Information, Knowledge, Wisdom


Initially, the use of computers in business was called business data processing. Eventually it became clear that this was too narrow a point of view. Thus, many colleges and universities developed programs of study in computer and information science, and the focus shifted from data processing to information processing. Now, we are beginning to see an emphasis on knowledge processing.

Data, information, knowledge, and wisdom form a scale. It is a rather peculiar scale, because the points on it are only vaguely related. Although all four of these ideas are often talked about at the same time, they are quite different things. Thus, for example, wisdom and data are the end points this scale, but they are not closely related. Data can be collected and stored. Computers and other aids to data processing can transform raw data into information. Through study and thinking, people transform information into personal knowledge. People gain wisdom by integrating and then maturely analyzing their accumulated knowledge.

This editorial explores how the scale is being affected by computer technology, and it recommends needed changes in education.

A Glut of Data

In the early days of computers—that is, in the days of mainframes—a large number of people worked in business data processing. They took raw data—facts and figures—from business and processed it into useful information and reports that management could use.

Currently data gathering is highly automated, and some people estimate that the total amount of data collected is doubling every six months or so. It should come as no surprise that people routinely buy computers with hard drives that can store 5 gigabytes of data—and even more.

Nowadays, of course, business is only one of many sources of data. Huge amounts of data, for example, come from measurements taken by orbiting satellites and ground-based instrumentation. In a nuclear power plant, a steady data flow is monitored by instrumentation and processed by computer into status reports that are displayed, printed, used, and stored.

Information and Knowledge

Although some people use the terms information and knowledge interchangeably, knowledge is more commonly thought of as something a person acquires and then uses to make decisions and solve problems. Information can be accumulated in libraries, but knowledge is accumulated in the human mind. People use their knowledge and skills as they process information to solve problems and make decisions.

We now routinely use sophisticated machines that can process data into information and then take action based on the information. For instance, a temperature-control system for an office building may take measurements from hundreds of locations and control a vast array of heating and cooling machinery.
In the mid-1940s, Norbert Wiener and [his] colleagues developed and named a new field of study "cybernetics"—the study of control and communication in animals and machines (Wiener, 1961). Nowadays we take it for granted that data being gathered through electronic sensors and other instrumentation can be processed by computer and then used to control the data gathering instrumentation or other equipment.

**Blurring the Distinction.**

Cybernetics and computers have blurred the distinction between information and knowledge. Increasingly, computers gather data, process it into information, and then make decisions and take actions based on the information. In a nuclear power plant emergency, for example, the computer system may make major decisions and take action based on those decisions.

This is my point: We routinely depend on computer systems to make and carry out decisions based on data being gathered and processed by computers. Previously, these were carried out only by people. These information-processing computer systems have now reached a certain level of artificial intelligence which we depend on.

**Wisdom and Its Educational Implications**

We know that computers can outperform people in lots of different information-processing areas, but computers do not understand the human condition and what it means to be human. In other words, computers lack wisdom. The computer, and information sciences have progressed from data processing to information processing, but they have not yet achieved knowledge processing. Computers are not human. They lack wisdom.

The field of artificial intelligence has made slow but steady progress over the past 40 years. This progress has contributed significantly to how business is conducted and how problems are solved in all academic disciplines—but with surprisingly little effect on education. We still use the old-fashioned idea that only humans have the knowledge and skills to process information for problem solving and decision making.

Moursund (1997) discusses first- and second-order computer applications—or, to be more precise, amplification and moving beyond amplification. Using a computer as a word processor is a first-order application; modern desktop publishing is second order. Using a computer to do the business data processing to produce payroll checks is a first-order application; developing sophisticated spreadsheet models that can be used to explore "What if?" questions is second-order. The math problem-solving systems routinely used by scientists and engineers are second-order applications, as are video-editing systems.

Most information-technology use in our schools is first-order application. Students, however, encounter information systems that process information into knowledge mainly at the second-order level. These are systems that can outperform students in many different tasks that students are still learning to do by hand. Unfortunately, the educational system is not really set up to assess student learning in environments in which second-order computer applications are routinely used. As a result, when such powerful software and hardware becomes more commonplace in schools, pressure will increase to change assessment systems.

And this is my ultimate point here. Students need to be assessed in environments in which they routinely use computers' information-processing capabilities to solve complex problems and accomplish difficult, challenging tasks. We need an assessment system that encourages students to move beyond just acquiring knowledge and into gaining wisdom.
References
