PART I

Introduction to Computers

LESSON 1

Computers and Society

> ## After completing this lesson, you will know:
>
> - *The history of computers from the 1940s up to the present.*
> - *The future of computing.*
> - *The many ways in which computers are used in modern life.*
> - *How it is possible to make computers accessible to persons with disabilities.*
> - *How computers are used in two key areas: business and education.*

This lesson introduces computers and their use today. This lesson gives a brief history of computing to date. This lesson also describes the accessibility issues faced by many individuals in the workforce and how computers and assistive technology help overcome accessibility problems.

A Brief History of Computers

Part of the reason your computer at work is called a PC (personal computer) can be found in the general history of computers. When computers started to show up on desks in more and more offices, they were in limited places such as banks and insurance companies. Bright green flickering screens provided access to only the most vital customer information. You might even remember having a computer like that on your desk, or on your parents' desk. But there was *nothing* personal about that computer.

Of course, there wasn't supposed to be. In fact, if you had talked to those corporations about letting individual employees influence or customize how computer systems worked, you'd have been shown the door. Companies put computing power into individual hands but controlled and limited every conceivable interaction between employees and computers. And let's not forget that we're talking about 30 years ago. No technology was available to make desktop computers anything more than a front end to a huge central computer that was miles away.

When the first computers called *personal computers* came on the scene in the late 1970s, the name really meant "not a business computer." Not only did businesses not see any use for them, but they didn't want anything to do with them and their anarchy. Customizing the color of the screen and the sounds the computer made was just silly. And writing your own programs to make the computer do what *you* wanted it to do? "No, thank you!"

It took some visionary people at three companies—IBM, Microsoft, and Apple Computer—to see that a computer you or I could really control—a truly personal computer—was exactly what business had been waiting for. The sections that follow contain a short timeline of the history of modern computing.

1940s

Some of the first automatic computers were built between 1939 and 1944 and were used as part of the code-breaking activities during World War II. One of these computers was named ENIAC (electronic numerical integrator and computer). ENIAC occupied 1000 square feet (about 93 square meters) of floor space, weighed more than 60,000 pounds (27,000 kilograms), and contained more than 18,000 vacuum tubes. Early computers such as ENIAC used a variety of relays and mechanical switches to perform various calculations. They had no memory function, so they had to be reset by hand for each different program.

The Origin of "Debugging"

In the 1940s, computers tended to be housed in small buildings with no air conditioning. In the evenings, the researchers would open windows to cool the building and the computer. One evening in the early 1940s, computer pioneer Grace Hopper spent quite a bit of time locating and solving a problem that kept the computer from running properly. A moth had been attracted to the heat and lights of the computer and had flown in through the open window and had become enmeshed between some of the moving mechanical switches, causing errors. In fact, it became a regular occurrence to get the bugs out of the computer each evening. Some believe this is how the phrase "debugging" came into being in the computer world.

1950s

The first transistors were patented in 1948. Transistors performed the same function as vacuum tubes but were smaller and more efficient. Transistors allowed computers to be smaller, use less electricity, and generate less heat.

However, computers continued to use vacuum tubes until the late 1950s. In 1952, IBM's Selective Sequence Electronic Calculator was 25 by 40 feet in size and still used vacuum tubes. This computer produced the moon position tables later used in 1969 by the Apollo flight to the moon.

In the late 1950s, IBM started producing its first transistorized computer, the 7000 series. This type of computer was smaller and faster than early versions but still huge by today's standards.

1960s

The integrated circuit or silicon chip was invented in 1958 and 1959 by two independent researchers. A single chip could contain the electronic circuitry of an entire computer, which created another revolution in computer design. The 1960s brought minicomputers, such as the DEC PDP 1 and the IBM System/360, into more and more industries. In addition, research at the National Aeronautics and Space Administration (NASA) in the United States led to the creation of even smaller computers. Computers no longer cost millions of U.S. dollars and no longer required specialized environments.

