your curriculum, instruction, and assessment? As an IT-knowledgeable teacher, do you enjoy living at the cutting edge?

Though microcomputers will continue to be very important in education, information appliances are emerging as a new cutting edge of IT in education.

Reference

Norman, D. (1998). *The invisible computer: Why good products can fail, the personal computer is so complex, and information appliances are the solution.* Cambridge, MA: The MIT Press.

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Online Supplement

Ten Powerful Ideas Shaping the Present and Future of IT in Education

By David Moursund

In the September 1999 issue of L&L, *I listed 10 powerful ideas that are helping shape the present and future of information technology (IT) in education. Each of these powerful ideas cuts across many disciplines, makes effective use of IT, and has enduring value.*

1. ***Connectivity.*** IT has facilitated the development of a Global Digital Library as well as other huge databases that are in routine use, and IT aids in communication among people. The world is being changed by communication systems that cut across national boundaries. Mobile computing is making access possible anywhere, anytime to information and to people. This supports increased educational emphasis on understanding and on library research skills, as compared to rote memory.
2. ***Information appliances*** (Norman, 1998). We are still in the early stages of a megatrend toward computers becoming invisible—much in the same way that electric motors are built into all kinds of appliances and are no longer emphasized. When a technology reaches the appliance stage, the focus switches from learning the technology to learning to solve problems and accomplish tasks using the appliance.
3. ***Effective procedure.*** An effective procedure is a detailed step-by-step set of instructions that can be mechanically interpreted and carried out by a specified agent, such as a computer or automated equipment. Procedural thinking includes developing, representing, testing, and debugging procedures.
4. ***User interface.*** We all understand the significance of the development of the graphical user interface that includes the mouse. We are just at the beginnings of routine use of voice and virtual reality as part of the human/machine interface.
5. ***IT as integral part of the content of non-IT disciplines.*** Logan (1995) points out that IT is a language that cuts across all disciplines and is increasingly part of the content of various disciplines. Examples include spreadsheets, geographic information systems, computer-aided design, and mathematics systems such as Mathematica and Maple. This trend means that each discipline-oriented teacher needs to have an increasing amount of knowledge of roles of IT in knowing and doing the discipline.
6. ***IT-assisted problem solving.*** One of the most useful strategies in problem solving is breaking big problems into smaller, more manageable subproblems. Increasingly, IT is a tool that can solve these subproblems—thus, greatly increasing the problem-solving capabilities of computer users.
7. ***Modeling and simulation.*** The 1998 Nobel Prize in chemistry was awarded to two computational chemists. Computer-based modeling and simulation are now powerful aids to knowing and doing all of the sciences as well as many other disciplines such as economics and business. For example, a spreadsheet is now a

routine aid to developing business models.

8. ***Communication in Cyberspace.*** This includes desktop publishing, desktop presentation, e-mail, videoconferencing, and interactive hypermedia. IT has opened up entirely new ways to communicate in both synchronous and asynchronous modes that include text, graphics, sound, color, and video.
9. ***Empowering students through project-based learning (PBL).*** IT is a powerful aid to doing the work on a project and to representing the results of this work. PBL is an excellent vehicle for implementing constructivism, cooperative learning, and collaborative problem solving (Papert, 1980; Moursund, 1999).
10. ***Lifelong learning—anywhere, anytime.*** IT has added new dimensions to learning, such as distance learning, computer-assisted learning, intelligent computer-assisted instruction, and learner-centered software. Progress in learning theory, brain theory, and artificial intelligence is being incorporated in software that is designed to help people learn—often in a "just-in-time" environment.

References

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