Chapter 11
Computers at Work, School, and Home
Objectives

✓ Describe how computers have changed the way people work in factories, offices, homes, and a variety of industries.
✓ Describe several ways in which computers have changed the quality of jobs, both positively and negatively.
✓ Speculate on how our society will adjust as more and more jobs are automated.
✓ Explain how the information age places new demands on our educational system.
Objectives (continued)

- Describe several ways computers are used in classrooms today.
- Discuss the advantages and limitations of computers as instructional tools.
- Describe the role of computers in our homes and leisure activities in the next decade.
Alan Kay has been inventing the future for most of his life:

- He was an Air Force programmer before attending college.
- His Ph.D. project was creating one of the first microcomputers, one of several that he would eventually develop.
- His research team developed the first personal computer—ALTO, a single-user desktop machine designed for interactive use.
- In a recent collaborative research project, he and MIT researchers worked with school children to design artificial life forms in artificial environments inside the computer.
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Where Computers Work

✓ Computers have a big impact on all of today’s job markets.
  ➢ Entertainment
    ◉ The production of television programs and movies
  ➢ Publishing
    ◉ Reporters scan the Internet for facts.
      ▪ Write and edit stories on location
      ▪ Transmit those stories by modem to central offices
    ◉ Artists design charts and drawings with graphics software.
    ◉ Photo retouchers use computers to edit photographs.
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Where Computers Work

- **Medicine**
  - Medical students and professionals use virtual emergency rooms to simulate processes of collecting vital signs and other patient data.

- **Airlines**
  - Commercial pilots use computer-controlled flight simulators to learn flight procedures and to upgrade and maintain their flying skills.
Science

- Scientists collect and analyze data using remote sensing devices, notebook computers, and statistical analysis programs.
- Scientists catalog and organize information in massive databases, many of which are accessible via the Web.
- Scientists use supercomputers, workstations, and processor-sharing grids to create computer models of objects or environments that would otherwise be out of reach.
- Scientists communicate with colleagues all over the world through the Internet.
The Automated Factory

**Robots:** computer-controlled machines
- Designed to perform specific manual tasks
- Used for painting, welding, and other repetitive assembly line jobs

Computers help track inventory, time the delivery of parts, control the quality of production, monitor wear and tear on machines, and schedule maintenance.
Engineers use CAD (computer-aided design) and CAM (computer-aided manufacturing) technologies to design new products and the machines that build those products.

Web cameras and Web displays built into assembly line equipment enable workers and managers to monitor production and inventory from across the factory floor or across the continent.
An automated factory:

- Is more efficient:
  - Tighter integration of planning with manufacturing, reducing the time that materials and machines sit idle
  - Reduces waste of facilities, raw materials, and labor

- Poses a threat to blue collar workers who keep traditional factories running:
  - In a typical high-tech manufacturing firm approximately half of the employees are white collar workers
The Automated Office

Office automation evolution

- During the mainframe era, computers were used for behind-the-scenes jobs, such as accounting and payroll.
  - Computer-related decisions were in the hands of central data processing managers.
- During the PC era, jobs migrated from mainframes to desktops; people used PCs to perform tasks that mainframes weren’t programmed to do.
Enterprise computing

- PCs are an essential part of the overall computing structure for most business enterprises.
  - Workers use technology tools, such as word processing, spreadsheets, desktop publishing, and email.
  - Companies can replace PCs with thin clients—low-cost, low-maintenance machines.
  - This allows workers to access critical network information without the overhead of a PC or workstation.

- Distributed computing integrates all kinds of computers, from mainframes to PCs, into a single, seamless system.
Workgroup computing

- **Groupware**: allows groups of users to share calendars, send messages, access data, and work on documents simultaneously
- **Intranets**: networks that use Internet technologies to link employees
- **Extranets**: networks accessible to strategic partners and customers
- Modern information technology makes an organization:
  - Flatter
  - More integrated
  - More flexible
  - More concerned with managing processes than people
The paperless office

- Magnetic and optical archives will replace reference books and file cabinets.
- Electronic communication will replace letters and memos.
- Web publications will replace newspapers and other periodicals.
- HTML, XML, Adobe’s popular PDF (portable document format), and other current technologies make it easier for documents to be transmitted and stored electronically without loss of formatting.
Electronic commerce