1970s

In 1975, the Xerox Alto was the first prototype computer to use a graphical user interface (GUI), by which symbols for computer functions are provided instead of the user having to type complete commands. This was also the first computer to use a mouse as an input device. Even though this system was never released to the public, it greatly influenced the development of Microsoft Windows and Apple Macintosh operating systems.

The MITS Altair, the first computer to be called a personal computer, also debuted in 1975. This was sold mainly as a kit computer: a user had to assemble it before it could be used. The computer used the Intel 8080 microprocessor chip, and even though it came with limited input and output devices (there was no keyboard or monitor), the computer was an immediate success among hobbyists and computer enthusiasts.

Tandy Corporation (the parent company of Radio Shack) introduced its first personal computer in 1977. It was a success because it included a keyboard and a display (a CRT screen).

Working in a small garage, Steve Wozniak and Steven Jobs designed and sold the Apple 1 computer to hobbyists. This computer was successful enough for the founders of Apple Computer to design the Apple II in 1977, which was a major success. The Apple II offered expanded memory, disk-drive programs, and color graphics.

1980s

IBM released its first PC in 1981. This computer used software called DOS (disk operating system) to control the computer. While this computer did not use the latest and greatest technology available, it was important because it proved that the personal computer was more than a fad; it was going to be an important part of every business.

In 1984, the Macintosh computer was introduced. This computer had a GUI that made using the computer much easier for the novice user. With the introduction of the LaserWriter printer in 1985, Apple started a desktop publishing revolution.

The growth of the power of the personal computer continued through the 1980s, until personal computers soon rivaled minicomputers in speed and computational power.

1990s

Apple, IBM, Microsoft, and other companies continued to produce and improve software that made computers easier to use. In 1990, Microsoft released the Windows 3.0 operating system, which marked a major change in how users worked with their computers. It featured a GUI that was to become a favorite of computer users.

2000s

It is now the early years of the new millennium, and computers and Internet access are available to more people in the world than ever before. Web services such as instant messaging allow people all over the world to be able to have real-time conversations with one another. Other web applications enable people to conduct nearly all of their daily business and personal tasks from their desktop. You can shop for and purchase just about anything you want, you can read a newspaper or listen to live radio broadcasts from scores of different countries, you can manage all of your personal or business finances, or even plan and book your next vacation—all from your computer. New technologies such as the personal digital assistant (PDA) and the tablet computer make it easy to take your computer with you and have access to the Internet wherever you go. Satellite and cellular telephone technology has improved so much that people in remote areas can still place calls to friends, family, and colleagues anywhere in the world.

With more people on the Internet, more information is at risk, and security has become an issue of even greater importance Computer viruses can spread worldwide in just hours, costing businesses and governments a great deal of time and money in lost files and recovery efforts. Software and hardware companies are coming up with new security software and patches on a regular basis.

Man vs. Computer

The year 1996 saw the first time a worldwide chess champion played a chess match against a computer. Even though the computer could calculate 100 million chess moves per second, Gary Kasparov defeated IBM's Deep Blue computer. In a 1997 rematch, Deep Blue won, marking the first time a computer beat a human chess champion.

Throughout the 1990s, personal computers continued to be made smaller, faster, and less expensive. Portable computers (such as laptop computers) also became more available and popular.

Future Developments in Computing

In 1965, Gordon Moore, a silicon chip researcher, predicted that the power and speed of chips would effectively double every 2 years. He was fairly accurate; currently computers and chips are doubling in their processing power every 18 months. And while some scientists predict that computer technology will hit the limits of conventional physics around 2010, research in quantum physics and quantum computers may make processors smaller and more powerful than anything previously conceived.

Computer components continue to become smaller, faster, and cheaper. As this occurs, computers become more flexible and are used in more and more functions. Common items, such as televisions, telephones, and even ovens use chips to improve their functionality. In the future, speech recognition, virtual reality, and other possibilities will continue to expand the use of computers.

