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


Consider the following two statements:

- The field of information technology (IT) is changing so rapidly that it boggles the mind and overwhelms the ability of most educators to keep up.
- There are a number of underlying Powerful Ideas of IT use in education that are changing very slowly and that will serve today's students and educators now and far into the future.

Although at first glance these two statements seem to contradict each other, I feel that they are both correct.
Powerful Ideas

Seymour Papert's seminal 1980 book is titled *Mindstorms: Children, Computers, and Powerful Ideas*. In this Logo-oriented book, Papert discusses empowering children—making use of computers to facilitate children doing exploratory projects and developing mental models that will help their learning throughout their lifetimes. He talks about computer-based constructivism, in which students build on their previous knowledge and learn by doing. These are examples of powerful ideas that have continued to be at the forefront of information technology in education over the past two decades. Powerful ideas tend to provide an enduring framework for educational renewal and improvement.

Today's microcomputers have thousands of times the compute power (speed, memory) and vastly improved software compared to the microcomputers of 1980. The pace of technological change during the past 20 years has been overwhelming. But, Papert's Powerful Ideas—as well as Logo—have endured and are still quite relevant to our educational system.

Ten Powerful Ideas

The remainder of this editorial is a list of Powerful Ideas of IT in education that I feel will have enduring value. These ideas can help guide educators in their work with students. For each Powerful Idea, I include a very brief discussion. I will discuss some of these Powerful Ideas in more detail in future issues of Learning and Leading With Technology.

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 possible anywhere, anytime access 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 (GUI) 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 spreadsheet,
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 sub problems. Increasingly, IT is a tool that can solve these sub problems—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 is now a powerful aid 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 publication, 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.

**Final Comments**

As you work with your students, you will want to help them gain a functional understanding of the Powerful Ideas outlined in this current article. A good way to do this is to weave these ideas into whatever aspects of IT you and your students happen to be using. Also, you may want to develop lessons that specifically focus on some Powerful Ideas. These Powerful Ideas will serve your students far into the future.

Quite likely you have your own ideas of possible additions to the list of Powerful Ideas given in this article. I hope that you will share your Powerful Ideas with others and me.

**References**


Norman, Donald A. (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.