

Beyond Amplification

Moursund, D.G. (May 1997). Beyond amplification. *Learning and Leading with Technology*. Eugene, OR: ISTE.

The use of new technologies tends to follow a common path. First the technology is used to do things that are already being done—but the technology provides an "amplification." The horseless carriage was an amplification of the horse and buggy.

Eventually, a successful new technology moves beyond amplification, to second-order effects. We can all name how cars and trucks have changed the world.

Educational use of Information Technology is following a predictable path. The great majority of current use is still at the first-order (amplification) level. However, many individual teachers are moving their students beyond amplification, into the second-order levels of applications. The ideas in this article are discussed in more detail in Moursund (1997).

An Example

Word processing is a common use of computers in schools. Typically, students learn to use a word processor as an amplification of an electric typewriter. A word processor does what an electric typewriter can do, but has storage and editing facilities. Most students learning to use a word processor learn typing rules such as "use a tab at the beginning of a paragraph," and "insert two blank spaces between sentences." (Both of these rules are incorrect in desktop publishing.)

Desktop publishing is a clear example of moving beyond use of a computer as an amplification of the electric typewriter. It includes: design for effective communication; multiple fonts; many aids to composition such as an outliner, spell checker, grammar checker, and style sheets; the ability to include graphics in a document; and aids to publication such as laser printers and color printers. The desktop publishing industry represents moving beyond amplification to achieve second-order effects.

There is a huge amount of knowledge about effective communication via desktop publication. Quite a bit of this can be woven into instruction that students receive as they begin learning word processing. Needless to say, this is a challenge to our instructional system.

Additional Examples

This section lists a number of additional examples of moving beyond amplification to achieve second-order effects. The examples are ones that are occurring in education.

- The use of a computer to automate flash cards is a first-order effect. Immersion of a learner in a highly realistic and interactive computer simulation designed to facilitate learning is a second-order effect. Students developing such simulations is a second-order effect.
- The use of a computer to do payroll computations is a first-order effect. The spreadsheet is a second-order effect. The spreadsheet facilitates the development of computer models of a business, and the use of these models to do forecasting and to examine "What if?"

types of questions. All modern computerized accounting systems are second-order effects.

- The use of a computer to do electronic mail is a first-order effect. The World Wide Web is a second-order effect. Teams of people working together via desktop conferencing and groupware are another second-order effect.
- The use of computers to do simple drawings or to insert simple graphics into a word processed document is a first-order effect. The entire Computer-Assisted Design/Computer-Assisted Manufacturing (CAD/CAM) industry is a second-order effect. The use of a computer to create and/or edit animation, photographs, and sound, and video are all second-order effects. The movie industry is being transformed by these computer capabilities.
- The use of a computer to do simple mathematical and scientific calculations is a first-order effect. The math packages that use techniques from artificial intelligence to solve a full range of problems up through the levels of several years of college mathematics are a second-order effect.
- The use of computers to make a linear sequence of pages (a linear multimedia "stack") containing color, text, and sound is a first-order effect. Interactive hypermedia containing sound, graphics, video, text, and color is a second-order effect.
- The use of a computer to search for a word or phrase in a large database is a first-order effect. The agent technology (a product of research in artificial intelligence) now being used to search databases is a second-order effect.
- The use of email to facilitate receiving and sending in lessons in a distance education course is a first-order effect. Interactive Web-based distance education courses are a second-order effect.
- The use of a computer to play simple tunes is a first-order effect. The teaching of musical composition in a computer-generated music environment is a second-order effect. The entire music industry has been changed by computers.
- The use of computers to implement simple simulation games is a first-order effect. Virtual realities are a second-order effect.
- Manufacturing, servicing, and selling computers are all new jobs created by the computer industry. These new jobs can be considered as a first-order effect. A second order-effect has been changes at the middle management level of employment. Millions of jobs have been lost. Another second-order effect is that worldwide networking facilitates worldwide competition for an increasing number of jobs. If a job can be accomplished by telecommuting, then perhaps the worker can live 10,000 miles from company headquarters.

Professional Development Challenge

Our educational system has succeeded in bring many of the first-order uses of the Information Technologies into the everyday classroom. This has required considerable investment in facilities, professional development, and curriculum development. Many schools now have the facilities for a broad-based movement beyond amplification. A lack of adequate professional development remains as a major barrier. ISTE members and subscribers are pioneering second-order effects. Learning and Leading With Technology features many articles that move beyond amplification. These grass roots efforts will eventually become mainstream.

Reference

Moursund, D.G. (1997). *The future of Information Technology in education*. Eugene, OR: ISTE.

Retrospective Comments 4/5/02

Five years after this editorial was written, the issues remain much the same. In the business and manufacturing world, we have continued to see major increases in productivity based on second-order effects of IT. We cannot say the same for our educational system.

The word processing versus desktop publication example in the editorial is still an accurate description. Most students now graduating from high school know the rudiments of using a word processor—as an amplification of an electric typewriter. They know very little about desktop publication.

It is interesting to analyze use of the Web. In the Editorial, the Web itself is classified as a second-order effect. We have seen rapid acceptance of the Web, and essentially all students graduating from high school know how to use the Web. However, they use it at an amplification (first-order) level. They have not learned the information retrieval research skills needed to use the Web at a second-order level. Similarly, many students learn to create Websites. However, they do not learn the multimedia document design and other aspects needed for effective communication in this interactive, multimedia environment.