Today's Use of Computers

When computers were first introduced into the business world, they were big and expensive and hadn't been designed with any accessibility issues in mind. They tended to be used for specialized purposes such as research and calculating large amounts of numbers. For example, a large company in the 1960s might have had a single computer dedicated to the payroll department. No other departments in the company used the computer, or if they did, they were forced to share computer time with several departments.

As computers and computer technology made computers smaller and cheaper, they began to be used in more and more situations. A department might have had its own dedicated word processing system or a minicomputer for specific projects instead of simply trying to share time on the corporate mainframe.

The eventual reduction in size and price brought about a revolution in computers, and personal computers became common on virtually every workplace desktop. Computers also found their way out of corporate environments and into everyday use. The following sections contain examples of the ways computers are present in many aspects of today's society.

On the Farm

Each year a farmer needs to determine how much fertilizer to add to increase crop yield. The cost of a unit of fertilizer is fixed, but the return from that unit can vary. Initially the return might be high, but after more and more fertilizer is added, the incremental return might decrease. So how does the farmer determine how much fertilizer to add?

Today's farmer can use a computer to create a spreadsheet model to determine the optimum amount of fertilizer to add to maximize profits, which might not be the same as maximizing return. The farmer can also store the results from various combinations of fertilizer for future reference.

Dairy farmers can use computers to track the milk producing capacity of various animals. They can vary the type and amount of feed given to each animal, observe the results over time, and use that information to maximize production or profit. They can also track which animals produce the most milk and use that information when determining which animals to breed. Computers simplify this type of record keeping and research.

At the Airport

Airplane pilots need a lot of practice before they can become licensed, which can be an expensive endeavor. Pilots must pay for fuel, an instructor's time, airplane rental, and other costs, and they might not be able to fly every day because of weather. A computer-driven simulator allows pilots to receive a lot of practice without these costs. Simulators can vary from massive airline trainers used by airplane manufacturers to Microsoft Flight Simulator, which can be used by anyone with a personal computer. A pilot might not be able to be licensed by using simulators alone, but the use of flight simulators reduces the amount of actual air time required.

Simulator software is also used to train workers in performing dangerous or expensive operations in other industries. Workers can use simulators to learn how to run an underground mining machine or operate a power plant without endangering themselves or others.

From the Warehouse

A local artist's cooperative has a retail storefront operation and a wholesale division with connections to both regional and worldwide distributors. The cooperative's staff use the computer to track their inventory, who has delivered what piece, what has sold and through which channel, and how much is due to each artist. In addition, they use the records to determine the type of item that sells best in the different channels—for example, small hand-carved items sell well in the retail store, but larger items such as furniture move slowly. However, the larger items do sell well in the wholesale channel. The computer is great for maintaining and organizing this type of information.

Making Computers Accessible to Everyone

More than 500 million people in the world have a permanent disability or impairment—so sooner or later, it's likely you'll encounter someone among your colleagues, students, administrators, family, and friends for whom accessible technology is beneficial. Add to that number the people who experience temporary impairments caused by illness or accident and people affected by aging, and it is clear that most organizations will have employees and customers with disabilities.

Enhance Productivity

Providing people with accessible technology that is adjustable to meet their needs increases productivity, job satisfaction, and morale. The range of what "accessible" is varies from person to person. When choosing technology, it is critical to consider the diverse needs and preferences of all people using the technology, not just "special cases." For some, accessible technology might simply mean the ability to easily change font size, icon size, colors, sounds, and speed of the mouse cursor on their PC. For others, additional assistive technology products might be needed for them to access a computer.

Accessible technology encompasses three elements:

- **Accessibility features.** An operating system and software that include accessibility features, which allow you to adjust and customize them to your own accessibility needs.

- **Assistive technology products.** Compatible assistive technology products chosen specifically to accommodate an individual's disability or multiple disabilities.

- **Compatibility.** An operating system and software that are compatible with a specific type of assistive technology product.

An accessibility feature is an option within a product that allows you to adjust the product settings to your personal accessibility needs—for example, vision, hearing, mobility, language, and learning needs.