- **Electronic commerce** — buying and selling products through the Internet or a smaller computer network
  - Includes marketing, sales, support, customer service, and communication with business partners
- **Business-to-business (B2B)** — transactions between corporations
- **Business-to-consumer (B2C)** — transactions between businesses and consumers
The electronic cottage

- Futurist Alvin Toffler popularized the term.
- **Electronic cottage** describes a house in which technology allows a person to work at home.
- The number of American telecommuters almost tripled between 1995 and 2000.
- There are many strong arguments for telecommuting:
  - Reduces the number of automobile commuters
  - Saves time
  - Allows for a more flexible schedule
  - Can increase productivity
There are also strong arguments against telecommuting:
- Doesn’t work with jobs requiring interaction
- Requires self-discipline
- Lacks office social life
- Causes low visibility

Variations on the electronic cottage:
- Satellite offices
- Shared regional work centers
- High-powered PCs and wireless hand devices for mobile commerce
Rules of Thumb: Considering Computer Careers

- Learn touch typing.
- Use computers regularly to help you accomplish your immediate goals; don’t forsake the basics.
- Combine your passions.
- Ask questions.
- Cultivate community.
- If you can’t find your dream job, create it yourself.
- When you’re ready to look for a job, don’t forget the Web.
- Prepare for change.
For many workers, computers have caused more problems than they have solved.

- Workers complain of stress, depersonalization, fatigue, boredom, and a variety of health problems attributed to computers; some of these complaints are directly related to technology, but others relate to human decisions about how technology is implemented.

- **De-skilling** and **up-skilling**
  - **De-skilling**: When a job is transformed so that it requires less skill
  - **Up-skilling**: When a job becomes more technical, requiring the worker to have more skills
Monitoring and surveillance

- Using computer technology to track, record, and evaluate employee performance, often without the knowledge of employees, can raise some serious issues:
  - Privacy
  - Morale
  - Devalued skills
  - Loss of quality
Electronic sweatshops

- A typical data-entry shop might contain hundreds of clerks sitting at terminals in a massive, windowless room.
- Workers—often minorities and almost always female—are paid minimum wage to do mindless keyboarding.
- Many of these workers experience headaches, backaches, serious wrist injuries, stress, anxiety, and other health problems.
- Optical character recognition and voice recognition technologies will enable companies to replace these workers with machines.
Writer Barbara Garson calls these worker warehouses **electronic sweatshops**, because working conditions bring to mind the oppressive factory sweatshops of the 19th century.

A growing number of electronic sweatshops are located across national borders from corporate headquarters in countries with lax labor laws and low wage scales.
Automation, Globalization, and Outsourcing

✓ Workers Against Machines?

- In the early days of the 19th century new textile machines were smashed for fear they would take jobs from skilled craftsmen.
- Every year brings new technological breakthroughs allow robots and computers to do jobs formerly reserved for humans.
- Automation has eliminated service jobs—it’s not just about robots on assembly lines.
- Technology creates jobs too—someone has to design, build, program, sell, run, and repair computers, robots, networks.
Automation, Globalization, and Outsourcing

✓ World Wide Workers

- In the past two decades, multinational corporations have closed thousands of factories in the U.S. and moved millions of manufacturing jobs to countries with less expensive labor.
- Evidence of globalization—the migration of jobs to countries where labor is less expensive.
- Offshore workers are replacing highly educated programmers and system designers.
- Underwater fiber-optic cables and high-speed computerized telephone switches link India to the U.S. allowing a shift of hundreds of thousands of technical support jobs to be moved to India.
Will we need a new economy?

Do governments have an obligation to provide permanent public assistance to the chronically unemployed?

Should large companies be required to give several months’ notice to workers whose jobs are being eliminated? Should they be required to retrain workers for other jobs?