Assistive technology products (also known as "accessibility aids") refer to particular products developed to work with a computer's operating system to accommodate specific impairments. Assistive technology products are chosen specifically to accommodate the disability, or multiple disabilities, so that an individual can effectively access a computer. It is critical that the assistive technology be compatible with the operating system and other software. Assistive technology can include products such as a different type of pointing device to use instead of a mouse, or a system equipped with a Braille display and screen reader. Not all users with accessibility needs require assistive technology products.

Because assistive technology cannot be added to just any computer—it must be compatible with the computer's operating system and additional software products—you should select software that is accessible.

Enhance Collaboration and Communication

Accessible technology further empowers individuals to share documents and collaborate on projects as well as to communicate among themselves. When everyone has the power to customize their computers to meet their individual needs, they can more easily communicate with others. For example, people who can modify the way information is presented to them visually, aurally, and tactilely (in the case of Braille output) can more fluidly communicate with others. With productivity software, it's also easier to collaborate on projects.

Take the examples of Nancy, Max, Josh, and Katie, who are able to communicate via e-mail and instant messaging. Previously, Josh and Max needed an interpreter to communicate because Max communicates with sign language and Josh is blind. Katie, who knows a little sign language, cannot sign with her arm in a cast. Katie and Max can still communicate via their computers while Katie recovers. Max and Josh can communicate directly online without an interpreter because they both feel comfortable using e-mail. For real-time discussions, they use instant messaging. In addition to easier communication with his friends, Josh is able to fully collaborate with the rest of his group in the writing and editing of a business plan by using his screen reader software.

Another benefit of using the same operating system and productivity software throughout the organization is that it is easy for users with disabilities to use other computers within your organization. There are occasions when people must use a computer other than their own—for example, when giving a presentation, attending a training course, or using a computer lab. Because all the computers are equipped with the same operating system and productivity software, people with accessibility needs can use another machine within your organization, either temporarily for a training course or permanently to replace obsolete or faulty hardware. This flexibility lowers costs and increases productivity.

With an accessible operating system, people with specific accessibility needs can save their profile settings, including their accessibility settings, so that when they log on to another machine on the network, their settings are automatically applied. Computers without built-in accessibility prevent or interrupt the activities of people who need such accommodations, resulting in lost time and money.

Technology in Business and Education

Computers affect many jobs in today's society. Cashiers at large markets or clothing stores use computers to read bar codes and total prices. Warehouse clerks enter inventory into databases. Wait staff at restaurants use computers to communicate with their kitchens. Accountants use computers to maintain records and spreadsheets. Police officers use computers to access information and assist in investigations.

Some people have jobs directly related to the computer industry. These people might work in the software or hardware industry, or they might work for just about any company that needs a person—or a team of people—to help the company run and maintain its network, Web site, or even its computers. These people are usually called Information Technology (IT) professionals.

Technology touches so many industries and professions today that computer skills are becoming increasingly important for students who want to enter the workforce. This section discusses possible career paths in the computer industry and in other industries that use computers in their daily course of business.

IT Professionals

The term IT Professional covers a large variety of workers. Some workers create the hardware, some workers create the software, and some workers help integrate the hardware and software. The following are just some of the job descriptions included under the heading of IT Professional.

Hardware Engineer

The people who design and create the various computer hardware components tend to be engineers who have specialized training in computer hardware. The hardware engineer might create new peripherals or other devices, such as computer chips, that use computer technology. A hardware engineer must understand how computer chips are created and how to integrate the various components into a working system.

Support Professionals

People with the title of Support Professional range from the support technician who answers the phone when you have trouble setting up your new computer to the consultant who figures out how to integrate the latest hardware into an existing computer system. Support Professionals troubleshoot and solve various problems . A support professional needs people skills, analytical skills, patience and perseverance, as well as knowledge of computer hardware and software systems.

Developer/Programmer

A developer (or programmer) is a person who designs and develops software. The software may perform tasks as simple as displaying a logo on a computer

screen or it may be a complete operating system that tells a computer how it should react to various input. Developers design software for varied audiences; the software may be business-specific, such as a pharmacy application that warns the pharmacists of drug interactions for a customer, or it may be generic, such as a word-processing application that allows you to type and print text.

Software developers and programmers use various programs, written in special programming languages, to tell the computer how to react to various input or commands.

A developer needs to have a strong understanding of math and logic as well as education in computer science and coding languages.

Software Tester

Once software is written by the developer, the software needs to be tested to make sure it does what it was designed to do and that no unexpected actions occur. Many developers do their own testing. In fact, a lot of testing can be automated using computer software. But in many instances a person or group is needed to test a software application.

Testers are specially trained in using testing software and making sure software operates properly. Testers must maintain accurate documentation of the testing procedure so that if an error is located, they can explain to the programmer where and when the error occurs. The tester must be able to replicate the errors if they are to be found and corrected.

Systems Administrator

A systems administrator maintains the day-to-day operation of an organization's computer system. This may range from a small, single computer where the administrative duties are just one of the administrator's jobs to a very large, complex set of computers, servers, and other hardware where the system administrator must make sure that everything operates correctly. The system administrator must be very familiar with security issues and basic user issues. He or she assigns user IDs and passwords, gives users permission to use various computer resources, and makes sure the computer system runs efficiently. In general, a degree in computer science or some certifications are necessary to work as a systems administrator.

Database Administrator

A database administrator is a specialist who designs, implements, and maintains databases, usually using specialized database software. The database may be something small, such as a list of contacts, or it might be as large as a list of all the clients of a major manufacturer and their purchases for the last five years. The database administrator has to analyze the type of database required to hold the information, implement the design, and maintain the database as new records are added.

A database administrator needs skills in logic, database design, database administration, and security.

Certified Professional

Because the computer industry has been growing so quickly, there has been a lack of qualified IT professionals to fill all of the new jobs in the industry. Companies have had difficulty determining exactly who is qualified for a technical job and who is merely claiming to have the required knowledge. To help with this issue, several companies and organizations have started certification programs. Companies such as Microsoft, Cisco, Novell, and CompTIA have created testing programs in which IT professionals can complete a series of exams and become certified by the company as experts in the selected fields. A variety of certification programs are available to IT professionals, each with its own unique requirements. If you are interested in certification programs, search the Internet for more details.

Computers in Careers

While many careers are directly involved in computers, many more use computers in day-to-day operations. In many countries, basic knowledge of computers and related technology is necessary to gain entry into most professional careers.

Basic keyboard and data-entry skills, knowledge of spreadsheets and word-processing software, and familiarity with e-mail and the Internet are some of the minimal skills that all students need to get started on the right path toward a career in today's technologically minded society. The next section discusses ways in which technology can simplify your job and help you teach your students about computers at the same time.

Technology in Education

Ever since Socrates sat down with his students, teachers have been trying to come up with more efficient ways to teach. A variety of technologies has been introduced into teaching in the past century. Inventor Thomas Edison was convinced that his moving-pictures technology would be a breakthrough in education. And in fact, film strips and other video systems are very helpful in introducing new and unique topics. Every new educational technology was going to be the one that improved education forever. However, adapting new technologies has been difficult for schools and teachers for several reasons. Not all schools and districts have the resources to provide the computers and the technology, and teachers often don't have the skills necessary to teach about technology. And there's also the fact that every student learns differently than every other student. There is no one-size-fits-all solution.

Today, there are new combinations of technologies that have changed the way students are taught, and the benefits of computers to education are becoming more obvious. Schools and districts are making it a priority to fund computer labs and include computers in the classroom. Teaching technology is becoming part of the required curriculum, teachers are being trained in software that will make their jobs easier, and students are using technology to help them with homework assignments.

The following are just a few examples of how computers are used with other technologies to provide rich learning experiences.