Should large companies be required to file “employment impact statements” before replacing people with machines, in the same way they’re required to file environmental impact statements before implementing policies that might harm the environment?
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Automation, Globalization, and Outsourcing

- If a worker is replaced by a robot, should the worker receive a share of the robot’s “earnings” through stocks or profit sharing?
- The average work week 150 years ago was 70 hours; for the last 50 years it has been steady at about 40 hours. Should governments and businesses encourage job-sharing and other systems that allow for a work week that is less than 40 hours?
- What will people do with their time if machines do most of the work? What new leisure activities should be made available?
- How will people define their identities if work becomes less central to their lives?
The Roots of Our Educational System

- Developed more than a century ago
- Teach students the basic facts and survival skills they need for jobs in industry and agriculture
- Known as a **factory model** because it assumes:
  - All students learn the same way and all students should learn the same things.
  - The teacher’s job is to “pour” facts into students, occasionally checking the level of knowledge in each student.
  - Students are expected to work individually, absorb facts, and spend most of their time sitting quietly in straight rows.
How should education provide for students in the information age?

- Technological familiarity
- Literacy
- Mathematics
- Culture
- Communication
- Learning how to learn

― Socrates

“Education is the kindling of a flame, not the filling of a vessel.”
Computer-Aided Instruction

- Computer-aided instruction (CAI) software combines tutorial material with drill-and-practice questions.
  - The interactive format provides instant student feedback.
- CIA is relatively easy and inexpensive to produce.
- It can be easily combined with more traditional educational techniques.
CAI offers many advantages over workbooks and worksheets.

- Individualized learning:
  - The individual student can learn at his or her own pace.
  - Teachers can spend their time working one-on-one with students.

- Motivation:
  - CAI can turn practice into a game.
  - It motivates students to practice arithmetic, spelling, touch typing, piano playing, and other skills that might otherwise be tedious to learn.
Confidence:
- CAI can help children become comfortable with computers as well as with the subject matter being taught.
- A well-designed program is infinitely patient, and enables students to make mistakes in private.
- Research has shown that younger children, disadvantaged children, and especially students with learning disabilities tend to respond positively to CAI.
Programming Tools

✓ Programming tools such as LOGO, Pascal, and Basic allow young students to take a more active role programming the computer.

➢ Rather than teaching through lessons and tests, LOGO creates environments for learning.
Simulations and Games

- Simulations and games allow students to explore artificial environments, whether imaginary or realistic.
- Educational simulations are metaphors designed to focus student attention on the most important concepts.
High-Tech Schools

Productivity Tools

- Word processors, spreadsheets, graphics programs, Web browsers, email programs—software tools used by adults—are the tools students learn to use most often in schools.
- Some schools also provide special-purpose tools for classroom use, including:
  - Laboratory sensing hardware and software that can be used to collect scientific data (such as temperature) and convert it into computer data to be analyzed by students.
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High-Tech Schools

- Collaborative writing groupware that enables students to work collectively on creative writing and editing projects
- Music synthesizers with sequencing and notation software for teaching music composition
Teachers use computers and multimedia tools to create in-class presentations.
- They range from simple slide shows to elaborate graphical simulations or multimedia demonstrations.

Students use authoring tools to create their own multimedia presentations.
- Students can create CD-ROMs, videos, interactive kiosks, and (especially) Web pages about their classes, schools, student organizations, and special projects.
Computers play an important role in improving the educational experience of students with special needs.

- Two federal laws, IDEA and ADA, have established equal access to schools and programs for every student.

Assistive technology for special needs students covers a broad spectrum of devices:

- Alternatives to the mouse and keyboard
- Augmented communication software
Distance education uses technology to extend educational process beyond the walls of a school.

Telecommunication technology is particularly important for students in remote locations.
A number of independent studies in the 1990s confirmed that information technology can improve education. Some of the findings included:

- Students improve problem-solving skills, outscore classmates, and learn more rapidly in a variety of subject areas and situations when using technology, as compared to conventional methods of study.
- Students find computer-based instruction to be more motivational, less intimidating, and easier to work with than traditional instruction.
Well-designed interactive multimedia systems can encourage active processing and higher-order thinking.

Students who create interactive multimedia reports often learn better than those who learn with more traditional methods.

Students can become more productive and more fluid writers using computers.

Computers can help students master the basic skills needed to participate and succeed in the workforce.

Positive changes occur gradually as teachers gain experience with technology.
Technology can facilitate educational reform.

Students with technology integrated into their classroom see the benefit in each major subject area.

Both regular and special-needs students show increased achievement from preschool through higher education when technology is incorporated into their curricula.

Students and teachers with positive attitudes toward technology achieve the most gain.

Students experience a greater benefit from technology when their teachers receive professional training. Teachers report that they are more enthusiastic about technology when provided with training.
However, researchers also found:

- If the only thing that changes in the learning process is the delivery medium (from traditional media to computer media), the advantages of technology are small—or nonexistent.
- Children and teachers forget advanced computer skills if they don’t use them regularly.
- Students have unequal access to technology; economically disadvantaged students are less likely to have computer access at school and at home.
Technology at School: Midterm Grades

- Technology doesn’t reduce teacher workloads; if anything, it seems to make teachers’ jobs harder. Of course, many teachers welcome the extra work because they believe it brings results.

- There is a gender gap that typically puts the computer room in the boys’ domain; the gap can be reduced by stressing computer activities that involve collaboration.

- Many of the outcomes of technology-based education are not revealed with traditional educational assessment methods.

- Sending students to a computer lab for 30 minutes a week has little or no value; computers are more effective when they are in classrooms where students can use them regularly.

- Younger students may be better served by art, music, and shop classes than by computer classes; unfortunately, these important parts of the curriculum are often eliminated to make room for computers.
After more than a decade of research, Apple Classroom of Tomorrow (ACOT) research demonstrated that the introduction of technology into classrooms can significantly increase the potential for learning, especially when it is used to support collaboration, information access, and the expression and representation of students’ thoughts and ideas.

“The further one pursues knowledge, the less one knows.”
—Lao Tse, 500 B.C.
Business applications at home:
- Word processors
- Spreadsheets
- Database programs
- Personal information management programs
- Web browsers and e-mail programs
- Accounting and tax programs

A smart card looks like a standard credit card but instead of a magnetic strip it contains an embedded microprocessor and memory.
Many educational software programs are used by children and adults in homes.

**Edutainment** programs specifically geared toward home markets combine education with entertainment to compete with television and electronic games.

Computer technology enables **narrowcasting** services—custom newscasts and entertainment features aimed at narrow groups or individuals. (Individualized broadcasting is sometimes called pointcasting.)
Many CD-ROM references have been eclipsed by Web references.

- The Web offers more up-to-the-minute information, often for free.
- Internet connections also provide email, discussion groups, and other communication options for home users.

Personalized Web portals enable people to control what they see on their home pages.

- Filtering software blocks browsers so children can’t visit “inappropriate” sites.
Regardless of how people say they use home computers, surveys suggest that many people mostly use them to play games.
The entertainment industry is exploring a variety of ways of adding interactivity to entertainment products.
Many DVD movies allow for customized movie viewing—language, subtitles, commentary, soundtracks, and sometimes even camera angle are under viewer control.

A few DVDs allow actual branching within a film. We may soon see truly interactive movies—features in which one or more of the characters or plot lines are controlled by the viewer.

We’re also likely to see a growth in interactive TV—broadcast television with built-in options for interactivity.
A 2000 report by the Childhood Alliance, a group of education experts, raises serious questions about computer use, especially by young children: “Intense use of computers can distract children and adults from … essential experiences.”

Many people worry that television, computer games, and other media are replacing real-world experiences.
Information technology is having a profound influence on the way we live and work. It is likely to challenge many of our beliefs, assumptions, and traditions.

The modern, automated factory uses computers at every level of operation.

Today’s office is more likely to emphasize networked PCs and workstations for decentralized enterprise computing; so far, predictions of widespread computer-supported cooperative work and paperless offices have not come true.
A growing number of workers use computers to work at home part- or full-time, staying in contact with their offices via the Internet.

The impact of computers varies from job to job. Some jobs are de-skilled—transformed so that they require less skill—while others are up-skilled into more technologically complex jobs.

The biggest problem of automation may be the elimination of jobs.
In the information age, when students can expect to change jobs several times, we need schools that teach technological familiarity, literacy, mathematics, culture, communication, problem solving, and, most importantly, the ability to learn in and adapt to an ever-changing world.

Clearly, computer technology can have a positive educational impact, but computers alone can’t guarantee improvement.

A small but growing number of families use home computers for basic business applications, education, information access, communication, entertainment, and creative pursuits; all of these tools will radically change as technology evolves over the next decade.