Reading

Computers are great tools to use for reading exercises. Not only can you select the style and size of text, but you can also adjust other parameters to make reading less strenuous. Software programs are available that allow you to use a computer to help with speed reading and developing reading skills. You can combine graphics, animation, and audio with a reading program to reach students of all ages and learning styles.

Writing

Word-processing software makes it very easy to create all sorts of writing projects. For example, you can create serial stories, in which one student starts the story and then passes it on to another. The students can either share the same computer or send the story between networked computers as they write it. Students can also use the network to critique each other's work anonymously. When this idea is tied in with the Internet, students can partner with students from around the world and create stories with an international flavor as students add unique aspects from their own cultures.

Math

Great computer software is available today to help students through repetitive math drills and practice math exercises. You can also use computer graphics to help explain both simple and complex problems. For example, three-dimensional graphics can be used to help with geometry topics. You can also have students create their own math exercises for other students to complete. Computers can help students solve problems as simple as adding apples or as complex as plotting landing trajectories on the moon.

Biology

Students can use the computer to perform virtual dissections and explore the internal organs of a variety of species. They can then use PowerPoint to present the data they find to the rest of the class.

Chemistry

You can use computers to simulate a variety of experiments safely, without the cost and expense of using actual chemicals. If a student wants to know what happens when water is added to zinc, you can perform that experiment on the computer without worrying about the resulting explosion and fire.

Ecology

Using a computer, you can set up and monitor virtual environments ranging from deserts to rainforests, all in the same room. You can adjust the time scale to watch the results of your actions over the course of years in a single classroom hour. You can explore various ecologies from all over world by searching the Internet and exchanging e-mail with students who live in different regions of the world.

Geology

Computer software is available that allows students to actually watch the continents move and form new continents. You can observe how the different layers of rock are formed and see how a volcano is created and why it erupts. You can visit Web sites that monitor live volcanoes all over the world. You can view simulations of the causes of earthquakes and then check Web sites for up-to-date information about actual earthquakes.

Art

You can tour museums all over the world right from your computer. Budding artists can use the computer to create their own graphics, posters, videos, newsletters, and other artwork.

Music

You can use the computer to create your own songs by imitating virtually any instrument, even entire orchestras. Combine your music with other media (such as visuals) and create new works of art. Students can also integrate digital images (motion and still) with audio and text, creating their own music videos.

Integrated research

Imagine being a teacher and assigning your students a research goal and then providing them with a computer that has access to all the research information they need. The students use the computer to access research articles, video programs, text of related speeches from experts, and a variety of useful materials. The students could even contact other students around the world who are researching a similar project. Every student would have access to the type of material they prefer to use when learning. As the students do their research, you are freed from presenting rote materials to the entire class and can spend your time with individual students, providing them with the coaching they need to complete their projects.

Such a scenario is not a dream. You can easily accomplish it with the materials available today. Just about any topic has educational software available. You can even get software that allows you to create your own education programs and customize learning experiences for each class or even for individual students.

Lesson Wrap-Up

In this lesson, you learned about the history and future of computers, the many ways in which computers are used in modern life, how it is possible to make computers accessible to persons with disabilities, and how computers are used in business and education.

Quick Quiz

1   When did IBM produce its first personal computer?

2   According to Gordon Moore, how often are computer chips supposed to double in power and speed?

3   What is "accessible technology" and why is it important?

4   What do systems administrators do in the field of information technology?

5   How is technology being used in education?

Putting It All Together

Exercise 1: To discover more about the history of computers, start your Internet browser and select File, Open. Type the following Internet address in the text box: http://www.computerhistory.org/ and then click OK. You'll be taken to online home of the Computer History Museum, which houses one of the largest collections of computer-related artifacts, documents, film, and photographs. Explore the timeline and the many virtual exhibits. Find out what you can about the "Thomas Arithmometer."

Exercise 2: If necessary, start your Internet browser and select File, Open. Type the following Internet address in the text box: http://www.microsoft.com/enable/. Here you can learn all about assistive technology and Microsoft's efforts to make technology accessible to all users.